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GREAT RIVERS OF THE WORLD



The Danube at Budapest

This river is the central European highway of war and commerce.

GREAT RIVERS OF THE WORLD

A Story of Their Service to Man

BY

WILSON S. DAKIN

REGIONAL SUPERVISOR
CONNECTICUT STATE BOARD OF EDUCATION



New York
THE MACMILLAN COMPANY
1950

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Reprinted February, 1950

PRINTED IN THE UNITED STATES OF AMERICA

TO THE TEACHER

Geography has been appropriately termed "a study of the earth, as the home of man." Miss Semple[1] has well said, "Man is a product of the earth's surface. This means not merely that he is a child of the earth, dust of her dust; but that the earth has mothered him, fed him, set him tasks, directed his thoughts, confronted him with difficulties, strengthened his body and sharpened his wits, given him problems of navigation and irrigation, and at the same time whispered hints of their solution."

Actual teaching of geography, however, almost invariably has confined itself to mere descriptions of man's environment, occupations, and customs. Such material may be useful for the general information it yields. It may have a passing interest to children, but in reality these facts have only the charm of novelty unless they are organized and used to show principles and tendencies. The vast quantity of miscellaneous descriptive matter in texts frequently makes the learning of geography a series of reading and memorizing exercises. Attempts to improve the situation by the problem method are worthy of consideration; but problems to be useful should permit, in their solution, the employment of data available to the child and

[1]Semple, Ellen C —*Influences of Geographic Environment* Henry Holt and Company.

should lead him to conclusions that clearly show the deep and abiding effects of geographic influences on human life. Such problems as "Why is New England a manufacturing region?" or "Why would Constantinople be a desirable location for the Capital of the League of Nations?" really require more than a knowledge of geography. They necessitate acquaintance with historical, social, and economic factors. To give pupils problems with no sources but the usual descriptive geography text often puts the entire problem method into disrepute.

This book aims to acquaint pupils with the geographic influences exerted by some great rivers of the world. It will, at the same time, serve to recall other geographical studies and, it is hoped, awaken in pupils an interest in the literature of history, travel, and exploration.

Analysis of the subject matter should give, for each river mentioned, answers to these general questions:

1. *What has been and is the relation of this river to the life of the peoples inhabiting its watershed?*

2. *What other river has had similar effects on its valley dwellers?*

Another result from the study of this book should be an improvement in the ability to use facts, such as location, direction, rate of flow, and volume of water, to determine possible uses and methods of controlling streams. Work of this character will stimulate constructive thought rather than store the mind with strange tales of foreign lands.

It is suggested that there be assignments for outside reading and reports on the numerous allusions to historic events and personages. These can be given to pupils by groups rather than to the class as a whole, thus securing greater variety and quantity of material. Those pupils who are most skillful in expression can be asked to report on reference readings. Those who are resourceful and inventive can be asked to propose inferences and make deductions that will yield profitable discussion of the topics read and investigated.

Avoid assignments which require memorizing of selections from this or any other book. Encourage wide, purposeful reading and free discussion. Compare, contrast, and classify rivers and their influences. If properly carried out, a study of the rivers herein described will organize knowledge regarding streams in general and will broaden pupils' ability to use geographic facts.

The usual textbook statements relating to these rivers are intentionally omitted. It is assumed that pupils have acquired these and are capable of doing more advanced work.

Maps should be consulted frequently, and exercises involving the construction of graphs and regional outlines, the tracing of trade routes, and the use of watershed maps will be found interesting and profitable. Collections of literary and historical references to the rivers studied, and statistics on their industrial utility, will prove valuable.

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GREAT RIVERS OF THE WORLD

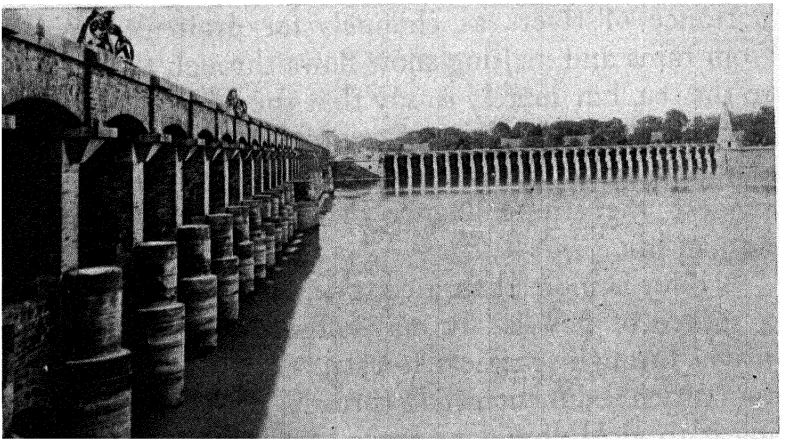
INFLUENCE OF RIVERS

The study of physical geography emphasizes the importance of rivers as channels for drainage. Water from rains and melting snow flows through them down to the sea, but merely to say that the Mississippi River drains the great plain of central North America or that the Rhine River drains western Germany fails to suggest the true influence of these great rivers on human life.

A river is more than a continental ditch. It may be a source of power. It may offer the only means of travel through trackless forests. Often its waters contain a rich sediment which spreads over the land, causing it to yield abundant crops.

Furthermore, rivers have always appealed to the imagination. Everyone is fascinated by the sound and sight of a running brook. The lure of the stream has been felt by all of us. For the adventurous, it is an invitation to explore. To follow a brook to its source has furnished excitement for many a boy. Great rivers have tempted men to do great deeds; remember Cartier, De Soto, La Salle, and Henry Hudson. The force of running water has always been a challenge to the inventor. The use of Niagara's power is our highest achievement in the employment of stream force. Rivers

often arouse feelings of mystery, awe, and even reverence. The ancient worship of the Nile, the spell of the Ganges, and the religious associations of the River Jordan are illustrations of these influences. The picturesque region of the Rhine, famous in song and story,



Courtesy of U. S. Geological Survey

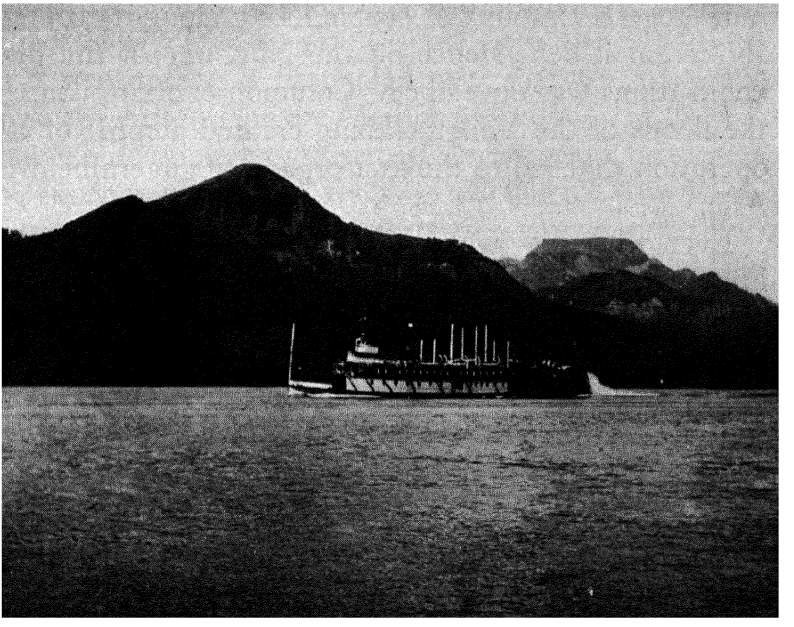
A Canal on the Ganges

This canal is an example of river control for the purpose of irrigation.

is a constant delight to lovers of the beautiful. The Danube and many lesser streams have also inspired their valley dwellers to compositions in music and literature.

The first use of rivers was as a means of travel and a highway for the transportation of goods. The raft and canoe were man's earliest devices for water journeying. In primitive or newly discovered countries these simple

means are the ones still most used. After the opening of the Mississippi, log rafts were used even until the nineteenth century. A study of the various ways of using



Courtesy of Union Pacific Ry. Co.

Steamer on the Columbia

Rivers are often the only means of transportation in a new country.

rivers for transportation from the days of dugout canoes to the time of steam and gas-propelled boats would make very interesting reading for some group of pupils.

The exchange of products and ideas that came from river transportation helped primitive people to progress

in many ways. This hastened the development of river-dwelling people as compared with those living in mountainous regions or roadless wildernesses.

River transportation always acts as a bond that knits together groups of people living along its course. By common dependence on the Nile, one of the first civilizations was developed. Common effort to control the floods of the Yangtze-kiang created a spirit of co-operation that led to the first organized government in Asia.

Even when low water makes navigation difficult or impossible, a river bed sometimes furnishes the only route for entry to some otherwise impassable territory. Such a stream is the Oxus, which, although practically unnavigable, determines by the course of its valley a trade route to central Asia. The Platte River, in our own western country, outlined a trade route that later determined the layout of a part of the Union Pacific Railroad system.

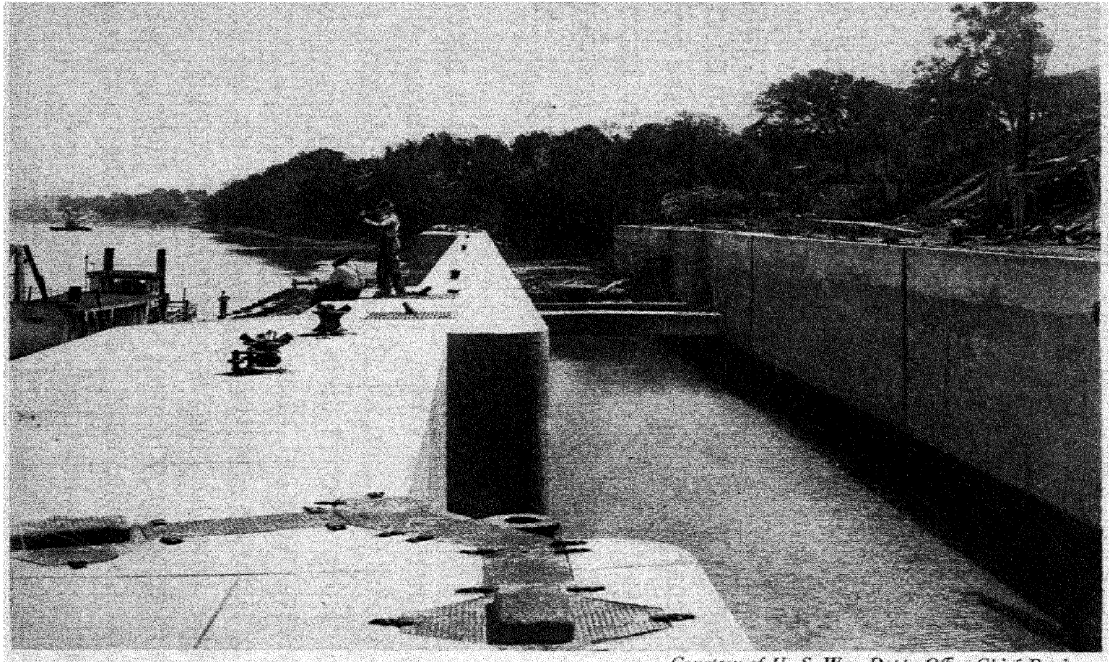
The importance of rivers in new regions is well illustrated by the rapid settlement of the St. Lawrence Valley and of the Hudson and Mohawk valleys, where, until the coming of railroads, the people were a hundred years ahead of those who lived in the less accessible country not reached by their waters. The Mississippi and the Ohio were the natural gateways to the West. The great number of villages and cities along their courses clearly indicates the effect of these streams on the location of settlements.

On the other hand, the lack of navigable rivers through the interior of a country has always hindered its development. Central Africa, inaccessible from the sea by water, remained the "dark continent" until railroad transportation finally made inland trade possible. How different would have been the conditions in Russia today, if the Volga were directly accessible from the Atlantic or the Mediterranean!

As civilization progressed, the constantly increasing dependence of man on rivers gradually led him to attempt to control them: sometimes to prevent the ravages of disastrous floods; sometimes to store excess water of the rainy season for use in times of scarcity. These control problems were the beginnings of the science of engineering.

The Chinese from the earliest times found it necessary to control their rivers, in order to prevent the awful floods that periodically destroyed millions of people. The protective dikes of China, built along the great rivers, were old when Europe was a wilderness. Some of China's greatest legendary heroes are her engineers. One, Li Ping, is honored by a temple. Although twenty-one centuries have passed since he lived and worked, his command, "Dig the bed deep and keep the banks low," inscribed in letters of gold on his memorial, is still heeded by his countrymen.

In our own country the levees on the Mississippi, to be described later, represent the best efforts of modern engineering to control a great river.



Courtesy of U. S. War Dept., Office Chief Engineer

A Lock on the Cumberland

This is an example of river control for the purpose of navigation. Through this lock, boats are enabled to pass around obstructions in the river.



Courtesy of Mississippi River Commission, Third District

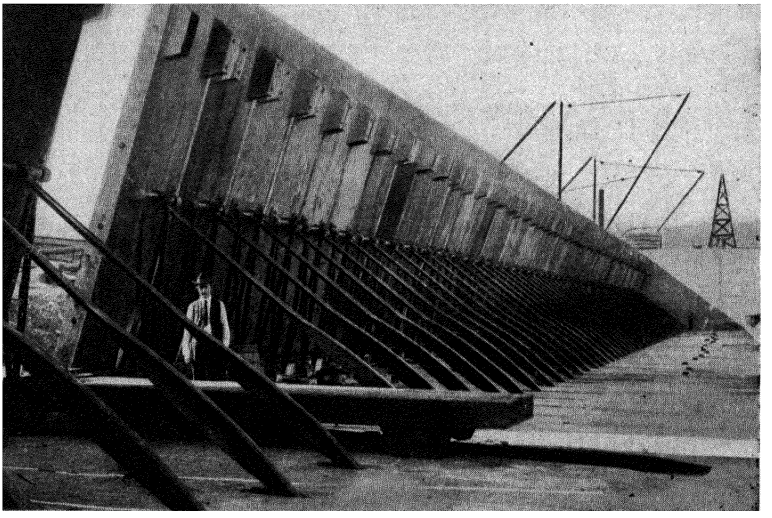
Building a Levee on the Mississippi

Here we have an example of river control for the purpose of protection.

Although the Incas of ancient Peru supplied their fields with water carried for many miles through skillfully constructed canals, control to insure an even supply of irrigating water throughout the year or to maintain a minimum depth of a river for shipping purposes is a comparatively modern art. The great work of the British at Assuan on the Nile will be mentioned again. Storage, by increasing the capacity of natural lakes and ponds, is being accomplished near the headwaters of the Mississippi. At this writing, plans are being completed to construct a storage reservoir on the Colorado River that will impound water over an area eighty miles

long reaching back to the Grand Canyon. Enough water will be stored to maintain the river at a useful height even though no rain should fall for several years.

The control or improvement of rivers, to increase their navigable length and to permit their use by larger



Courtesy U. S. Engineers' Office, Pittsburgh

Movable Dams on the Ohio

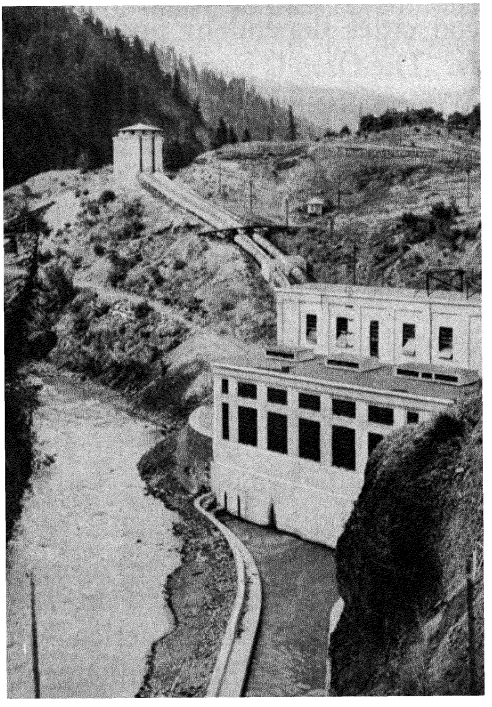
These dams temporarily increase the depth of water for the passage of coal barges. This is another example of river control for navigation.

vessels, means more than pulling out snags and sunken logs. It necessitates dredges and powerful machinery. On the Mississippi it has meant protection of the river banks to prevent the formation of new channels, and the construction of long lines of masonry called jetties designed to help the current scour out its own bed.

In Europe very small streams are often so improved that they become useful transportation lines. France has many such rivers. In England, Liverpool on the Mersey, and in Scotland, Glasgow on the Clyde are examples of commercial cities dependent upon reconstructed river channels. The Ohio is partially canalized by a series of weirs that create behind them a succession of pools. Boats unable to float on the river as it was can navigate these pools and, by a series of movable dams, go from one to another, thus ascending or descending the river in safety.

The use of streams for power came long after their employment for navigation and irrigation. While life and labor were cheap and human needs few, the demand for power was satisfied by the strong arm of man and the pull of the ox and horse. But, in the struggle to increase production and economize labor, the force of running water became our first ally. The water mill of the colonists ground their corn, sawed their logs, and operated their blast furnaces. It contributed mightily to the advance of civilization in North America. Indeed, until the practical use of steam in the nineteenth century, falling water was the only source of factory power. It is true that steam engineering and abundant coal did for a time divert attention from water; but the increasing cost of fuel and constantly growing demands for power have resulted in a rediscovery, so to speak, of the possibilities of hydraulic force—"white coal," as it is called in Switzerland.

The improvement in methods for transmitting electricity has given new value to water power sites, even though they may be remote from cities and almost inaccessible to railways. Hydroelectric stations, near mountain streams whose enormous power was hitherto wasted, may now run trolley cars and factories in cities hundreds of miles away.



Courtesy of U. S. Forestry Service

A Hydroelectric Station

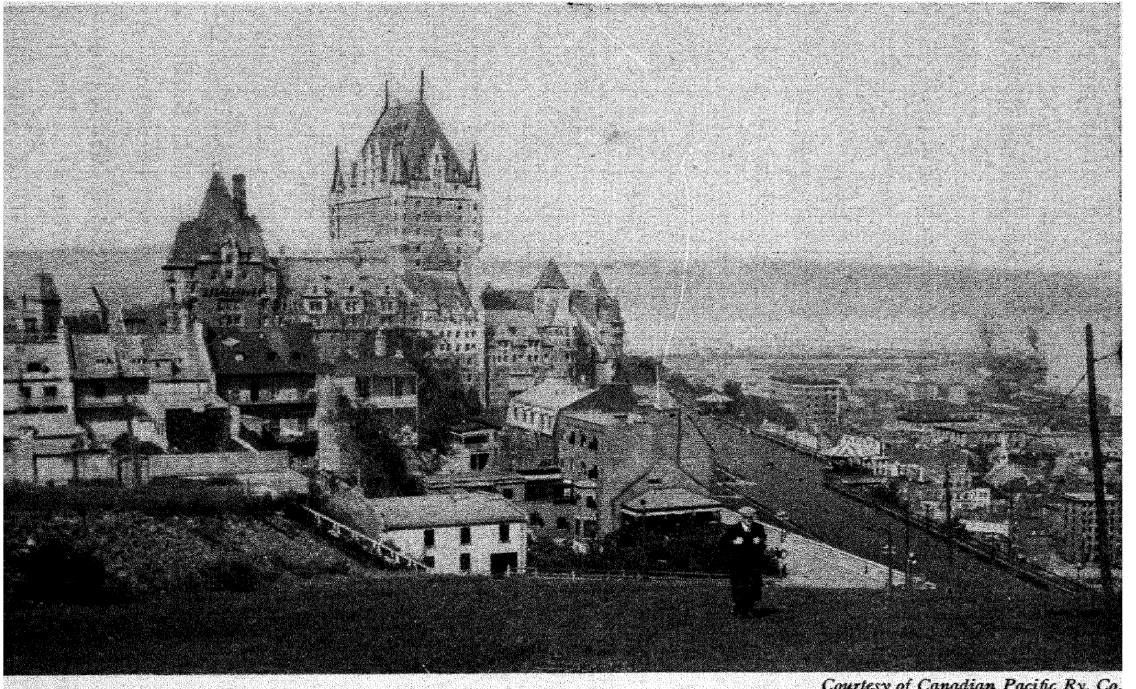
This station situated on a mountain stream—Washington State—is an example of river control for power.

Such stations are far more common in the western part of the United States than in the East. Sweden, Switzerland, and to some extent Italy are installing hydroelectric plants. France has just completed arrangements whereby she will derive over one million horsepower from the Rhone. This power is to be used to run trains on two important

railway lines leading from Paris. It is interesting to note, however, that in the contract for this work provision is made to reserve some of the Rhone flow for irrigation and navigation.

Rivers frequently have decided where men were to live and what their national boundaries would be. London and New York, the largest cities in the world, and Buenos Aires, the largest city in the southern hemisphere, have grown prosperous because they were situated near great river trade routes. Odessa, Rotterdam, and Calcutta are other examples. Construct a population map of a county, a state, or a nation, and you will readily notice that the villages and towns of importance are clustered near streams, where they derive wealth by trade, by power, or from rich alluvial lands.

As national boundaries, rivers themselves are unsatisfactory. Their influence is to unite those along their banks rather than to separate them. This is becoming more true with our increased ability to bridge and tunnel under wide streams or to operate regular ferry service for vehicles and trains across their waters. A more effective boundary is the water parting between two rivers. Attempts to make the Rhine a boundary have caused war for thousands of years. As long as the Rhine is navigable and easily crossed, people on both sides will have common interests. Political conditions in the Danube Valley illustrate the same struggle against the unifying influences of a river. Jefferson doubtless realized the tendency of rivers to



Courtesy of Canadian Pacific Ry. Co.

Quebec on the St. Lawrence

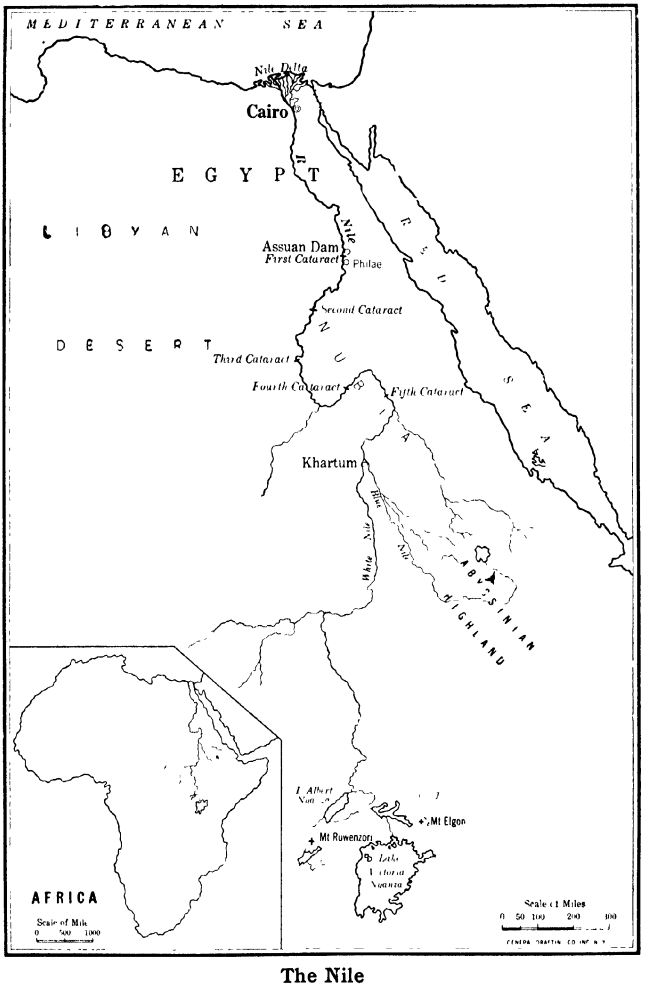
Here a river determined the location of a city.

unite bordering peoples when he purchased the Louisiana territory, comprising the entire Mississippi watershed. As a boundary, this river would have been impossible.

Rivers and streams of any and all sizes are factors to be reckoned with in community and national affairs. They have been sources of wealth and influence, prizes in war, and invaluable assets in times of peace. The progress of modern power and transportation engineering is constantly increasing their importance.

PROBLEMS

1—What has been the history of the streams in your vicinity?
2—Are they useful to the people living near them?
3—Are their beauties appreciated?


MEDITERRANEAN SEA
Nile Delta
Cairo
EGYPT
LIBYAN
DESERT
Assuan Dam
First Cataract
Philae
Second Cataract
Third Cataract
Fourth Cataract
Fifth Cataract
NUBIAN DESERT
Khartum
Blue Nile
White Nile
ABYSSINIAN HIGHLAND
RED SEA
L. Albert
Mt Ruwenzori
Mt Elgon
Lake Victoria Nyanza
AFRICA
Scale of Miles
0 500 1000
Scale of Miles
0 50 100 200 300

The Nile

THE NILE

Hail to thee, O Nile!
Who manifesteth thyself over this land
And cometh to give life to Egypt.
Mysterious is thy coming forth from the darkness,
Watering the orchards created by Ra
To cause all the cattle to live.
Thou givest the earth to drink,
Inestimable one!
Thou createst the corn,
Thou bringest forth the barley,
Causing the temple to keep holiday.

This selection, from an ancient Egyptian hymn, shows how the Nile was regarded thousands of years ago. References to Egypt, so numerous in the *Bible*, mention the country as a land of wealth and plenty. As we shall see, all this was due to the Nile River. Remains of wonderful temples, rich with massive carvings and monuments, line the river from Cairo to the Cataracts. When people in Europe were living in caves and huts, when they were existing on wild game and warring against one another with bows and axes, the Egyptians were building splendid cities in the Nile Valley.

Long before the Greeks gave the world their wonderful art and learning, Egypt had developed an architecture; her people knew something of science, history, and engineering; her artisans were skilled in metal working, in textile design, and the making of pottery. China has

enjoyed the longer continuous civilization, but the Nile valley was one of the localities where man first emerged from barbarism. During the development of its civilization, geographic conditions played an important part. The mild climate, the regular supply of fertilizing water from the Nile, the protection from hostile tribes by an almost impassable desert — these things made the Nile a natural nursery for human civilization. Removed from the necessity of constant warfare, the early Egyptians were able to study the arts of peace.



©*Beseler Lantern Slide Co.*

Native Boats

In these boats much freight is carried up and down the river. Their form probably has not changed since the time of the Pharaohs.

Strange as it may seem, until the nineteenth century the sources of the Nile were shrouded in mystery. Curiosity, which prompts man to explore, was not an Egyptian trait. Legends and fantastic stories apparently satisfied these people. One account attributed the

water to the weeping of the gods. The great annual flood was known as the "Tear of Isis." Another story described in detail two massive fountains whence the water was supposed to spring in limitless quantity at certain seasons of the year.

When Egypt became known to adventurous people from the north, Greek and Roman explorers attempted to trace the Nile. One Roman officer, with a small army, succeeded in reaching the African jungle, but no definite information resulted from his trip. A Greek geographer, Ptolemy, living in Alexandria, tried to make a map of the ancient world. Although it was inaccurate, he made shrewd guesses, some of which stood unchallenged for fifteen hundred years. Ptolemy placed the Nile source in the lakes and mountains of central Africa.

There was no real knowledge of this region, however, until 1863, when Captain Speke, an Englishman, located definitely the sources of certain tributaries. He found that one main source of the Nile is in the central lake system, which includes Lakes Victoria Nyanza and Albert Nyanza. This discovery was later verified by Henry Morton Stanley, a great American explorer. That branch of the river which comes from the lakes is known as the "White Nile." Mr. Stanley, in his book *In Darkest Africa* gives a thrilling and accurate account of his journey across that continent. The other main branch is known as the "Blue Nile." It flows from the Abyssinian highlands and was first traced through by

Captain Baker, another Englishman. During modern times, the lure of the Nile has drawn men from almost every country of Europe. Central Africa for a time rivaled the poles as a field for exploration and adventure. Between 1550 and the present, more than seventy different explorers have contributed toward clearing up the secret of central Africa and the sources of the Nile. Among these names, ten different European nations are represented. The discoveries of these men finally explained the regularity of the Nile flood and accounted for its vast supply of water.

Located in the equatorial heat belt, the White Nile drains the enormous rainfall of that region. The Blue Nile not only taps a heavily watered country but also draws an added supply from the snow and ice fields of Ruwenzori. These mountains, known to the ancients as "The Mountains of the Moon," extend for some thirty miles at an altitude of thirteen to sixteen thousand feet. Their summits, clad in eternal snow, and their upland valleys, filled with glaciers, present a wonderful scene when viewed under the glare of the tropic sun. Chances to view them are rare, however, because the mists from the surrounding country usually hide the peaks of Ruwenzori so effectively that Mr. Stanley camped for weeks near the base of these mountains without suspecting their existence.

In the torrential rains, coming at stated intervals, plus the steady flow from melting snows, we have an explanation of the "Nile gift." The wonderful fer-

tilizing quality of its flood is due to its Abyssinian sources. Constantly the Blue Nile is bringing down a finely powdered lava dust from the mountains, which are volcanic in their formation and contain many extinct cones. One of these, Mount Elgon, is perhaps the largest extinct volcano in the world.

Promptly by the middle of June each year the water of the Nile begins to rise. At first it has a greenish tinge acquired from the swampy region through which the White Nile passes after it leaves the lakes. This rise reaches Cairo about June 20. Soon after, the water begins to take on a reddish muddy hue caused by the Blue Nile pouring in its flood which is laden with volcanic ash. By July 25 this water, rich in sediment, has spread over the entire lower valley of the Nile.

The rains of Abyssinia really determine the height of the flood. When the Blue Nile water comes down, it is so much greater in volume than the White Nile that the latter is for a time held back. Then, as the Blue Nile recedes, the accumulated water of the White Nile resumes its flow and keeps an even height on the lower river for a long period.

The startling rapidity with which the floods come is well illustrated by the following incident. On the twenty-fourth of June, Baker (a friend of Speke's, knighted for his explorations) and his men were resting on the clear sands of a river tributary to the Blue Nile. Suddenly they heard a rumbling sound like distant thunder. This roar increased in volume until it awoke

the men, who rushed into camp shouting, "The river, the river." Baker writes:[1]

We were up in an instant and my interpreter, in a state of intense confusion, explained that the river was coming down, and that the supposed distant thunder was the roar of approaching water. . . . Many of the people were sleeping on the clean sand of the river bed and were only just in time to reach the top of the steep bank before the water was on them in the darkness. . . . The river had arrived "like a thief in the night." When morning broke, I stood upon the banks of a noble river, the wonder of the desert! Yesterday there was a sheet of glaring sand with a fringe of withered bushes and trees upon its borders. . . . No bush could boast of a leaf, no tree could throw a shade; crisp gum crackled upon the stems of the mimosa. . . . In one night there was a mysterious change. . . . An army of water was hastening to the wasted river, which had become a magnificent stream some five hundred yards in width and fifteen to twenty feet in depth. Bamboos and reeds, with trash of all kinds, were hurried along the muddy water. . . . I realized what had occurred; the rains were falling and the snows were melting in Abyssinia.

The average flood rise at Assuan is forty-nine feet; at Cairo twenty-five feet. The ancient Egyptians measured the height of the river by a device known as the nilometer, located just below the First Cataract. It consisted of a well, sunk below the water level of the river and near its bank. As the river rose, the water in this well rose with it and marks, placed at certain

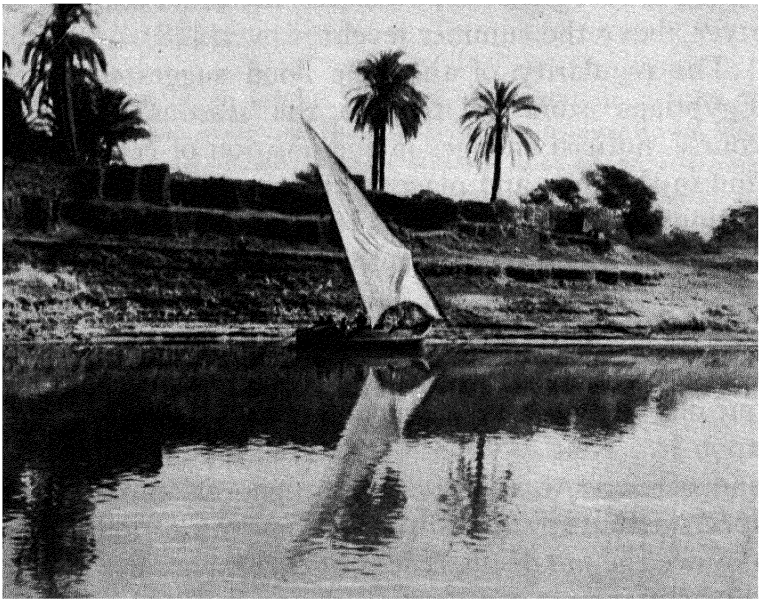
[1] Reprinted by permission from *The Nile Quest*, by Sir Harry Johnston. Copyright 1903 by Frederick A. Stokes Company.

intervals along its side, indicated the exact stage of the river above the summer level.

The regularity of the Nile flood suggested to the Egyptians some relation to the seasons. They, of course, noticed changes in the position of certain stars and in the time and place of the sunrise. These observations were the beginnings of a study of astronomy, a science in which these people became very expert. They used this knowledge not only to forecast the coming of the flood but to give their temples added glory. One device was to place a statue in a temple so that only on one day in the year would the sun's rays strike directly upon it. That day was set apart as a great occasion and, of course, was believed by the ignorant classes to be a special tribute to their shrine by some mysterious power.

Since the fall of the Nile is but six inches per mile for the greater part of its course through northern Egypt, little erosion or wearing of the banks occurs. The fertilizing current moves so slowly that its sediment is evenly distributed through the whole lower valley.

The value of land was in direct relation to the supply of water. Land near the river, that was sure to receive an annual flood deposit of sediment, was extremely valuable. Efforts to mark off this land and to preserve the boundaries made it necessary to use very careful measurements. It is said that the art and practice of land surveying originated along the Nile as a means of settling the constant disputes over ownership of the small parcels that were claimed by each family.



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The River at Low Water

To irrigate at this season, the water must be pumped or lifted to the top of this high bank.

Owing to the intense tropical heat of this rainless country, the land begins to dry as soon as the supply of water is withdrawn. Under the ancient system of irrigation, but one or two crops a year could be harvested. Exceptions occurred only where the water could be lifted from the lowered Nile. Raising water in this way from the bed of the river is a very difficult operation. Sometimes it is accomplished by means of huge wheels worked by man power or by an ox or

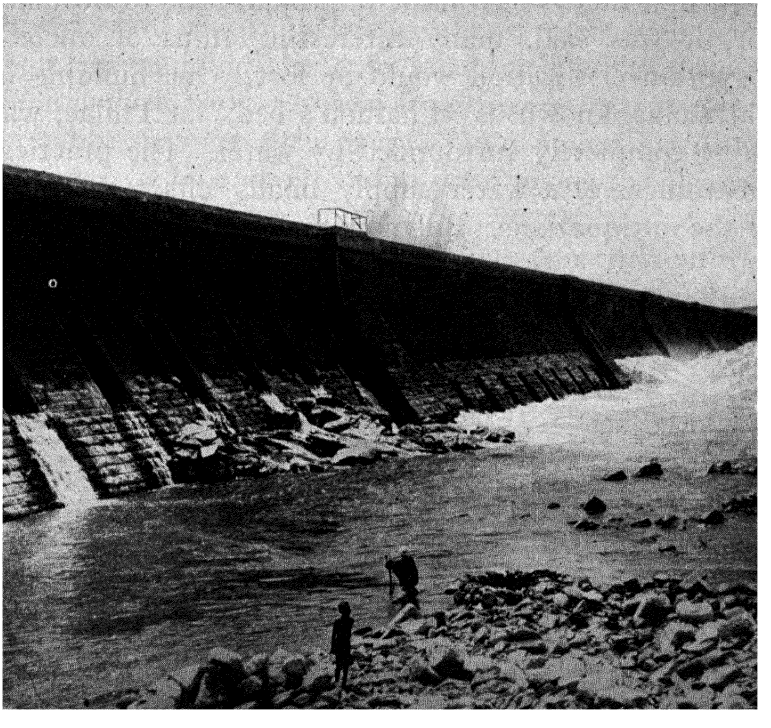
camel. Buckets and jars placed on the rim of the wheel automatically fill as they are slowly dipped into the river by the revolving wheel. Then as the buckets are carried over the top their contents spill into a trough that leads the water to fields and gardens. Where the banks are very high, the water is lifted from one platform to another higher one by men, much as in the bucket brigade at a country fire. These picturesque but clumsy methods can, of course, never supply water on a large scale. In the main, however, the only system of irrigation that was extensively used was one known as the "basin plan," which did not make it possible to grow a crop like sugar, which requires an entire year to mature, or cotton, a summer crop, that would require water when the Nile was at its lowest.

In the first quarter of the nineteenth century, the attempts to grow these crops led to a complete change in irrigation policy. Under a progressive ruler, Mohammed Ali, the basin plan gave way to a system of continuous irrigation. Systems of intersecting storage canals were constructed. These were filled with water when the Nile was at flood height. As it receded, the entrances to the canals were closed and the water thus held was distributed as needed by means of a network of ditches that carried water to the fields. Even under this plan, there was great loss due to evaporation. Hence engineers sought some way of keeping these canals filled, regardless of the height of the river. The wheel device was, of course, inadequate, and so the first

human control of the Nile was attempted. This was accomplished by constructing a great dike or barrage across the river just below Cairo. By means of gates, the river was allowed to flow freely in the flood season. When the waters began to recede, the gates were closed and enough water held back to feed directly into the irrigation canals.

Owing to poor engineering, the dike system was not entirely successful and in 1867 its use was abandoned. Later, English engineers repaired it and the irrigation of the lower Nile valley by this means was firmly established. Several similar dikes have since been constructed so that constantly increasing areas of northern Egypt are watered by this system of continuous irrigation. The great loss of surplus water during the flood season suggested the possibility of further control by storing this water nearer its source and doling it out as needed. This was accomplished by the construction of the Assuan Dam near the First Cataract. When completed in 1902, it was the greatest irrigation project of its kind in the world. Sixty-four hundred feet long, built at a cost of over ten million dollars, the dam holds back the water of the Nile for over two hundred miles, creating an immense artificial lake.

Granite, from quarries used by the ancient Egyptians, was employed in erecting the dam. It varies from twenty-three to ninety-eight feet in thickness and is one hundred thirty feet high from foundation to top. One hundred eighty sluice gates are provided, to allow



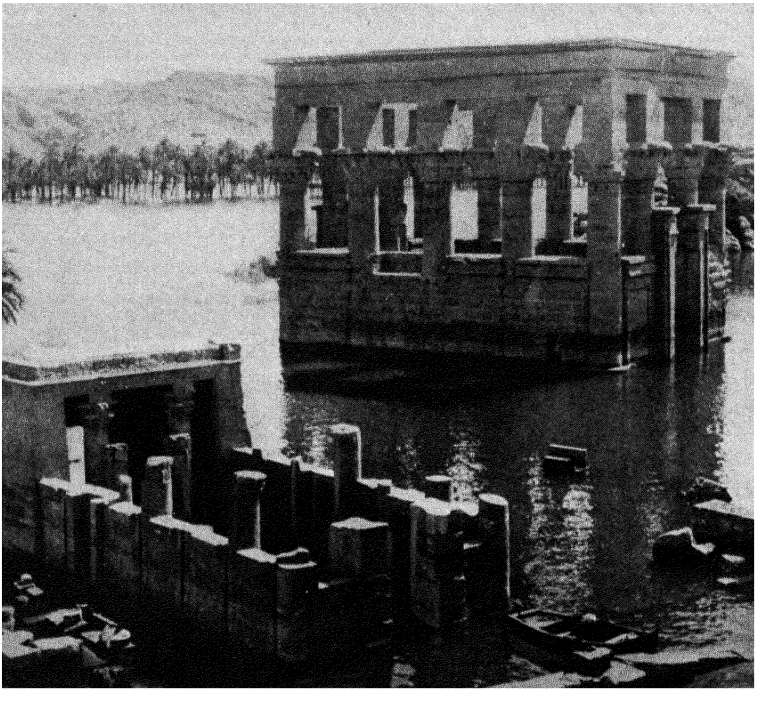
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Assuan Dam

This great structure, built by English engineers, controls the Nile flood.

escape for the water while the Nile is rising. These are closed after the height of the flood passes. Then water is allowed to accumulate until the basin is filled. A canal with four locks has been constructed to permit the passage of boats around the dam, so that navigation on the river is not interrupted.

At first there was considerable opposition to the dam, for, it was said, many interesting ruins of ancient Egyptian civilization would be lost. One building in particular, known as "Pharaoh's bed," at Philae, was to be completely surrounded by water. The practical advantages of a water supply finally offset the pleas of the antiquarians. But now the picturesque ruins of



©*Beseler Lantern Slide Co.*

Philae on the Nile above Assuan

Water, held back by the great dam, has flooded this region.

Philae, when seen across the waters of Assuan, have gained, some think, in beauty. To protect them, the engineers building the dam reënforced with concrete the foundations of these old structures so that they are probably stronger than ever. Now a favorite trip for tourists is to hire a boat and sail out among the gigantic columns of the old temple.

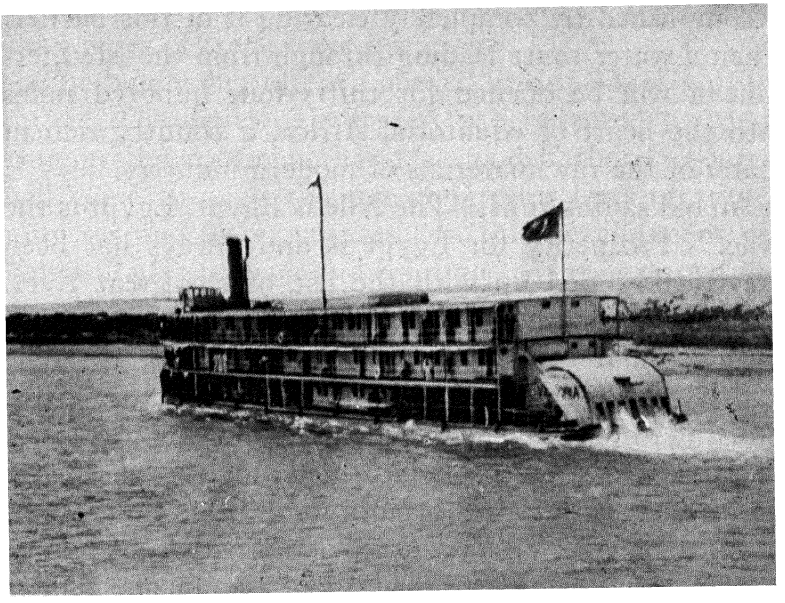
An immediate result of the Assuan construction was to remove the menace of famine that always threatened when there was a slight variation in the annual Nile rise. If an unusual amount of water came down, flood dangers resulted; when not enough came, some fields remained unproductive for a year. Another effect of the water storage at Assuan was to increase the crop production. With an even flow of water all the year round, a long crop season was possible. This meant some three or four harvests from the same ground; cereals in winter, and cotton and rice in summer. The increased production has resulted in a rapid growth of population. Now nearly twelve million people live comfortably on the produce of six million acres of irrigated land.

We do not think of the Nile as an important commercial route, yet for Egypt it has been almost the only means of transportation. Immense quarries, far up the river, were the sources for stone that was used in building the pyramids. Blocks that were to be carved into massive columns and gigantic statues were carried by rafts and boats for long distances on the Nile. In Cen-

tral Park, New York, one can see a splendid example of Egyptian art. This is the obelisk known as "Cleopatra's Needle," an immense shaft of stone covered with hieroglyphics. Even in this day, with our modern appliances, it was considered a feat of engineering to bring such a great monument across the water to New York.

Without the transportation afforded by the Nile, commercial relations on a large scale would never have developed. The arts of the early Egyptians would have been limited to small sections and probably would never have developed at all. Nile commerce also made possible an exchange of a crop surplus, thus preventing serious famines so common in many eastern countries where the lack of roads and rivers often rendered useless the excess of produce of one section needed to relieve the shortage in another. Nile navigation made trade with the Mediterranean countries practicable and thus brought to Egypt metals and materials in quantities larger than overland trade could ever have done.

Another geographic influence of the Nile was the favoring air current over it. A prevailing north wind made ascent of the river by sailboat comparatively easy and regular. To float back with the stream thus made a round trip both simple and profitable. Soon after the invention of steamboats French traders introduced them on the Nile and today they ply regularly from Cairo to the First Cataracts. But the quaint "felucca," a native sailboat, is still seen carrying on a



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Tourist Steamer on the Nile

With rear paddle wheels, this boat can be navigated in very shallow water.

profitable local trade between cities and towns along the way. Although a railroad now extends from Cairo to Khartum, river commerce is and will continue to be important.

In tropical Africa, the upper part of the Nile is obstructed by thick masses of vegetable matter known as "sudd." The water is amply sufficient for navigation but boats make their way through the sudd with great difficulty. Some of it has already been successfully removed. Further control of the Nile will doubtless be

accomplished by completely clearing it of this barrier. Then a water route leading through from the Mediterranean will be opened for thirty-four hundred miles into the heart of equatorial Africa, a country rich in many of the raw materials of modern industry.

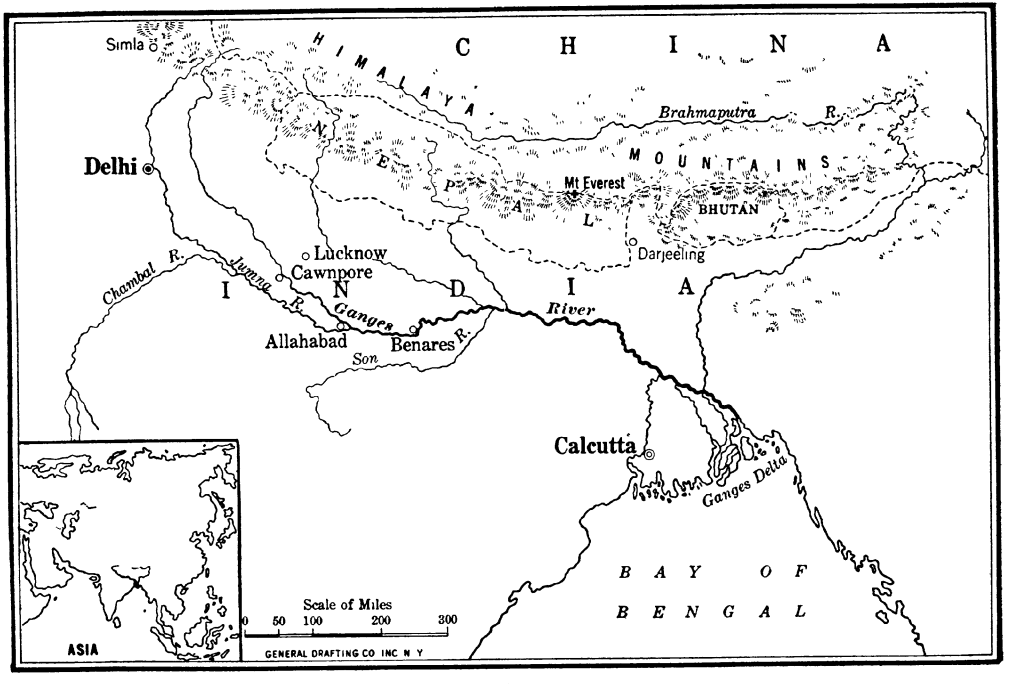
An old saying runs, "The Nile is Egypt, Egypt is the Nile." Prosperity for Egypt is and always has been inextricably tied up with the use of the great river. Although modern exploration has lifted the veil of mystery that so long concealed its sources, the Nile still has a fascination unlike that of any other river. Starting from palm encircled glaciers, flowing by rugged volcanic highlands, through tangled jungles, then emerging to water the peaceful corn fields of an industrious people, the river offers a series of contrasts unequalled in their variety. As we read about the ancient glories of the Egyptians, so beautifully described by Loti, Todd, Breasted, and others, we cannot help wondering what the future may yet hold for such a region. Already modern Egyptians are claiming independence which England in a large measure has granted. Will Egypt ever again take an important place in the civilized world? If so, it will be due to the improvement of its great river by continuing the work so thoroughly started by English engineers and governors, notably Lord Cromer, who in his book *Modern Egypt* tells the fascinating story of her recent progress. Cecil Rhodes, the great South African administrator, dreamed of a "Cape to Cairo" railroad. Already a telegraph line

extends along this entire route and nearly three thousand miles of track have been laid.

The Nile valley offers a needed link in this important route. The development of Africa is bound to come. But, as the continent has few good harbors, progress will come through the use of interior lines of travel, railways and water courses. In this development the Nile will play its part and continue, as in the past, to be an important factor in the history of human life and progress.

PROBLEMS

1—What information can you find concerning the Kongo River?
2—Compare the Nile with the Kongo in regard to length, fall, and commerce.
3—Try to account for the differences in the use and importance of each.
4—What present commercial, historical, or recreational interests have the people of the United States in the Nile valley?
5—Collect a series of Biblical references to the Nile and Egypt.

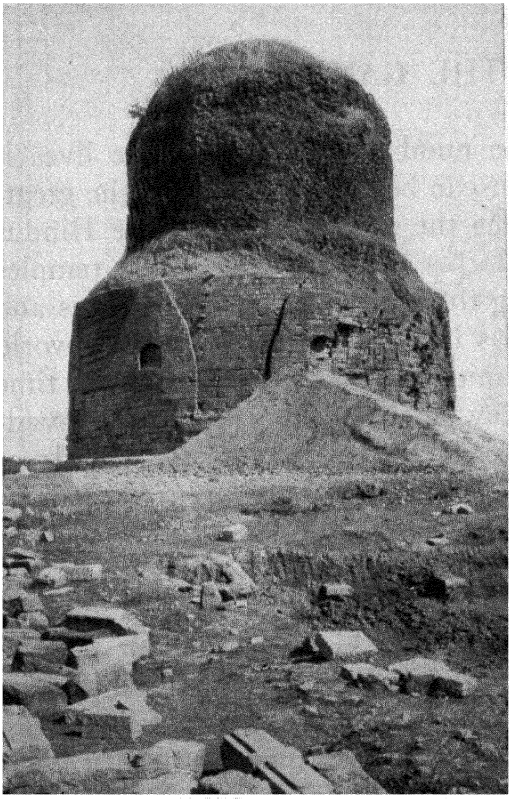

Simla
HIMALAYA
C H I N A
Brahmaputra R.
Delhi
MOUNTAINS
Mt Everest
BHUTAN
Darjeeling
Lucknow
Cawnpore
Chambal R.
Jumna R.
Ganges River
Allahabad
Benares
Son
I N D I A
Calcutta
Ganges Delta
BAY OF BENGAL
Scale of Miles
0 50 100 200 300
ASIA
GENERAL DRAFTING CO INC N Y

The Ganges

THE GANGES

Measured by the number of people whose lives it influences, this river can be classed as one of the greatest. It is to millions the sacred river, by the Hindus lovingly called "Mother Ganga." Venerable temples mark its rise among the glaciers of the Himalayas and keep guard along its banks. Few rivers in the world have touched humanity in so many ways. From time immemorial its valley has been the gateway for invading hordes from north and west. For thousands of years the wealth of India has been concentrated in its basin. Near it lived Buddha, founder of a religion that to this day profoundly influences the peoples of the Orient.

The main course of the Ganges is about sixteen hundred miles in length. In the three hundred ninety-one thousand square miles of its watershed are living forty-four million people. Two hundred twenty miles from the sea, it loses its main stream in a vast delta through which its great volume of water streams into the Bay of Bengal by a network of channels. This delta, almost a country in itself, two hundred miles on its seaward face, has been built by deposits of mud and sand brought down by the Ganges. In its lower reaches, the water of the river is almost the color and consistency of broth. The fine silt that it carries is so rich in plant



Courtesy Methodist Episcopal Church Society

Buddhist Stupa

This is where Buddha began his preaching.

food that where it is deposited no other fertilizer is needed. In this particular it surpasses even the Nile. On the alluvial soil of its delta from two to four luxuriant crops can be produced annually. Four hundred miles from the sea it is thirty-five feet deep and its volume of water is one third greater than that of the Mississippi. Although steamers can ascend the river for more than a thousand miles, the constantly shifting channels make regular travel by large boats very dangerous. The extension of the Indian railroad system, with six bridges, each a half mile or more in length, crossing the Ganges, also

tends to make long-trip water carriage unprofitable, except for non-perishable materials. But the importance of the river to the natives has in no way lessened. Every peasant near its canals has his canoe and every farmer his cargo boat. These native craft congregate for months at a time near trading centers which, through the waterways, are accessible to a vast population.

The religious importance of this river, however, is greater than its commercial value. To bathe in its water gives one great virtue in the eyes of the Brahmins. This bathing is not a simple matter. It involves complicated rites, each of which has some special meaning. The great city of Benares may be said to owe its existence to the faith of the thousands who annually come to bathe in the Ganges. Families make long journeys from the interior, carrying with them the sick and dying, and when death takes place on the way the body is cremated at specially provided places and the ashes are thrown into the river. The burning ghats, where the bodies of the faithful are cremated so that their ashes may be cast into the Ganges, are gruesome but interesting places. Sick and dying people are brought here from great distances, to enjoy the satisfaction of bathing in the river and of having their remains cast into it after they die. Cattle, which are sacred to the Hindus, are never slain for food but wander about Benares unharmed and often decorated with wreaths of flowers. When these fortunate beasts die, their bodies, too, are cast into the all-devouring Ganges.



©Publishers Photo Service

Benares

Note that the temples face the "sacred river."



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Washing Clothes in the Ganges

The use of the river for bathing, drinking, and the disposal of human waste violates, of course, all our ideas of sanitation, though it seems in no way unusual to the natives. As might be expected, Benares is a breeding place for diseases that are always prevalent.

Frequently, serious epidemics spread over the country. England's slowness to remedy such conditions is due to her general policy of noninterference with native customs.

The sacredness of the Ganges is well described by Scidmore,[1] a traveler, who says:

The greatest human spectacle in India, the chief incident and motive of Benares life, and the most extraordinary manifestation of religious zeal and superstition in the world, begins at sunrise by the Ganges bank and lasts for several hours. The picturesque sweep of the city front,—a high cliff with palaces, temples and gardens clinging to its terraced embankment and long flights of steps descending to its waters,—is spectacle enough, when lighted by the first yellow flash of sunlight, without the thousands of white clad worshippers at the Ganges brink and far out in the turbid flood. From twenty-five to fifty thousand people regularly,—on special occasions, one hundred thousand, bathers and worshippers,—Brahmins and believers of every caste,—perform their daily rites in the Ganges. They are so rapt, ecstatic, bent on and absorbed in their mechanical formulas, the endless minutae of their worship, that they are unconscious of the few curious strangers who may drift up and down the river front in the brief tourist season. A Brahmin cannot let his eye or mind wander for one moment, lest, by omitting something, or changing the order of invocation, prayers, and movements, he should have to begin the ritual afresh. The daily religious observances should occupy nearly twelve hours so that a repetition is something of a penance.

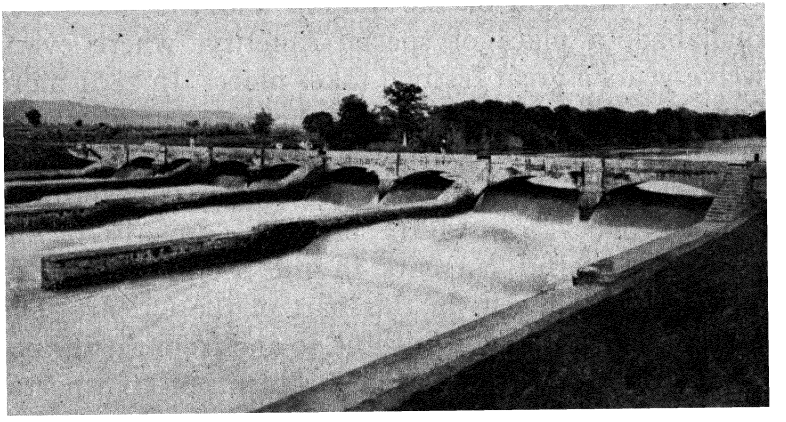
Another curious way of securing favor is for the devoted pilgrims to measure their length, literally to crawl, from the source to the mouth of the Ganges. For some reason, the left bank of the river is preferred.

[1] From *Winter India* by Eliza R Scidmore The Century Company

At the junction of the Jumna and the Ganges is Allahabad, a place of special sanctity, where every twelve years a great festival takes place. In 1894 more than one million pilgrims came there to attend it. To the Brahmins, who constitute a large portion of the population of native India, the Ganges is a spiritual magnet that is constantly creating, directly or indirectly, powerful currents in the seething mass of humanity that dwells in this part of the Orient. The great pilgrimages of the faithful, to and from the shrines on the Ganges, present serious problems of transportation and control for the government of India.

The natives have not, however, been blind to the practical advantages of a river like the Ganges. Long before the coming of the English, the Hindus devised various ways of using the surplus water to irrigate crops in semiarid regions. Although the rainfall on the delta is seventy-five inches per year, in many parts of India it is so small and uncertain that one sixth of the arable land must receive water artificially, in order to insure the ripening of the crops. It is estimated that there are in India over two million wells constructed solely for irrigation purposes. Sometimes the water of small streams is held back by means of embankments. Such ponds are called "tanks" by the English.

Another method of irrigation practiced by the natives is to draw water from the river by large canals. During the first one hundred eighty miles of its course almost all the Ganges is used for irrigation.



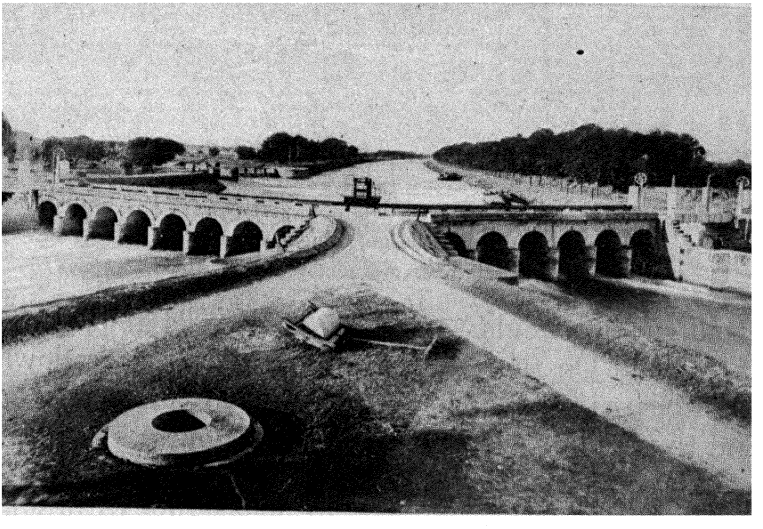
Courtesy of U. S. Geological Survey

Asafnagar Falls, Ganges Canal

These extensive engineering works have been constructed by the English.

The British government, in its attempt to improve the conditions of the Indian people and to prevent the recurrence of terrible famines, has planned and constructed here some of the world's greatest irrigation systems. Although the expense in money has been enormous, the return through increased crop production has more than repaid the first cost. Sixteen hundred miles of irrigation canals have been excavated and over two million seven hundred thousand acres of land benefited in this way. Previous to the construction of modern irrigation works and railroad systems for distributing the surplus products, nine famines per century were considered necessary evils to be endured patiently and expected regularly.

The Ganges irrigation canals are of two varieties. One type is the flood canal, which stores water in the rainy season. This kind is used only in sections producing a single annual crop. The other type is known as the continuous or perennial canal, which supplies water in all seasons so that frequent cropping of the land or the growing of long-maturing crops like sugar cane becomes possible. The canals, with numerous branches controlled by gates, extend through the fields for miles and miles. Each farmer draws from the canal, by crude baskets or pumps, the water which he needs. This he carefully guides in little streamlets between



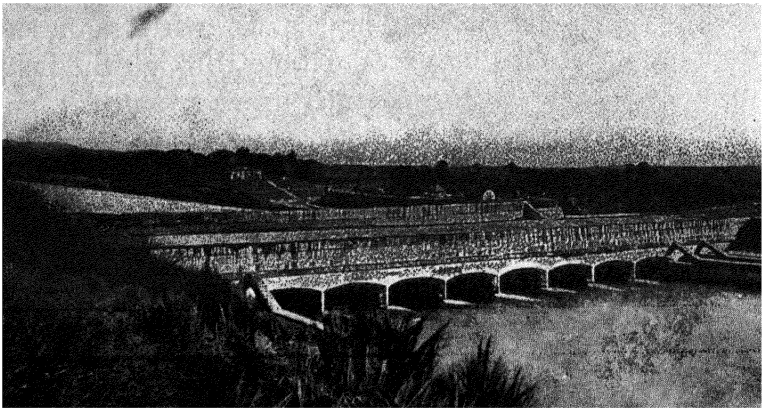
Courtesy of U. S. Geological Survey

Gopalpur Canal

Irrigation from canals like this saves crops from drouth and reduces the terrible famine periods.

the furrows, or, for rice and similar crops, he lets it flow over the entire field for a time.

The large main canals are marvels of engineering. By means of bridges, they frequently cross one another or the very river from which they started. Great care has to be taken to secure a gradual, even flow, since a



Courtesy of U. S. Geological Survey

Ranipur Passage, Ganges Canal

Here one canal crosses over another of a lower level.

rapid current would soon wash the banks and destroy the canal. On the other hand, if the water is allowed to stagnate in the canal, it will drop too much of its silt and thus rapidly fill up the water channels.

Irrigation on a large scale presented many new problems. Engineers found that, by neglecting to provide proper drainage, the land in some places became waterlogged. Another unlooked-for result was deposit by

evaporation of alkaline salts which rendered the land sterile.

Some of the great cities along the Ganges are Calcutta, Cawnpore, Delhi, Lucknow, and Benares.

Calcutta on the Hooghly, one of the mouths of the Ganges, has become great through its location as a trading center. At the gateway of the Ganges basin, it is a natural terminus for the many railroad lines that have been constructed in recent years. It is also the harbor of import and export for northeastern India.

Vast quantities of jute go from Calcutta to America for the manufacture of rugs, carpets, and sacking. India's demand for the manufactured goods of the Occident has never equalled the value of her exports. Consequently her people receive the difference in money, preferably in silver. The native Indian hoards his silver in the form of ornaments or coins. The coin he hides in secret places. Every year great quantities of silver go into India and little of it ever comes out. The mystery of its disposal puzzles and annoys the bankers and business men of the western world. India today has in her stores of silver a great wealth of treasure. From our point of view this represents a serious loss, since hoarded money is not used for any productive purpose. It might, with a system of banking, be used to build railroads and to develop industry which would give employment to vast numbers now idle and yield to all greater comforts and pleasures.

Cawnpore is an industrial center, with leather, cotton, and woolen manufactures, also flour mills and foundries.

The city of Delhi is nearer the Himalayas than the sea. There Great Britain is constructing government offices on a magnificent scale. There also are found many remains of ancient Indian architecture.

Lucknow, referred to in Tennyson's poem *The Defense of Lucknow*, is on the Ganges. It is associated with the terrible Sepoy rebellion.

Benares, the Holy City of the Hindus, rises high on the north bank of the Ganges; and its buildings, displaying many varieties of oriental architecture, present a splendid appearance for four miles along the water front.

In countries where a factory system has not been developed and where industries are carried on by artisans in their homes, great cities do not spring up so rapidly as in America. Although these cities of India play an important part in the commerce of the country, they owe their growth more to the great religious influence of the Ganges River than to its commercial value. This influence, associated with the life-giving waters it furnishes to a vast farming section, has tended to develop a peace-loving people, conservative and deeply attached to the soil. Their name for the river, "Mother Ganga," well expresses their feeling toward it.

PROBLEMS

1—What information can you find concerning the Brahmaputra River?

2—Compare the Ganges with the Brahmaputra, as to:

(a) source,

(b) population and importance of watersheds.

3—Try to account for the differences in their control and use.

4—Notice the points of similarity between the Ganges and the Nile valleys, as to:

(a) history,

(b) types of people,

(c) relative importance,

(d) buildings and works of art,

(e) control and use of waters.

5—List other rivers famous for their religious associations and compare them with the Ganges.



The Tigris-Euphrates

THE TIGRIS AND EUPHRATES

All hail Euphrates! Stream of hoary time,
Fair as majestic, sacred as sublime!
What thoughts of earth's young morning dost thou bring!
What hallowed memories to thy bright waves cling!

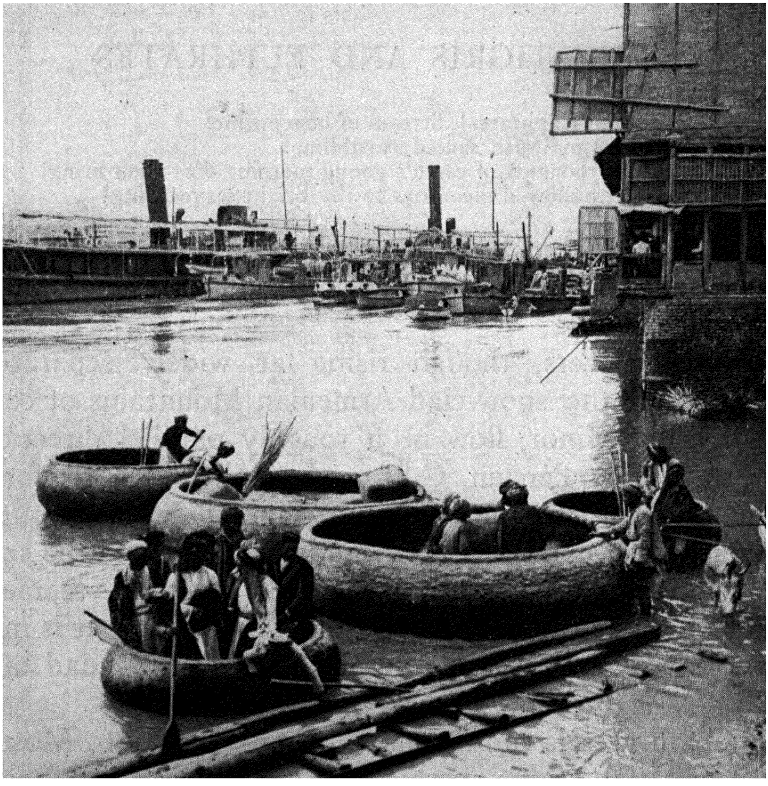
The Tigris and Euphrates have a human interest that entitles them to more attention than our geographies usually give.

These rivers, though rising at widely separated points in the snow-clad Armenian Mountains of central Asia Minor, flow in a roughly parallel direction toward the Persian Gulf and finally join to form one short, broad stream, the Shat el Arab, through which they discharge their muddy waters into the sea.

The Euphrates can be navigated by small steamers for over one thousand miles to Birejik. There it is met by the overland caravan route between Bagdad and Syria.

Small vessels can ascend the Tigris nearly to Mosul. Most of the traffic on this river is downstream. Boats called "keleks" are used. These are made by fastening timbers to inflated skins and considerable cargo can be carried. At the end of the down trip, the boat is broken up, the timber sold, and the deflated skins carried back overland to be used again.

A regular line of steamers operates between Bagdad and the Persian Gulf.



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The Tigris at Bagdad

The round boats are common on this river. The modern shipping indicates considerable trade and contact with the outside world.

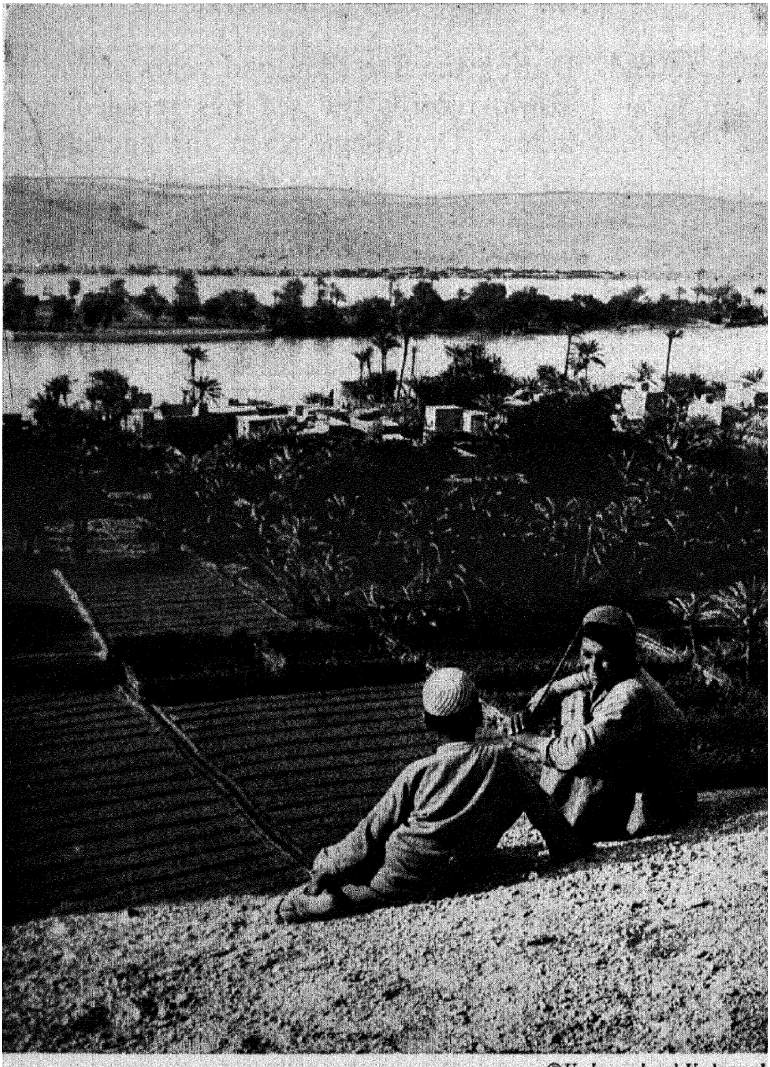
The silt from the Tigris and Euphrates has formed a delta six times as large as the Nile delta. Gradually this deposit is extending into the Persian Gulf so that the sites of ancient cities formerly on its coast are now

miles inland. During the five thousand years of which there is an historic record, the sea has receded one hundred fifty miles. Doubtless, when the ancient irrigation systems were in repair, there was less silt carried to the delta. A great deal of it must have been deposited in the canals and on the land, saving much valuable soil material.

The land between the lower reaches of these rivers, a section equal to Great Britain in area, was one of the cradles of civilization. Whether man first emerged from barbarism here or in the valley of the Nile is a question for scholars to decide, but at any rate the Tigris-Euphrates rivers have had a humanizing, civilizing influence equalled by few other rivers in the world.

According to early Biblical history, the Garden of Eden where Adam and Eve, the first man and woman, dwelt was bordered by four rivers, one of which was the Euphrates and another the Tigris. From the *Book of Genesis* onward, frequent allusions to the Euphrates show its importance, even at the dawn of history. The river was so well known that it is frequently referred to in the *Bible* merely as "The River" or as "The Great River."

Nation after nation rose and fell in the Tigris-Euphrates Valley, where the kings were so powerful at times that all the rest of the known world came under their control. When Assyria was in its prime, between 700 and 600 B.C., Nineveh on the Tigris was



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View near Babylon

To the dwellers in an arid land, this place is a real "Garden of Eden."

its capital. This city then had fine libraries and the most magnificent buildings anywhere to be found.

Babylon on the Euphrates was a metropolis of ancient times. The hanging gardens of Nebuchadnezzar were considered one of the seven wonders of the world. After the Babylonian supremacy came the Chaldeans; then the Persians, under Darius, controlled Mesopotamia. Alexander the Great planned to rebuild Babylon and make it the capital of the world. Later Rome extended her empire to include a part of Mesopotamia. With the decline of Rome came the Parthians, and after them the Mohammedan Arabs secured control of this coveted region, which they held practically unchallenged until the recent World War.

Was it the rich soil of this valley or the soothing climate that drew and bred so many people and made it possible for them to progress so far in the art of living? In earliest times the influence of the Tigris and Euphrates was largely agricultural. Shut in by a desert on practically all sides, those valleys, like the Nile, tempted dwellers to peaceful pursuits. Wheat, which here is said to have originally grown wild, was extensively cultivated. The growing of date palms was another profitable industry.

The dry season that comes after the spring floods suggested irrigation, as in the Nile and Ganges valleys. Here today are the remains of the wonderful engineering skill developed by the ancients. There is evidence that the excess water of spring floods was stored in vast

lakes and reservoirs so that in time of want this water could be drawn off as needed. Such storage reservoirs also lessened the danger of floods by reducing the volume that otherwise might break through the river dikes and spread death and destruction. The long lines of earthworks that once guided the waters of the Tigris and Euphrates intersect their valleys in every direction. The greatest of these was the Nahrwan Canal which paralleled the Tigris for two hundred fifty miles and carried its waters along at an easy grade for distribution through other and smaller canals to the fields of growing crops. To utilize both rivers to the best advantage, canals frequently connected one with the other. It was discovered that at places the Euphrates is slightly above the level of the Tigris and there canals were excavated to carry water from it to the Tigris. Farther down their course, the Tigris is higher than the Euphrates and canals carried water in the opposite direction. Besides using the canals for irrigation, the ancients used them to transport goods and, in time of war, to carry soldiers from one part of the country to another.

It can readily be seen that people intelligent enough to control and use rivers in this way might be ambitious to extend their domain. Furthermore, their vast estates of rich land excited the envy of less fortunate nations. Such conditions made for war and the Tigris-Euphrates Valley has been one of the world's battle grounds. There Darius the Great fought, there the

Greeks were repulsed, there Alexander the Great dreamed of establishing a center of world empire. Up and down the Tigris-Euphrates valleys for thousands of years have marched the armies of contending nations. Even during the late World War, one of England's first acts was to dispatch from India armed forces to the mouth of the Tigris and Euphrates. Later, severe fighting with Turkish troops took place in this region. A very entertaining account of the struggle is given in Kermit Roosevelt's book *War in the Garden of Eden.*

The supremacy of the Arabs and the spread of the Mohammedan religion since 622 A.D. checked and, for a time, deadened the enterprise so long associated with Mesopotamia. Now not a hundredth part of the vast irrigation systems are kept in repair or used. This neglect causes frequent floods that have turned many fertile fields into wastes of sand and swamp. Naturally trade has dwindled, and during the last thousand years the Bedouin of the desert has reigned supreme along these rivers. Only Bagdad, a sorry reminder of former times, remains to link the closed past with the present.

From 900 A.D. to the nineteenth century the Tigris and Euphrates region was practically lost to the world, except as a trade route. No longer desirable as a place of settlement, it became merely a connecting link between the modern civilization of Europe and the old of Asia. Before sea routes around Africa and through the Suez Canal were available, long caravans of camels

passed up and down the Tigris-Euphrates route bringing the highly prized rugs, spices, gold, leather work, and dried fruits of the Orient to Europe.

Owing to the commercial importance of the Tigris-Euphrates route, a great city has always existed somewhere near its Asiatic entrance. Before Bagdad it was the city of Ctesiphon. Today that city is marked only by a pile of picturesque ruins. Before Ctesiphon it was Seleucia. Before Seleucia it was Babylon. These cities were always in touch with the great nations of Asia on the east and the European and Egyptian peoples to the westward. Gathered at these gateway cities, goods were shipped up the Tigris-Euphrates valleys over the mountain passes and thence to the Mediterranean.

With the coming of Mohammedanism, religious pilgrimages have increased the importance of these valley routes. Every year thousands of Mohammedans from southwestern Asia pass through Bagdad, some *en route* to Mecca but the majority going to the gold-domed tombs of their sainted leaders at Kerbela and Kasimin. Frequently these pilgrims bring with them the bodies of the dead whom they wish to bury in these sacred places. It is said that in one year sixty thousand bodies were carried through Bagdad for this purpose.

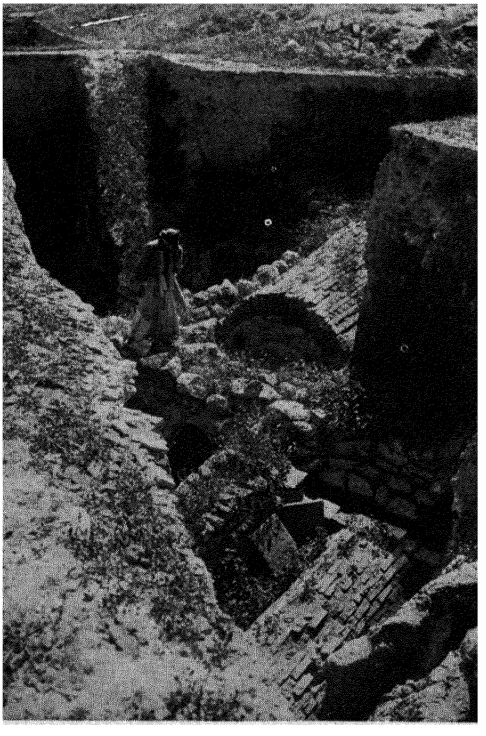
Another natural city location is where the trade routes converge in the northwestern part of Mesopotamia. Such a place is at Mosul. Our word "muslin" is derived from the name of this city once famed for its cotton goods. Before the present city, Nineveh of the

Assyrians was located here. Its extensive ruins can still be seen.

Temporarily, overland traffic was greatly reduced by the opening of the sea route between Asia and Europe. The development of steamboats and railroads, however, suggested new possibilities, and again the natural force of geographic influence exerted itself. The English were the first to see the strategic value of the Tigris-Euphrates route, and in 1835 they sent an expedition to explore the long-forgotten rivers. Two steamers were transported overland in parts, from Antioch to the Euphrates, by a caravan of eight hundred forty-one camels. These boats were put together there and the expedition sailed down toward the Persian Gulf. One boat was lost on the Euphrates but the other was used to explore the lower Tigris. The result of the trip was to awaken the world to the advantages of the ancient route. Indeed Russian jealousy caused an immediate protest to Turkey against permitting foreign boats on the Tigris and the Euphrates. Commercially nothing was done for a long time.

The English expedition of 1835 also aroused great interest among scholars. The vast ruins and numerous remains of former civilizations with which the Tigris and Euphrates valleys are strewn suggested new ways of studying ancient life. Since that time excavations by English, German, French, and American antiquarians have brought to our museums wonderful specimens of art. The outlines of enormous buildings have been

discovered and restored to view. And what is still more important, thousands of tablets containing inscriptions in ancient languages were found. After years of patient study, these inscriptions have been deciphered. The border line between dim legend and authentic history was pushed back hundreds of years by these discoveries.



©Underwood and Underwood

Modern Excavation of Ancient Assyrian Ruins, Upper Tigris

Students of history from Europe and America are making important discoveries in this region.

Puzzling problems of early Biblical literature are also being solved by these studies. Many interesting books describing the excavations and discoveries in Babylonia and Assyria are available in our libraries.

Germany, Russia, and England, all anxious to secure and control the Tigris-Euphrates route to the East, have persistently courted Turkey for her permission to use

it. The Germans with their slogan, "Berlin to Bagdad," gradually brought to a crisis the struggle for this region. Indirectly this desire of Germany to extend her trade routes into the East may have been one of the causes of the World War. Her alliance with Turkey was in part to secure concessions in Mesopotamia, including the right to build a railroad from the Dardanelles to Bagdad. Thus there would have been opened a safe and speedy route to India and all the Orient. So far did this plan go that a railway under German engineers was actually started. Some seventy miles were built westward from Bagdad. From Constantinople toward the southwest this road has been completed nearly to Mosul on the upper Tigris.

At the outbreak of the World War the importance of the Tigris-Euphrates Valley caused England to dispatch strong forces to Mesopotamia, where General Maude captured Bagdad, and now Mesopotamia is under nominal British control. As in Egypt and India, England's first efforts are being directed toward renewing the prosperity of the country. Under trained irrigation engineers, dams are being rebuilt and the ancient canal systems repaired. Probably in one or two generations the agricultural values of this region will be restored. It is estimated that, by an expenditure of thirty million dollars at this time, an annual yield of ten million will be possible after fifty years.

The discovery of rich deposits of petroleum near Mosul has brought new attention to this region. Amer-

ican business men are seeking the right to develop the oil properties. Thus our own country is becoming interested in the awakening of this historic land.

Although the Tigris-Euphrates Valley may never again become the seat of a powerful empire, its control will be bitterly contested and jealously watched by ambitious nations. They will seek the most practical way to use it as a key to India and the Orient. In addition to the agricultural and commercial importance of this section, the remains of its ancient art and civilization will have an ever increasing human interest for the world at large.

PROBLEMS

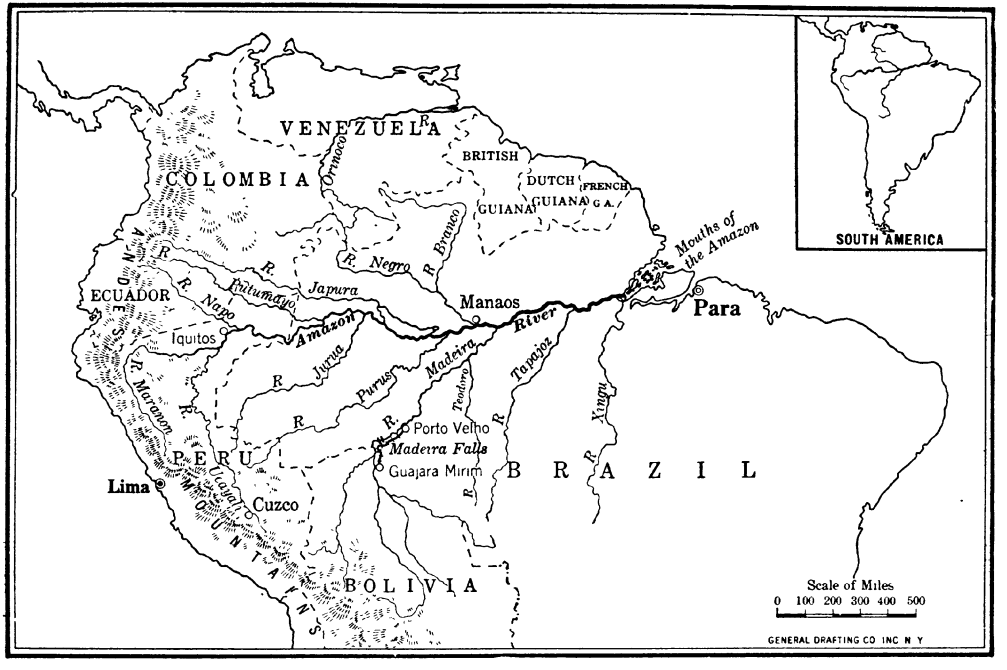
1—Trace on a map of Southwestern Asia:
   (a) a water and land route between India and Europe *via* Bagdad,
   (b) a water and land route between Bagdad and Cairo.
2—Compare the Tigris-Euphrates with the Nile, as to:
   (a) history,
   (b) control,
   (c) present conditions and importance.
3—Locate Mosul and account for its present importance.
4—Search textbooks in ancient history for references to Babylon, Nineveh, the Assyrians.

THE AMAZON

Although the Amazon was discovered in 1540 by Orellano, its basin has not to this day been thoroughly explored. Only about ten years ago Theodore Roosevelt, discovered a hitherto unknown tributary of the Amazon hundreds of miles in length. This branch is now called the River Teodoro in his honor. In the Amazon basin there are thousands of square miles of virgin forest that have never been visited by civilized man. In these regions of South America are still to be found some huge unexplored areas.

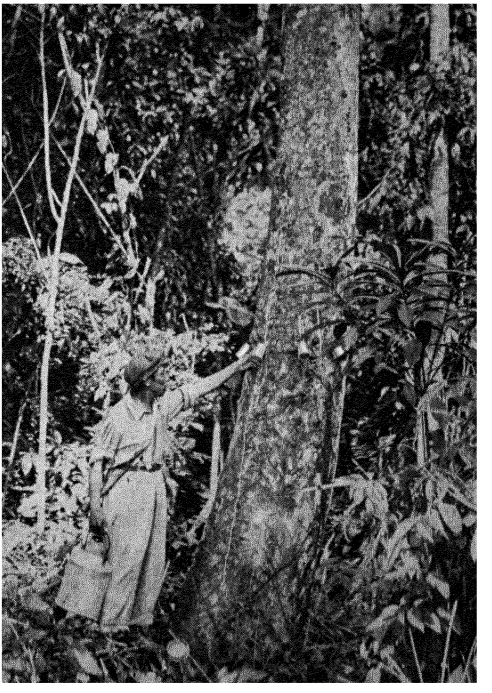
The first effort to traverse this country was made by Gonzalo Pizarro, relative of the famous conqueror of Peru. Starting from Cuzco in Peru on Christmas Day, 1539, Pizarro planned to explore the "Land of Cinnamon," as the country east of the Andes was called. To overcome hostile tribes he took three hundred forty soldiers, one hundred fifty cavalrymen, and four thousand Indians. All went well until they reached the forests of the upper Amazon. Then the intense heat, the plague of insects, attacks of disease, and difficulties of travel proved fatal. Even the thousands of swine and llamas were insufficient to supply food. At last, broken down by hunger and privation, the remains of the party halted.

In hope of securing aid, one Captain De Orellano


VENEZUELA
COLOMBIA
ECUADOR
PERU
BOLIVIA
BRAZIL
BRITISH GUIANA
DUTCH GUIANA
(FRENCH G.A.)
Orinoco R.
R. Negro
R. Branco
Mouths of the Amazon
R. Napo
Putumayo R.
Japura R.
Amazon River
Manaos
Para
Iquitos
Juruá R.
Purus R.
Madeira R.
Tapajoz R.
Tocantins R.
Xingu R.
R. Maranon
Porto Velho
Madeira Falls
Guajara Mirim
Lima
Cuzco
Canal
ANDES MOUNTAINS
SOUTH AMERICA
Scale of Miles
0 100 200 300 400 500
GENERAL DRAFTING CO. INC. N. Y.

The Amazon

took a small party of men and floated down one of the numerous rivers in a rudely constructed boat. He found the country inhospitable then as now. Sailing on for weeks, attacked by Indians, he secured no store of food sufficient to justify returning. Great was his surprise when at last he found that he was approaching the sea. It was the Atlantic. Through fortunate circumstances he was able to reach Spain where he was honored by a commission from the king.



Rubber Tree in the Jungle

Growth of shrubs and plants is so rapid and dense that cultivation of the soil is almost impossible.

The great river, which he had explored almost throughout its entire length, was christened by De Orellano "Rio de Amazonas," or "River of Amazons," because many of the Indians attacking him on the voyage were dressed somewhat like women, in capes

and skirts of straw, and he supposed them to be tribes of female warriors similar to the Amazons of legendary fame. The name given by this first explorer, shortened to Amazon, has ever since been connected with the river, although the story of its feminine fighters was later found to be false.

For nearly three hundred years the Amazon remained a river of mystery that tempted many explorers. Sir Walter Raleigh was one of them. It also appealed to the imagination of writers and men of science, who pictured in glowing terms the possible wealth, strange animals, and wonderful natural phenomena to be found in the Amazon Valley.

The following translation from a book published early in the sixteenth century shows how men of those days dreamed of wealth hidden in this great wilderness. "There existed somewhere or other a country traversed by a white sea whose waves rolled over sands of gold and a beach of diamonds. Its capital, Manao [Manaos], was a great city full of palaces, some built of stone riveted with silver, whilst the roofs of others were tiled with plates of gold. One trod everywhere on most precious metals. Manao was the storehouse of all the riches of the earth. There reigned a man called 'The Golden One,' 'El Dorado,' and his body scintillated with golden sequins even as the sky with stars."

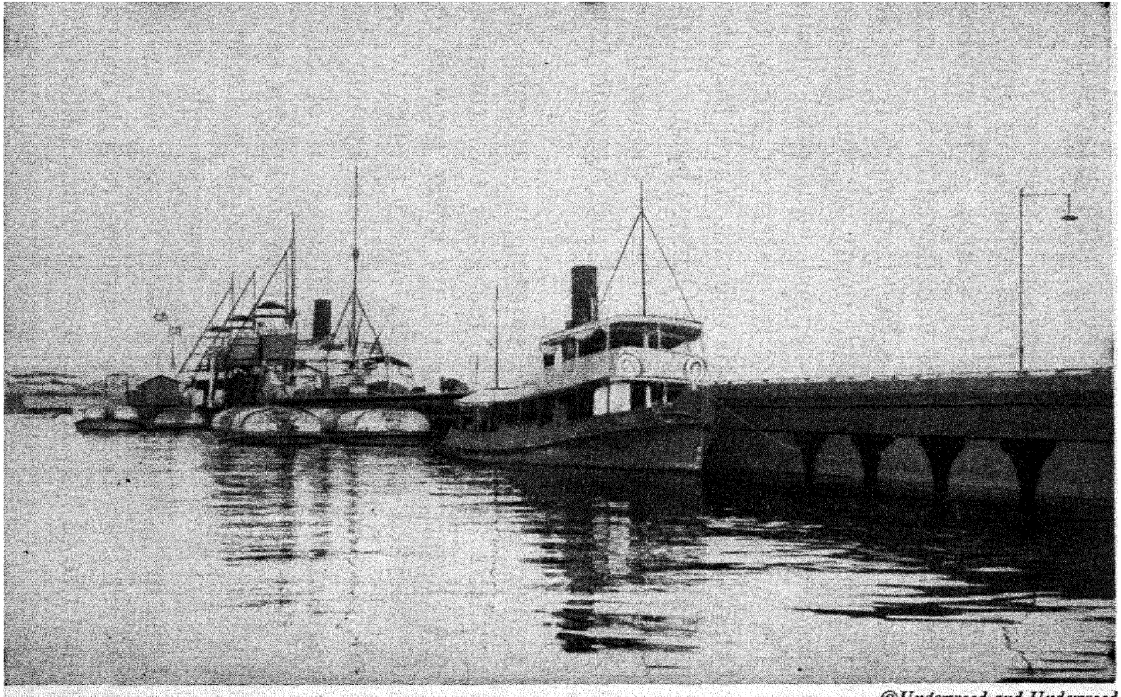
Although, of course, no wonder city was ever actually found there, the total wealth in forest and rubber products taken from the Amazon Valley would doubtless

have been sufficient to build even such a fairyland of gold and precious stones.

Many streams unite to form the Amazon so that it is difficult to name any one as its source. The extreme western limit of its watershed is believed to be a small lake in the Andes not over a hundred miles from the Pacific Ocean. Like the Nile, many of the Amazon tributaries are fed by snow-capped, equatorial mountains. The northern limits of its watershed are so undefined that in certain seasons one can travel by canoe directly from the Amazon to the Orinoco basin. In the south there are places where less than a thousand feet of dry land separate the waters of the Amazon from the Paraguay River.

In its main stream, the Amazon is navigable for ocean steamers as far as Iquitos, over two thousand miles from Para. At places on its lower reaches the depth is recorded to vary from ninety to nearly one thousand feet. So vast is the entire river system that it is frequently called the Mediterranean of South America. Eleven hundred tributaries are known, seven of them over a thousand miles in length and one of them, the Madeira, nearly three thousand miles long.

Since the main stream of the river is only thirty-five feet above sea level two thousand miles from its mouth, the annual rise of fifty feet causes at times a flood that reaches back into the surrounding forests for hundreds of miles, making for the time a real inland sea. This almost level course reduces the current to only two and



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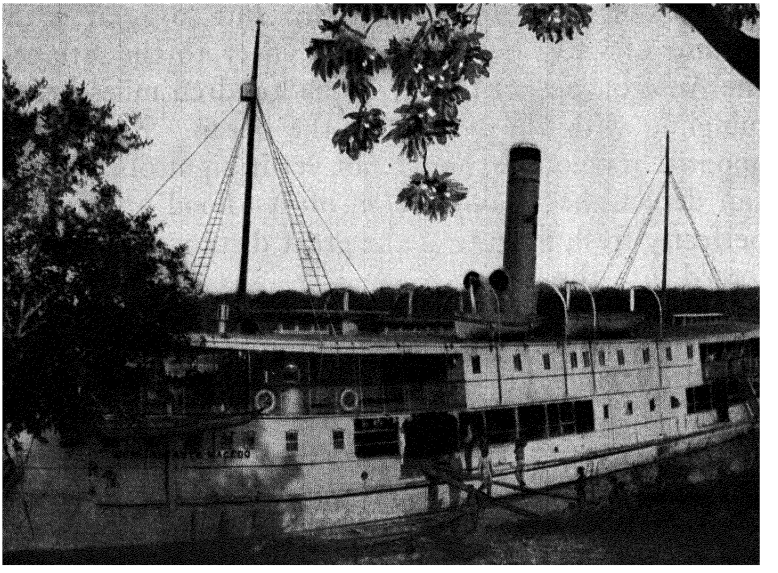
Manaos Docks

An ocean steamer from New York coming to dock 1600 miles up the Amazon.

one-half or three miles per hour. But so great is the volume of its discharge that on entry to the Atlantic the Amazon pushes out over one hundred miles before mingling with the waters of the ocean. From ships opposite its mouth, though not yet in sight of land, one can detect the muddy color of its flood and find it perfectly fresh in spite of the great distance it has been forced into the sea.

The rise and fall of tides is noticed over five hundred miles above Para. At times unusually high tides set in toward the shore, turn back the river, and create a terrible wave known as a "bore." The bore is feared only at certain seasons of the year. The force of an unusually high tide meeting the resistance of the Amazon's outward flow causes the water to pile up, forming a series of great waves twelve to fifteen feet high. These waves sometimes sweep up the river for one hundred miles. They completely strip forest growth along the banks and make and unmake numerous islands in the river.

The Amazon offers conditions so favorable for commerce that anywhere else in the world immigration and rapid development of river lands would have resulted, but inadequate drainage and excessive rainfall (two hundred inches annually) make the Amazon country a hotbed of disease. The moisture and tropic heat favor a growth of plant life so luxuriant and vigorous that men have been unable to cope with it. Paths cut through the jungle are completely overgrown within a



Courtesy of American Consulate, Para, Brazil

Amazon Steamer at River Landing

Boats of this kind are used for local traffic on the Amazon and its tributaries.

few weeks. Clearings made for planting are obliterated within a short time unless a constant fight is maintained against an encroaching growth of vines and trees. No other place in the world has such rank, impassable growth as the Amazon Basin. The luxuriant vegetation of the carboniferous age could hardly have exceeded that in these jungles. The great scientist, Humboldt, visited this region in 1799; Wallace and Agassiz, famous naturalists, studied it later and found hundreds of plants unknown elsewhere.

The native inhabitants are able to live only in long, narrow strips of land on the river banks. There they grow a few vegetables and exist on the fish and game obtained from the water courses. They seldom undertake to travel inland except in search of rubber trees. Save for the hum of insects and the weird call of animals, these forests are solemn, gloomy, silent places, almost entirely devoid of human life.

Whether in ancient times the Inca civilization ever extended to the Amazon is uncertain. It is known that



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Crude Rubber

This crude rubber was brought by native boats to a steamer landing. Here, as in all Amazon views, note how the forest growth extends to the water's edge.

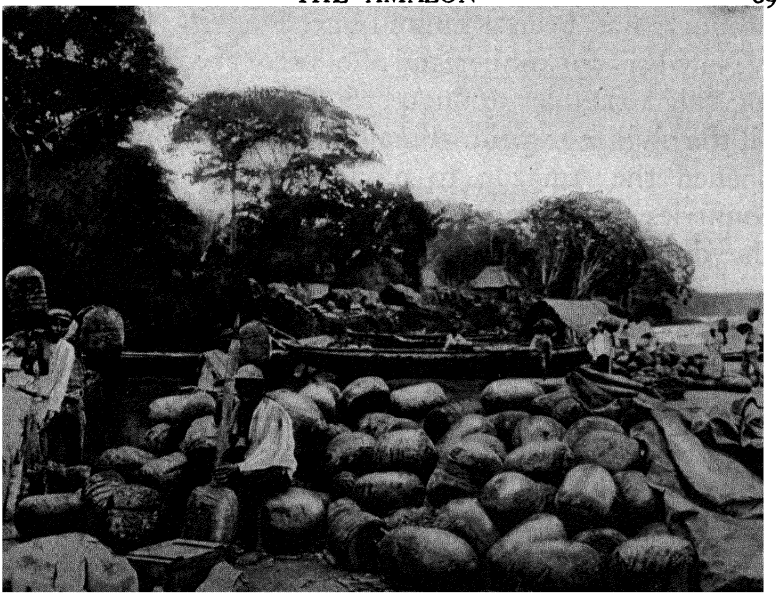
Andean people occasionally visited its upper tributaries in search of gold but no remains of their occupation have as yet been found. Discoveries of pottery and relics on some islands of the Amazon give evidence that people more advanced than the present Indians once dwelt there.

Until rubber became a commercial product, the river meant little to South America and almost nothing to the rest of the world. Spanish hopes of a hidden Eldorado had vanished. Colonization proved impossible. The market for plant gums and other forest products had been a limited one.

New uses for rubber and the discovery of trees yielding this valuable product brought to Para ships from all the civilized world. Finally, on July 31, 1867, Brazil opened the Amazon to navigation for vessels of all countries and the great river became a real factor in the development of South America. Although Para was founded in 1616, its real importance came with the export of rubber. Now, with a population of one hundred fifty thousand, it has many fine buildings, and docks, and warehouses, as modern as those of Liverpool and Hamburg.

The other commercial cities are Manaos, at the junction with the river Negro, and Iquitos in Peru, at the head of navigation for ocean-going steamers.

Manaos is about five days by steamer from the mouth of the river. It is said to be the best-lighted city in Brazil. It has a theater, which cost over two



©Brown Bros.

Rubber on the Wharf at Iquitos, Peru

million dollars, and excellent docks. Its population is about eighty thousand. To allow for the fifty-foot rise and fall of the river at this point, warehouses and unloading platforms are built on pontoons connected with the land by bridges. Between Manaos and Para are only small villages and camps of rubber gatherers.

Iquitos, besides having a considerable rubber trade, is the general business center for eastern Peru, the Peru beyond the Andes. There are many Americans living there and European commercial houses have agents in the vicinity. Some time there may be railroad connections between this point and the mining regions. At

present the journey from Iquitos to Lima occupies about two weeks. It is made partly by rail, partly by horse, and partly by steam launch. At Iquitos, over two thousand miles from the Atlantic, the Amazon is three miles wide. Lines of steamers give direct communication with New York and London.

Eastern Bolivia looks toward the Amazon as the outlet for her products, mineral and agricultural. By ascending the Madeira River, the principal tributary of the Amazon from the south, one reaches an immense territory high enough above the Amazon basin to be habitable. For a long time commerce on this route was hampered by the necessity for carrying goods around a series of nineteen falls covering a section of the river two hundred miles in length. As early as 1871, American engineers employed by the Brazilian government attempted to build a railroad around these falls. Labor problems and the difficulty of controlling tropical diseases resulted in failure. Another attempt was made in 1878. This likewise failed. Starting a third time, in 1907, the railroad was pushed through from Porto Velho below the falls to a point about two hundred miles up the river where navigation can be resumed and continued to the Bolivian lowlands east of the Andes. The construction of this railroad presented many of the same problems encountered in building the Panama Canal, particularly those relating to health and sanitation. That it was finally put through was due to the pluck and perseverance of American capitalists and

engineers. It is said that on the third attempt to construct the railroad one locomotive, abandoned in 1875 after standing thirty years in the forest, was repaired



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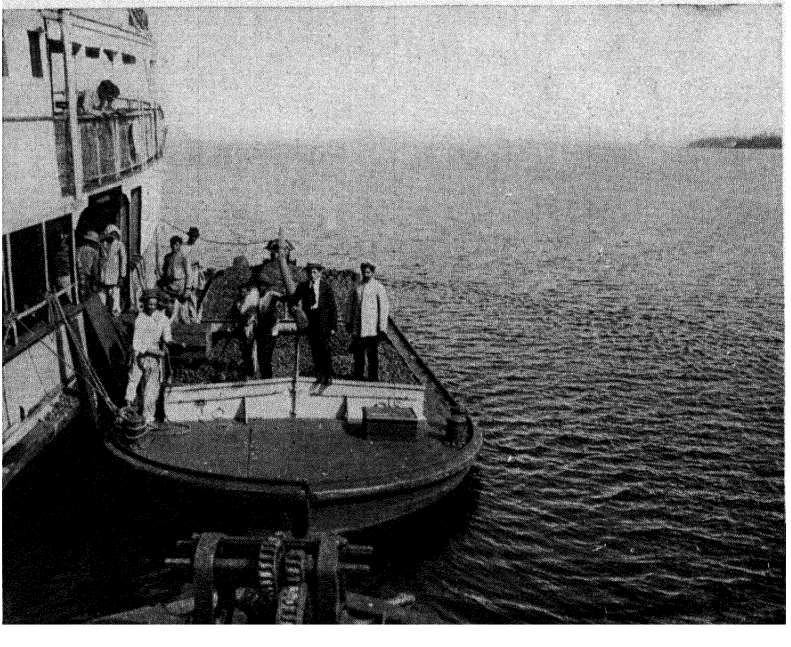
Building a Railroad in the Jungle

The track has to be supported by mattresses of brushwood. This type of land condition is common in the Amazon Valley.

and put in running order. At present there are three trains a week on this line.

Owing to the development of rubber production in other parts of the world, notably in the East Indies, there has in recent years been a steady decline in the

export of rubber from the Amazon region. From 1919 to 1920 there was a fifty per cent decrease in the value of rubber exported. Since rubber trees along the Amazon are never found in groves but are scattered in the almost impenetrable forests and average only one to the acre, the expense of gathering and marketing is much greater than on an efficiently managed plantation. But the decline of the rubber export trade probably will not lessen the importance of the Amazon



©*Brown Bros.*

Loading Brazil Nuts

Note the broad sea-like expanse of the Amazon.

Valley. Now that commerce is firmly established, other products and other regions will be developed and yield a continually greater volume of trade.

Eastern Peru and Bolivia will some day offer to colonists a healthful and profitable area the products of which will find their way to the world not over the Andes but through the Amazon. This trade passing along the river will draw more and more on the resources of its immense valley. The lumber and various plant products may well become important sources of world supply. Evidences of petroleum are already attracting prospectors from Europe and the United States.

Although actual settlement in the Amazon Valley is now impossible, the influence of the river is, after nearly four hundred years, coming to be a real factor in the development of South America.

PROBLEMS

1—What facts can you discover concerning the Niger River?

2—Compare the Amazon with the Kongo and the Niger, as to:
   (a) routes for travel and trade;
   (b) population and products of their watersheds;
   (c) history of exploration and adventure along these rivers.

3—With a constantly increasing demand for tropical products, which of these rivers will probably become the most important in the next fifty years?

4—Why may the Amazon become more influential in the development of South America than either the Orinoco or the Plata River?

5—Secure from the United States Department of Commerce statistics on the quantity of rubber imported from Brazil and from the East Indies for a recent five-year period. Compare totals to determine:

(a) relative quantity from each region;

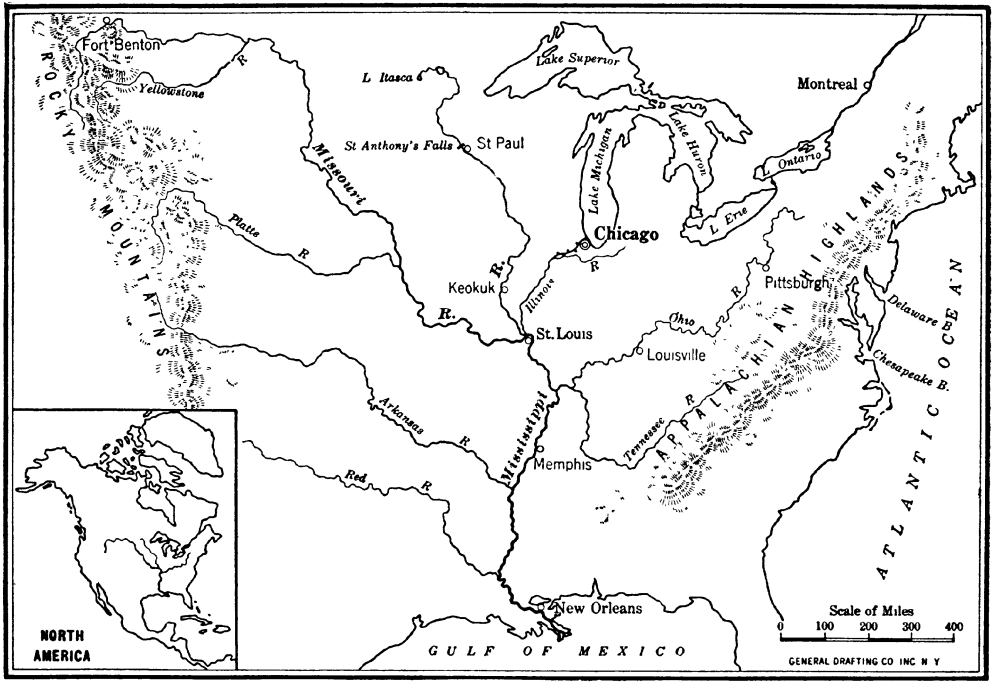
(b) tendency of imports to increase or decrease from each region.

THE MISSISSIPPI

A brief glance at the map of North America reveals the close relationship of the Mississippi River system to the life of the central region. From the Gulf of Mexico to the Great Lakes, from the Appalachian to the Rocky Mountains, all water routes lead to the Mississippi, aptly named by the Indians "Father of Waters."

Although this river has been well-known for two hundred years, the actual source of the Mississippi was not definitely determined until the nineteenth century. In 1832 Schoolcraft and in 1836 Nicollet explored the headwaters of the river in an attempt to determine the exact point at which it rises. In the Minnesota Historical Collections, Volume 6, is an interesting account of these explorations. Finally the little lake from which the main branch of the Mississippi starts was definitely located, two thousand five hundred miles from its mouth. It was named Itasca, a word said to be made from the last and first syllables of two Latin words, *veritas caput*, meaning "true head."

For us, the history of the great river begins with the discoveries of De Soto and the explorations of La Salle, but we have, in the remains of the mound-builders, evidence that, at some time in the dim past, parts of the Mississippi Valley were inhabitated by people who made considerable progress in the art of pottery-making



The Mississippi

and possibly in the use of copper and bronze instruments. The Mississippi thus had an important influence on the location and development of people dwelling in its valley long before the coming of the white man. Excavations of the unique and extensive earthworks of the mound-builders give evidence of a numerous people dependent on agriculture. These mounds also yield relics that indicate trade with distant places, a trade doubtless carried on through water routes afforded by the numerous tributaries of the Mississippi.

Although trade and fertile lands promote development of peoples possessing them, they arouse the jealousy of less fortunate groups. The very river that encourages peaceful commerce also offers easy avenues for invasion by hostile tribes. The Nile civilization was protected by a great desert on either side. Had there been navigable tributaries between Assuan and Cairo, the history of Egypt would have been far different, for it would probably have been threatened by the invasion of savage blacks.

The great Mississippi system, connecting all parts of the continent, made raids and warfare easy. Only in secluded places, such as those occupied by the cliff dwellers of southern Utah and the Pueblo Indians of Arizona, could we expect a long-continued peace so necessary to settled life and the growth of some industry and art.

The commercial possibilities of the Mississippi River

were soon appreciated. As early as 1719, John Law, a keen Scotchman residing in Paris, secured from King Louis XIV the right to form a company with exclusive trade privileges in Louisiana and all the Mississippi basin. Stock in the company was sold at fabulous prices. Everyone, common people as well as courtiers, invested their money. Poor management and misunderstanding resulted in a failure that has become historic. It was the first attempt to form on a large scale a joint stock company like those which are now so common. Its rapid growth and instantaneous collapse gave it the name "Mississippi Bubble" and caused it to be remembered to this day.

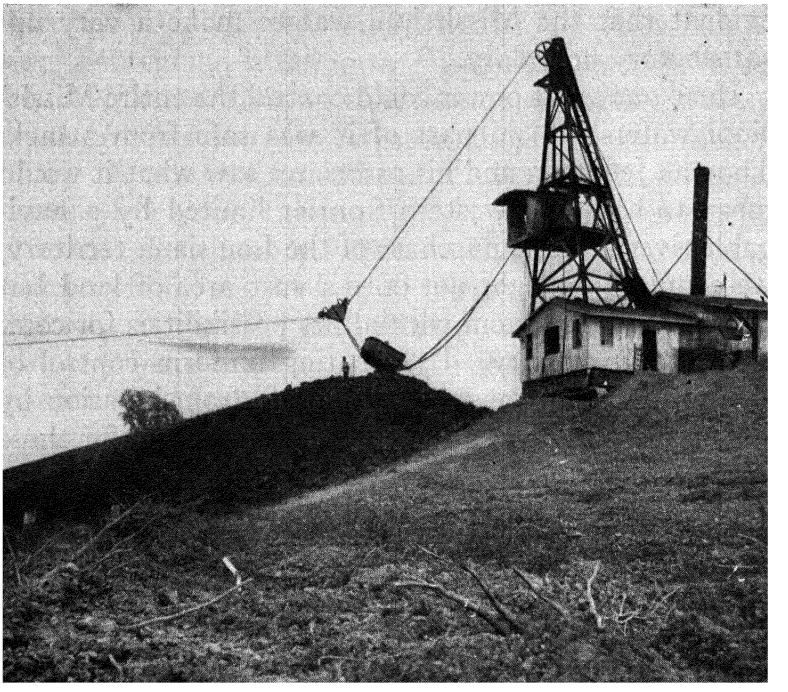
Free and unrestricted use of the Mississippi River for settlers and traders was guaranteed by a treaty made in 1795 with Spain. Disputes with this country regarding Florida caused the Spanish government to annoy Americans who were beginning to ship their grain, pork, and tobacco from the western Appalachians via the Mississippi River to the sea. At one time it was proposed to close the river to Americans for twenty years. Some of the New England states actually favored such a plan because they thought that it might reduce the competition of western farmers with eastern producers. Dwellers in the Mississippi Valley, however, realized that their future progress depended upon free navigation of the Mississippi and even talked of seceding from the east, if any attempt were made to deprive them of their natural commercial outlet. It became

evident that the Mississippi was to make a very unsatisfactory boundary.

Until one great power could control the entire Mississippi watershed, no part of it was safe from attack. Thomas Jefferson and his associates saw what it would mean to have our western frontier limited by a navigable river. In the purchase of the Louisiana territory, we acquired outright not only a vast area of land but an entire river system with all its possibilities for commerce and industry. By securing uniform control of the entire basin, we rendered it safe from invasion by foreign powers and at the same time insured, for those who chose to settle in it, complete protection for the development of its soil, its timber lands, and its minerals. Could the Danube have unified control, how different would be the condition of central Europe today! The political importance of the Mississippi has ceased. Its problems have now become those concerning its improvement and utility.

Instead of constructing massive forts and gun bases like those that border many places on the Rhine, our engineering is devoted to the betterment of the Mississippi River for navigation and power so that it may become more useful in the commercial and industrial development of central North America.

Some two thousand two hundred miles from the Gulf of Mexico to St. Anthony's Falls the river can be navigated profitably by steamers and barges. The Missouri, its principal branch, can be operated to the



Courtesy of Mississippi River Commission, Third District

Enlarging a Small Low Levee

The engine with the cable-way moves by its own power along the bank as the filling is completed.

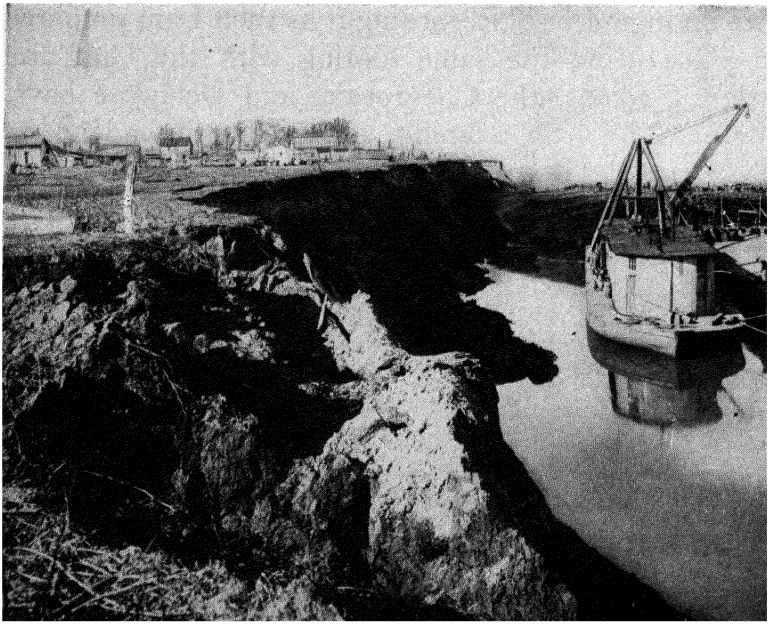
foothills of the Rocky Mountains. The Mississippi, with all its tributaries, has over sixteen thousand miles of navigable water courses. From Pittsburgh, boats of moderate draft can reach Fort Benton, Montana, a distance of 4,333 miles. Its basin embraces approximately a million and a quarter square miles and the alluvial lands of the lower Mississippi Valley are equal

to eighteen times the area of Holland and three fourths the area of England.

John C. Calhoun in 1845 said at Memphis, "The invention of Fulton has in reality, for all practical purposes, converted the Mississippi with all its tributaries into an inland sea. Regarding it as such I am prepared to place it on the same footing with the Gulf and Atlantic coasts, the Chesapeake and Delaware bays, and the Lakes, in reference to the superintendence of the General Government over its navigation. It is manifest that it is far beyond the power of individual or separate States to supervise it."

No study of the Mississippi is complete without a story of the wonderful success of our engineers in controlling its floods and improving its channel. Until the middle of the nineteenth century improvement consisted merely in removing the most dangerous obstacles and marking the treacherous shoals. The increased shipments of coal down the Ohio to New Orleans, the growth of the grain and lumber trade from Missouri and Illinois that came with the introduction of steam navigation, made New Orleans one of the great ports of North America. Its commerce, however, was constantly threatened by the shifting sands of the Mississippi. Millions of tons of sediment brought down and deposited in the Gulf gradually settled, as the water of the sea was reached, and there built up numerous bars. Vessels drawing over eighteen feet could not enter or leave the river. Ordinary methods of dredging

were like dipping up the ocean with a spoon. A channel open one week might be closed the next. At one time over five million dollars' worth of cotton was held up by the grounding of vessels at the mouth of the river.



Courtesy of Engineering Office, War Dept.

Caving Banks along the Mississippi River

In 1872–77 over four hundred ships were delaved by grounding as they passed over the bar.

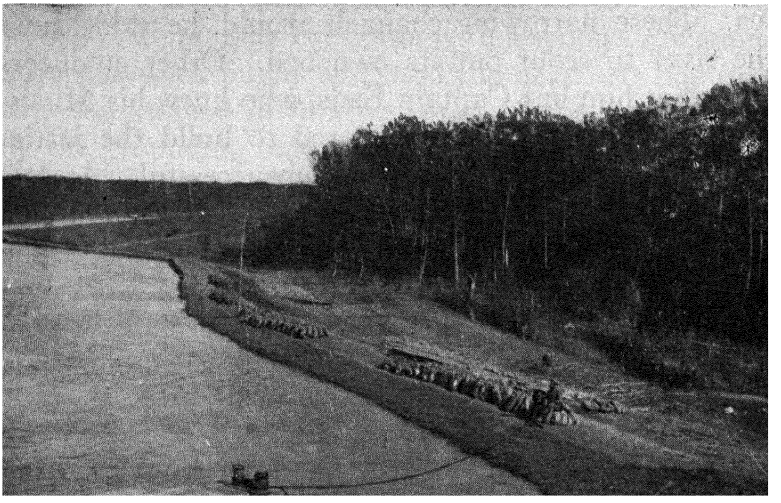
Finally Captain Eads, a practical engineer, suggested a system of artificial banks, called jetties, extending from the mouth of the river slightly out to

sea. These narrowing channels would, he said, cause the river to scour out its own bed. Other engineers scoffed at him but Captain Eads, who knew his Mississippi, persisted. He even offered to build the jetties himself and receive no pay if unsuccessful. At last Congress appropriated five and one-quarter million dollars to be paid in installments to Captain Eads upon successful completion of the jetties. The work was begun in 1875 and was a complete success. A continuous twenty-foot channel was obtained. Since July, 1879, there has been a constant depth of almost thirty feet.

After that another series of jetties was authorized and now there are two practical thirty-foot channels through the Mississippi delta. These works cost the federal government over fifteen million dollars but are considered a good investment.

Equally interesting are the efforts to control the floods of the Mississippi. As early as 1717 French engineers found it necessary to erect high embankments around the city of New Orleans. Protection of lands along the river beyond the city was attempted but not completed until recently. These rich lands, fifteen million acres in area, can produce millions of dollars' worth of sugar, cotton, and corn each year, but the uncertainty of flood control caused much to remain in swamp and wilderness.

Beginning near New Orleans the river now has a levee system of protection extending on both sides more



Courtesy of Mississippi River Commission, Third District

The Mississippi River at Extreme Flood

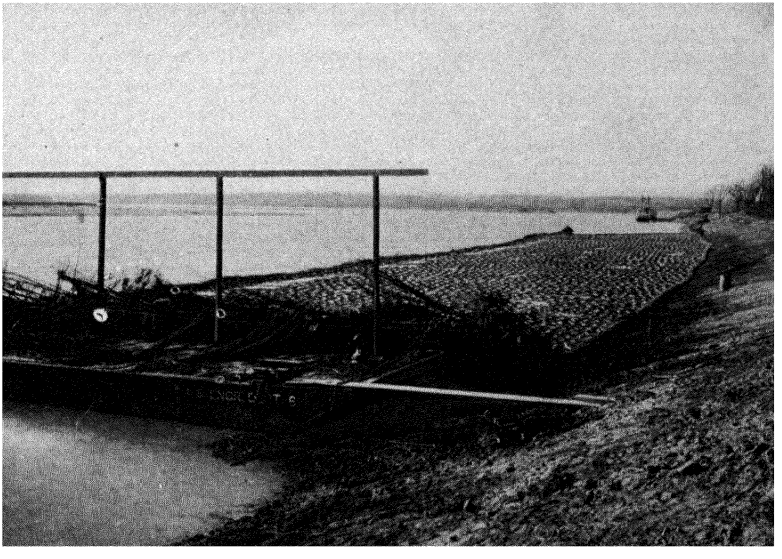
The surface of the water is about twenty-five feet higher than the ground back of the levee.

than seven hundred miles northward. The United States government appropriated fifty million dollars for levee construction. So great is the value of the reclaimed farm land that even further sums will be spent until this region is rendered absolutely safe. One of the most serious overflows was in 1913 when the river rose to forty-six and one-half feet above low water at Memphis, Tennessee. The reclaimed lands now support nearly one million people and have three thousand two hundred miles of railway.

The river side of the levee is faced with enormous mats made of woven willow and weighted down with rock. These mats are sometimes made in sections one

thousand feet long and three hundred feet wide. Hundreds of miles of these protecting coverings line the levees.

During high water the levees are patrolled day and night. The boring of a rat may start a leak which will result in a break or crevasse, as it is called. When there is danger of a serious break, hundreds of men are quickly brought together and, by using bags of sand and willow mats, the leak may sometimes be stopped. If the crevasse is a large one, the great river may spread



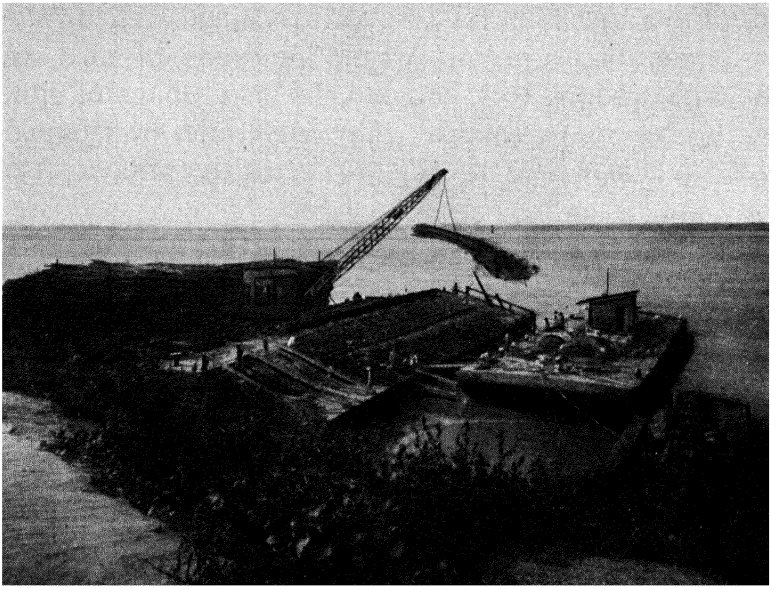
Courtesy of U. S. Engineering Dept., No. 6

Willow Mattress Ready to Be Placed along Face of Levee

By weighting the mattress with stone, it will remain flat against the inside of the levee and prevent erosion by the river current.

its course over an area forty miles in width, and the valley may become a vast lake, causing enormous damage to land and live stock.

Another interesting form of control is the protection



Courtesy of Mississippi River Commission, Third District

Constructing a Willow-Tree Mattress

The operations of handling the material, placing it, tying, and weaving can be seen.

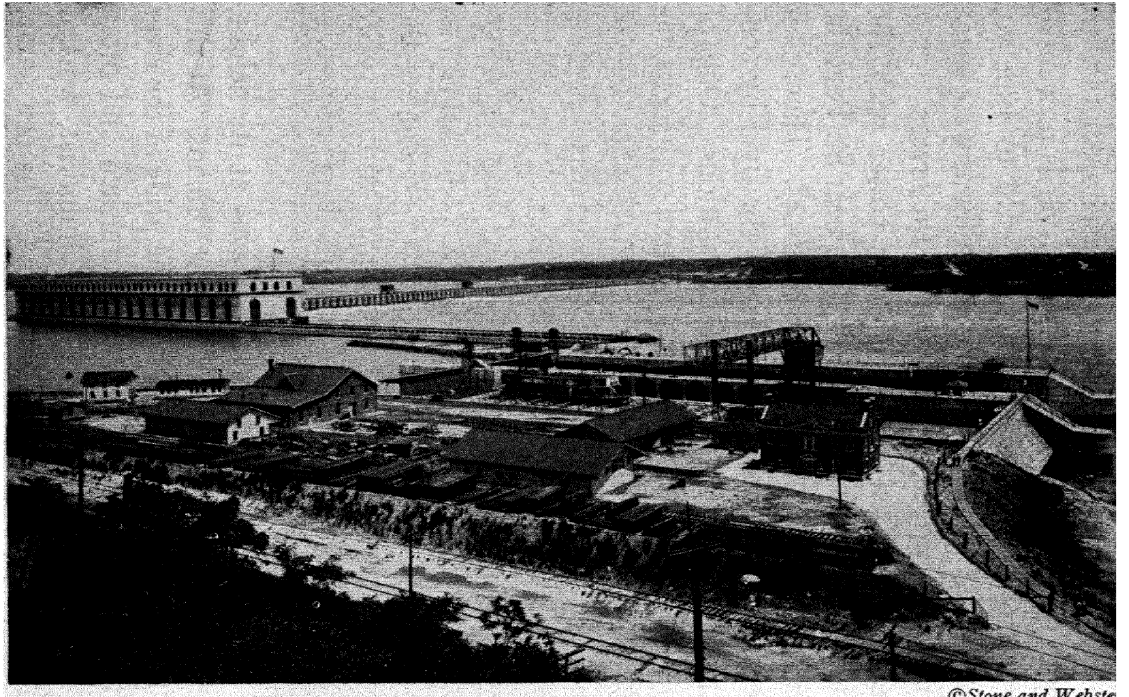
of river banks to insure an even channel. The tendency of the river is to wind from one side of the valley to the other, snake fashion. This causes the current to eat away the concave side of each curve. The earth thus washed out is carried diagonally downstream where

it builds up bars and projecting points on the opposite side. By covering the banks at these vital spots with heavy mats of willow and straw the river is prevented from constantly shifting its channel. Up to June 30, 1923, over one hundred thirty-eight millions were spent on channel improvement, apart from the levees.

We do not often associate water power with the Mississippi but at St. Anthony's Falls near St. Paul the power has long been utilized in factories. There is a tendency to make still greater use of the river by constructing enormous hydro-electric stations. One of these has been built at Keokuk. A canal with locks has likewise been constructed here to permit the passage of boats. The deepened water behind the Keokuk dam has improved navigation for many miles.

Steam navigation on the Mississippi began in 1817. The trip from Louisville to New Orleans and return was made in forty-one days. In 1843, forty years after the purchase of Louisiana, 2917 steamer landings were recorded in New Orleans, and besides these, 2673 flatboats arrived from the North.

In 1860, when steamboat travel was at its height, 3566 arrivals were registered in New Orleans. At this time the fast passenger boats were the pride of the river country. They were luxuriously furnished and often very speedy. Samuel Clemens, the humorist, worked when a boy as a pilot on these boats. His pen name, Mark Twain, was said to be an expression used by pilots to indicate a certain depth of water.

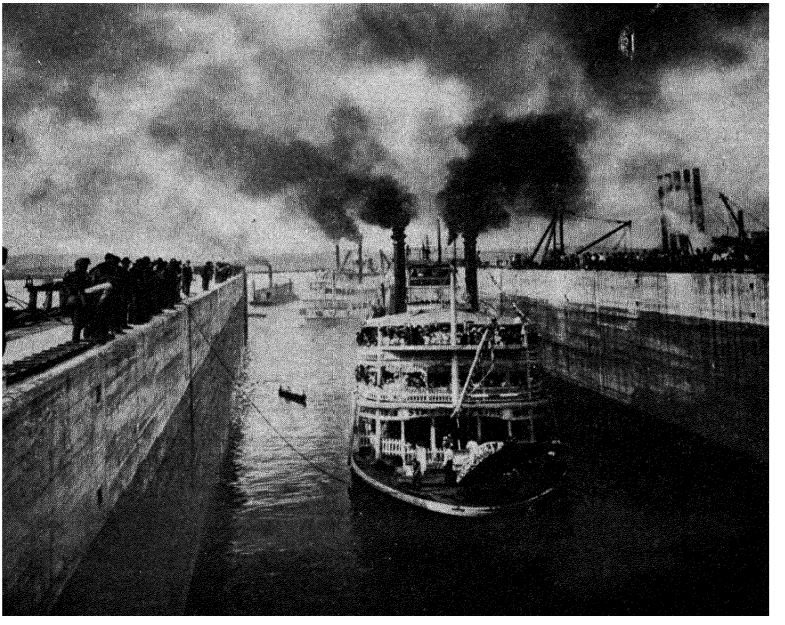


©Stone and Webste

View of Dam and Electric Power Station, Keokuk, Iowa

Locks for boats can be seen in the foreground. The river, for miles above, is now deeper and more easily navi
gated than before the dam was built.

Of course, the Civil War checked commerce in the South. The blockade of the Mississippi stopped it entirely for a time; then, just as it was recovering, in



©Stone and Webster

Locks around the Great Dam across the Mississippi at Keokuk

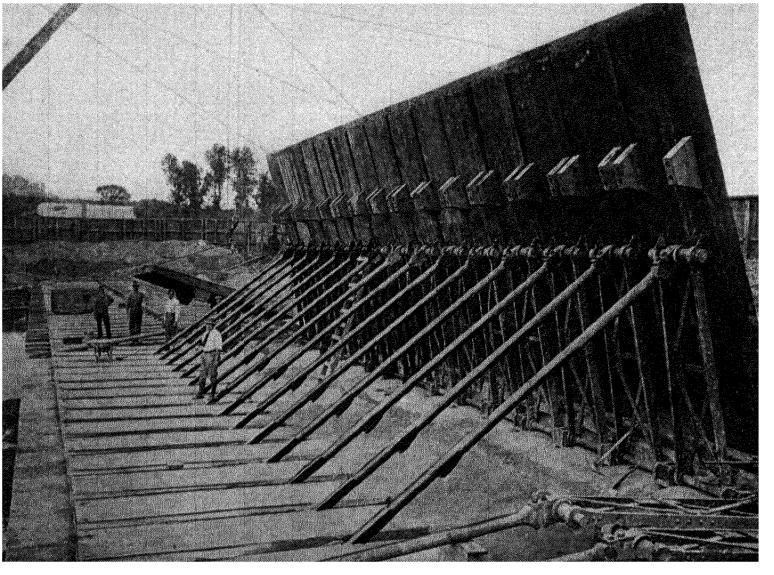
The steamer is a common type on the river.

the 1870's the railroads began a competition that has probably driven passenger traffic forever from the river.

Traffic in heavy freight, particularly coal from the Pittsburgh region, is now the main business on the lower Mississippi. A line of barges used by the govern-

ment during the World War has proved so profitable that St. Louis is constructing new docks and there is a promise of a great revival of trade on the upper river.

The opening of the Chicago Drainage Canal affords



Courtesy of U. S. Engineering Office, Wheeling, West Virginia

Collapsible Dam on the Ohio River

By this means, water is held back until deep enough to float loaded barges; then the wickets are opened, and the boats are carried forward to the next pool.

a useful channel from Lake Michigan to the Illinois River, thence to the Mississippi and the seaboard.

The following quotation from Theodore Roosevelt, who knew and appreciated the West better than any other president, well states the necessity for far-sighted

development of the Mississippi water routes: "The valley of the Mississippi is politically and commercially more important than any other valley on the face of the globe. Here more than anywhere else will be determined the future of the United States, and indeed of the whole western world; and the type of civilization reached in this mighty valley, in this vast stretch of country lying between the Alleghanies and the Rockies, the Great Lakes and the Gulf, will largely fix the type of civilization of the western hemisphere."

PROBLEMS

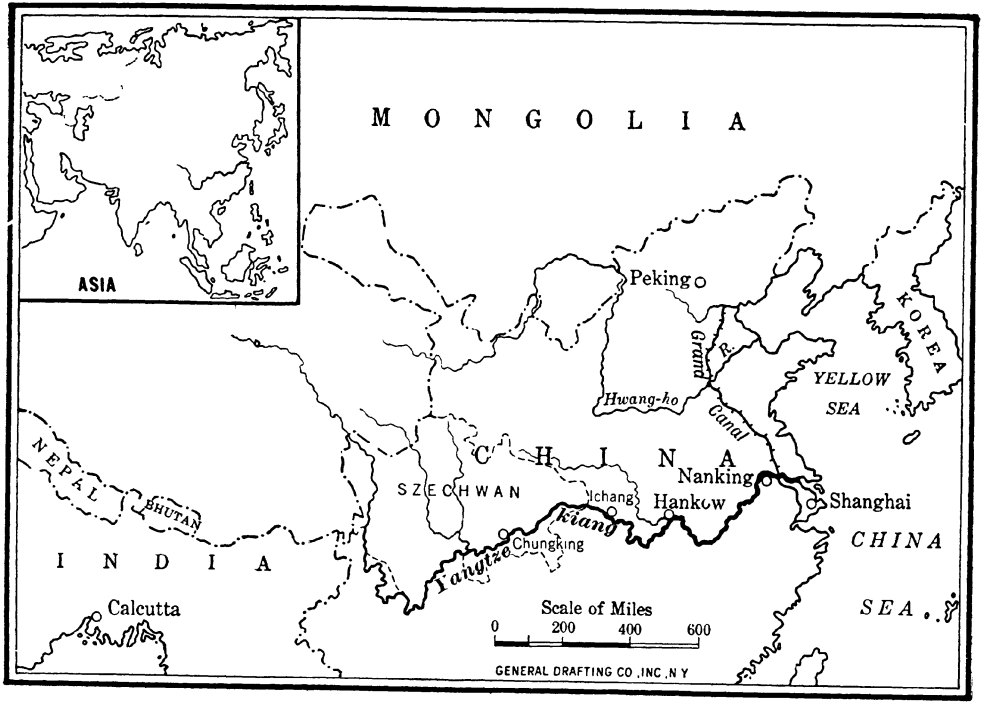
1—Compare the Mississippi River with the Amazon as to:
   (a) physical features,
   (b) use and control,
   (c) difference in importance.

2—What information can you find concerning the Volga River?

3—Compare the Mississippi with the Volga as to:
   (a) relation to their respective continents,
   (b) area of watersheds,
   (c) commerce.

4—Trace a possible all-water canoe trip from Montreal to Pittsburgh.

5—In what ways is the Mississippi River an actual barrier to east-west overland commerce?
   (a) Find how this barrier is overcome at various places.



The Yangtze-Kiang

THE YANGTZE-KIANG

For ages the rivers of China have been both a menace and a source of livelihood to its people. With their alluvial deposits these rivers created millions of acres of fertile soil—lands so rich and so easily worked that the Chinese have clung to them and multiplied in numbers despite the terrible floods that have devastated their eastern plains.

The very struggle to hold this profitable territory



Courtesy of Methodist Episcopal Church Society

Flooded District

To control flood water has always been a problem in Eastern China.

early developed in the Chinese a feeling of common danger and a bond of common interests. It is evident that these collective interests stimulated a spirit of coöperation and hastened the organization of government, which in China began earlier than in any other region except perhaps Egypt and Mesopotamia. The Egyptians, it will be remembered, grew in unity through their dependence on the Nile.

In the effort to control their rivers and to lessen the destruction from floods, the Chinese acquired by practice the beginnings of engineering science. They advanced in this science far more and much earlier than other peoples of their time. To the Chinese, an engineer who could plan and construct a system of dikes and canals was a greater national hero than the general who led an army through victorious battles. Evidences of this engineering ability are still to be seen in the Grand Canal, some six hundred miles long, connecting north and south China; in the network of ditches and drainage canals many thousands of miles in length; and in the artificial ponds and lakes designed to draw off and store some of the surplus flood water. Another engineering work was the diversion of an entire river, the Huai, with its seventy-two tributaries; another, the canal paralleling the Yangtze-kiang for one hundred forty miles. Just north of this canal is a district eight thousand square miles in area. Like parts of Holland, it is below water level but reclaimed by drainage. It is now the best rice land in all China.

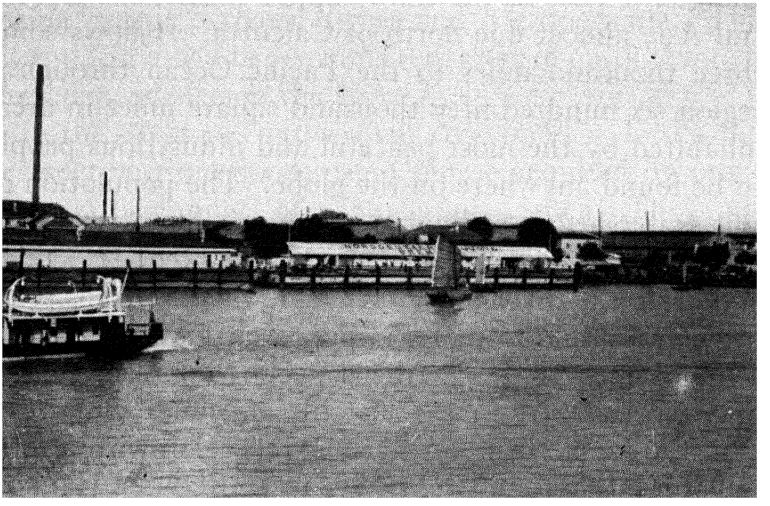
The greatest of Asiatic rivers in length, volume, and utility is the Yangtze-kiang. To the people dwelling in its valley, it is all the Amazon might have been and more than the Ganges or the Nile can ever be. Like the Ganges, it rises in the snow-capped mountains of central Asia almost due north of Calcutta. It flows some three thousand miles to the Pacific Ocean through a region six hundred fifty thousand square miles in area, inhabited by the most peaceful and industrious people to be found anywhere on the globe. The population of this watershed is estimated to be one hundred eighty millions.

During the first half of its course the river falls some fifteen thousand feet. Its upper reaches were unknown until recently and have been explored by occidentals only since 1873. In the last fifteen hundred miles it flows through a comparatively level region with a total fall of one thousand twenty-five feet. Between Hankow and the sea, a fall of only one inch per mile causes an almost imperceptible current very favorable to navigation. High water with a rise of forty feet occurs during March and August even more regularly than on the Nile.

The Yangtze-kiang is navigable for the largest ocean steamers to Hankow, six hundred miles from the coast. Over three thousand foreign vessels entered the river in 1918. Besides these there were hundreds of Chinese steamers and sailing vessels, not counting the thousands of launches, towboats, and junks that help to

carry the enormous trade of central China over this river route.

Beyond Hankow smaller steamers ascend to Ichang, four hundred miles farther inland. At this point all



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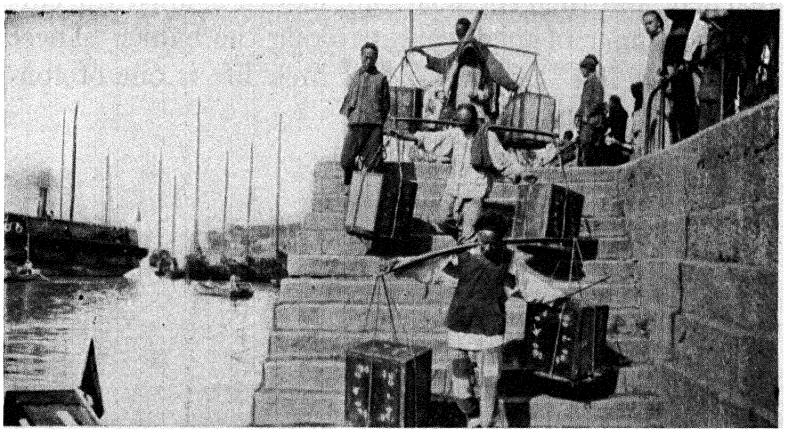
Wharf at Hankow

Ocean steamers ascend to this city.

goods destined for the upper river must be transferred to sailing vessels. The river is the sole outlet for Szechwan Province, which has a population of over sixty million and an area equal to that of France. Trade estimated at thirty million dollars annually passes in and out of this province via the Yangtze-kiang.

Szechwan has a splendid climate, excellent forests, and some of the world's greatest coal fields. Natural

gas was used here long before it was even known in the western world. Here too are wonderful salt wells, drilled with crude machinery, operated by ropes and man-powered windlasses. Sometimes the drilling of a very deep well requires several generations to complete it. Sons carry on the work of the fathers until a depth



©*Beseler Lantern Slide Co.*

Loading Tea at Hankow

of two to three thousand feet has been reached. Natural gas conducted through bamboo tubes to furnaces is used to evaporate the brine drawn from the salt wells.

River traffic above Ichang is extremely dangerous but at the same time very picturesque. The river flows through vast gorges with mountains rising a sheer three thousand feet or more directly from the water's edge. As might be expected the current is rapid and the channel filled with treacherous eddies and cross-cur-

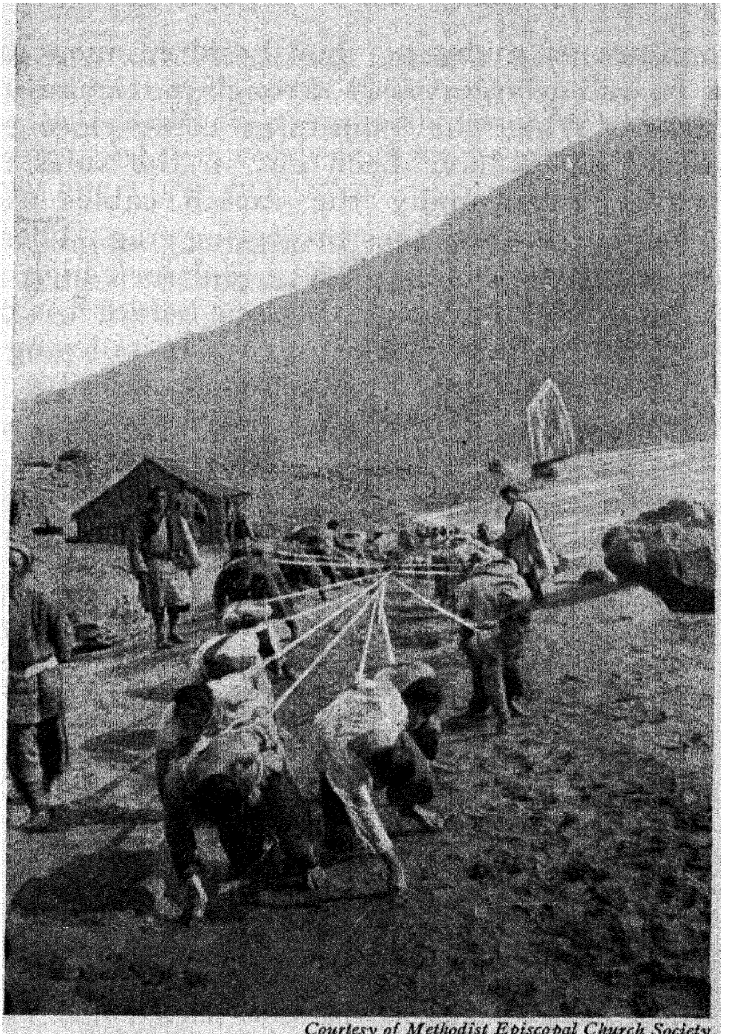
rents. Junks especially constructed of stout frame are used in this trade. These sturdy boats have low square bows and lofty sterns. They are from eighty to one hundred twenty feet long, from nine to twelve feet broad, and carry up to one hundred tons of freight. Leaving Ichang, sails are used until the gorges are reached, and then the boats are hauled against the current by gangs of men walking along the banks. These men are called "trackers," and their life is one of constant toil and adventure.



Courtesy of Methodist Episcopal Church Society

In the Gorges

The river is the only route to a vast, productive, interior province.



Courtesy of Methodist Episcopal Church Society

Trackers on the Upper River

Until recently, no steamers were used. Most of the up-river freight is still dragged by man power against the current of the rapids.

Sometimes as many as four hundred men are required to pull a large vessel through particularly difficult rapids. When the mountains come close to the river edge, paths have been cut in the sides of the steep cliffs. Occasionally the rattan cables used in towing become caught on a projecting crag. Then bold trackers must climb along the ragged rock high above the swirling river to push off the rope before it is chafed to pieces by the heavy boat tugging at its lower end.

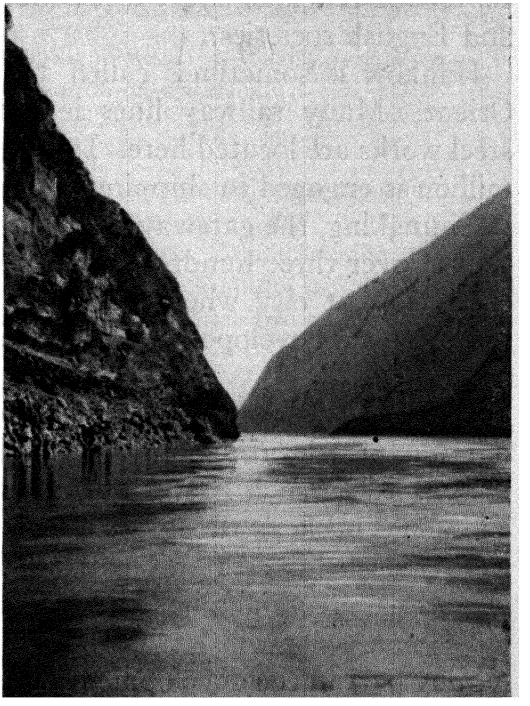
The following vivid account[1] well describes some common incidents in the dangerous return journey, when boats descend with the swift current:

I never saw such exciting water scenes; the wild rush of the cataract; the great junks hauled up the channel on the north side by 400 men each, hanging trembling in the surges, or, as in one case, from a tow-rope breaking, spinning down the cataract at tremendous speed into frightful perils; while others, after a last tremendous effort, entered into the peace of the upper waters. Then there were big junks with masts lashed on their sides, bound downwards, and their passage was more exciting than all else. They came broadside on down the smooth slope of the water above, then make the leap, bow on, eighty, even a hundred rowers at the oars and *yulows*, standing facing forwards, and with shrieks and yells pulling for their lives. The plunge comes; the bow and fore part of the deck are lost in foam and spray, emerging but to be lost again as they flash by, then turning round and round, mere playthings of the cataract, but by skill and effort got bow on again in time to take the lesser rapid below. It is a sublime sight. *Wupans* and *sampans*, making the same plunge, were lost sight of altogether in clouds of foam and spray but appeared again.

[1] From *The Yangtze Valley and Beyond*, by Isabella Bird Bishop Courtesy G. P. Putnam's Sons Publishers, New York and London.

Red lifeboats, with their smart turbaned crews, dodged in the eddies, trim and alert; crowds of half-naked trackers, struggling over the boulders with their 1200 feet of tow-rope, dragged, yelled, and chanted; and from each wild shore the mountains rose black and gaunt into a cold, grey sky.

The Chinese government maintains life-saving crews in the gorges. Many boats are wrecked each year, but the loss of life is comparatively small. Not until 1899 was any attempt made to navigate this section of the river by steam power. The first boats were unsuccessful but high-powered ones now ascend to Chungking. Either the river or a railway along its bank must always be the connecting line between central-western China and the seaboard.



Courtesy of Methodist Episcopal Church Society

Another View in the Gorges

Here can be seen the difficulties in road building. The river will long continue to be the only transportation route.

Like other great rivers of the world, the Yangtze-kiang has in its valley cities of great commercial and political importance. Shanghai, one of the leading port cities, owes its prominence to a position near the entrance to this river.

Nanking, once the capital of China, has a population of over three hundred thousand. It is now an important center for religious and educational work of American and English societies.

Hankow is sometimes called the Pittsburgh of the Orient. Many railway lines lead from it. Immense steel works are located here. Its population of over one million is engaged in shipping and manufacturing.

Chungking, the gateway to Szechwan, with a population of over three hundred thousand, is destined to become a great city when coal fields and other natural resources are developed and better transportation facilities provided.

The Chinese have done all and even more than one might expect in utilizing the great Yangtze-kiang. To it they owe much of their progress. Life in central China has been a struggle to control it while cultivating the fertile fields created by its silt-laden waters. Just as the Yangtze-kiang has had a large part in the life of old China, so it will have a larger and perhaps determining part in the development of new China. It offers the only practicable route to the interior. If it can be open. to all nations, the people along its course will be the first to know the benefits of modern civilization.

Already the Yangtze-kiang has come to be a great highway over which new ideas and new commodities from a new civilization are being carried to the heart of China. If, as stated by many close observers, the Chinese, man for man, have intellects as keen as ours, their contribution to world life and trade will be well worth while.

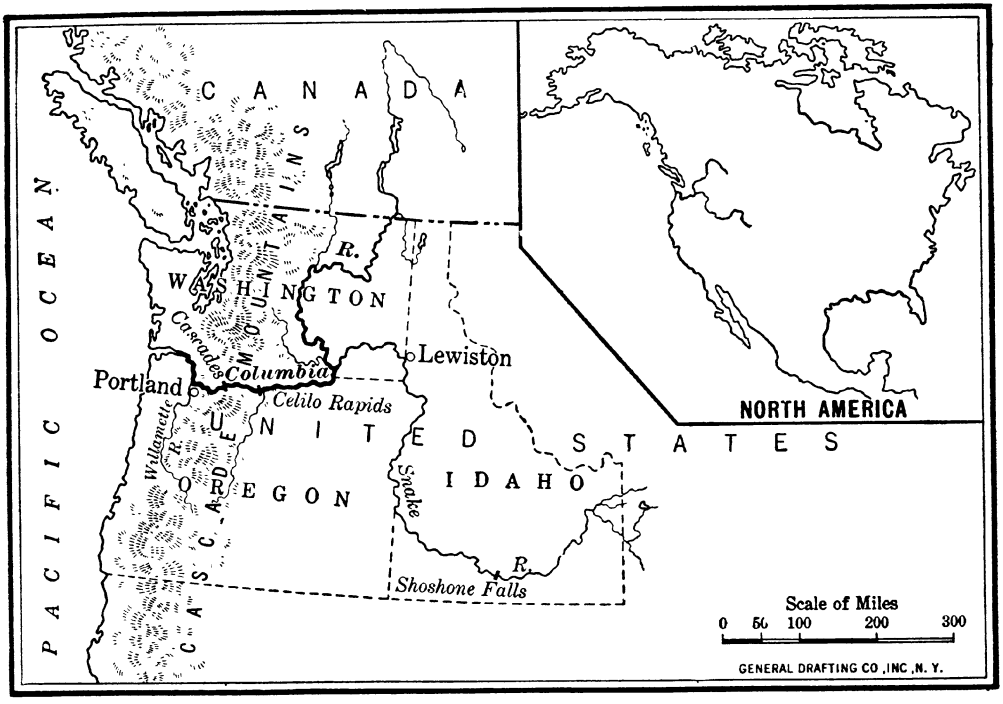
PROBLEMS

1—Compare the Yangtze-kiang with the Mississippi, as to:
- (a) density of population on watershed,
- (b) direction of flow,
- (c) extent of commerce,
- (d) engineering works for control and improvement,
- (e) rela ion to development of continent.

2—Make similar comparisons with the Columbia River.

3—List all large rivers flowing to the Atlantic; list all large rivers flowing to the Pacific; compare these two groups, as to:
- (a) total navigable water,
- (b) total population (estimated),
- (c) total areas of watershed,
- (d) progress in civilization among peoples as a whole living near each group.

4—Do the results of the above comparisons suggest any facts regarding the commercial importance of the two oceans?



The Columbia

THE COLUMBIA

The new world was discovered in 1492 but many centuries elapsed before the surface or even the outlines of the western continent were known as they are today.

In their search for a passage across or through North America, explorers cruised up and down both coasts of the continent. Parliament in 1745 even offered an award of twenty thousand pounds sterling to the officers and crew of any English ship discovering a water route through the Americas.

Much to the surprise of these adventurers, there seemed to be on the Pacific side no great navigable river from Cape Horn to Alaska. Somewhere north of California it was rumored that a great stream called the "River of the West" entered the sea, but no mariner had yet found it.

Russian, Spanish, and English sailors, including the famous Captain Cook and the bold Sir Francis Drake, examined this section of the coast in their search for harbors, places to establish Indian trade, and possible water routes to the Atlantic. In 1775 one Spaniard, Captain Heceta, did notice what seemed to be the mouth of a large river but did not think it worth while to investigate further. An Englishman, Captain Meares, also thought that he had found the long-sought river.

Failing, he named the point of land near his supposed discovery "Cape Disappointment."

Finally in 1792, just three hundred years after Columbus' first voyage, Captain Robert Gray, an



Land's End

This lighthouse marks the entrance to the Columbia so hard to find in Captain Gray's time.

American, actually located the mysterious river, entered it, and named it the Columbia in honor of his vessel, the *Columbia* of Boston.

The following entry in Gray's log book describes, in concise, sailor English, the great event:

"Ship Columbia, May 7, 1792, A.M.—Being within six miles of the land, saw an entrance in the same, which had a very good appearance of a harbor; lowered away the jolly-boat, and went in search of an anchor-



©*A. M. Prentiss*

Jetties at Mouth of Columbia

These jetties break the force of ocean waves and currents. The timbers were part of a temporary trestle over which carloads of stone were transported.

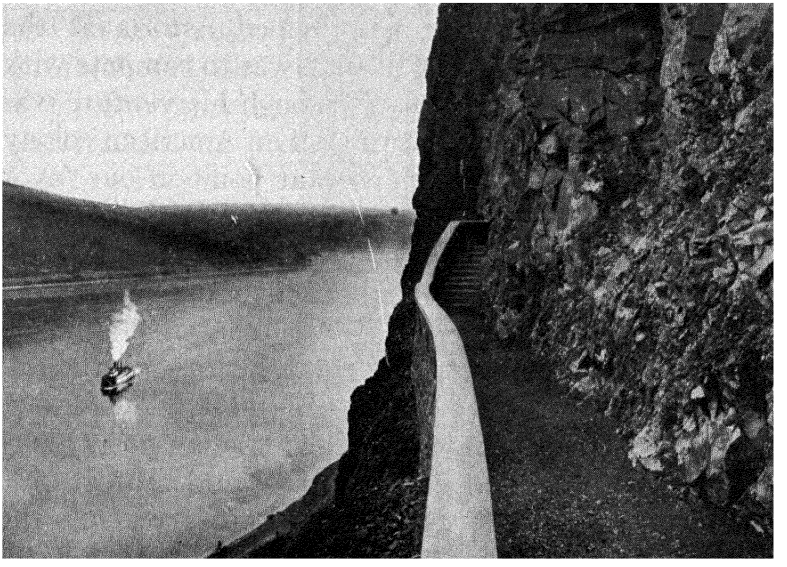
ing-place, the ship standing to and fro with a very strong weather current. At one P.M. the boat returned, having found no place where the ship could anchor with safety; made sail on the ship; stood in for the shore. We soon saw from our masthead a passage in between

the sand bars. At half past three, bore away, and ran in northeast by east, having from four to eight fathoms, sandy bottom; and, as we drew in nearer between the bars, had from ten to thirteen fathoms, having a very strong ebb of tide to stem. Many canoes came alongside. At five P.M. came to in five fathoms water, sandy bottom with a safe harbor, well sheltered from the sea by long sand bars and spits. Our latitude observed this day was 46 degrees 58 minutes North."

Gray's discovery was destined to play an important part in the development and control of the Pacific coast. Until this time no white man had ever explored or even crossed the great northwest between the Missouri River and the ocean. As soon as the discovery of the Columbia became known, trails were opened from the coast inland and from the Mississippi Valley to the western ocean.

When President Jefferson sent Lewis and Clark across the continent in 1804, he asked them to find an overland route to the Columbia, frequently called the "River of the West." After following the Missouri to its head waters in the Rocky Mountains, the expedition passed the great divide and soon reached tributaries of the Columbia. By descending these, the Lewis and Clark expedition finally came to the main stream and followed it to the sea. Just as Americans were the first to enter the Columbia, so Americans were first to trace its course from the interior.

During the next twenty-five years scores of sailing



©*A. M. Prentiss*

The Lower Columbia

To see views like this a fine roadway has been built along the heights.

vessels were engaged in trade between the Atlantic coast cities and the Columbia region. It was customary to start with cargoes of hardware, trinkets, and cloth. These goods were exchanged with the Indians for furs. The furs, especially otter skins, were taken to China and there exchanged for tea and silk. With these products of the Orient the ships returned to their home ports. To make the round trip on such a voyage often required a year or more but the profits, like the risks, were great.

John Jacob Astor, a New York merchant, established in 1811 a trading settlement named Astoria at the mouth of the Columbia. His plan was to compete with the English fur companies. Although his venture was not successful, the early location of an American colony at this place became an important point in our favor when the United States claimed the valley of the Columbia. Washington Irving in his book *Astoria* gives a vivid and interesting description of pioneer life in Oregon.

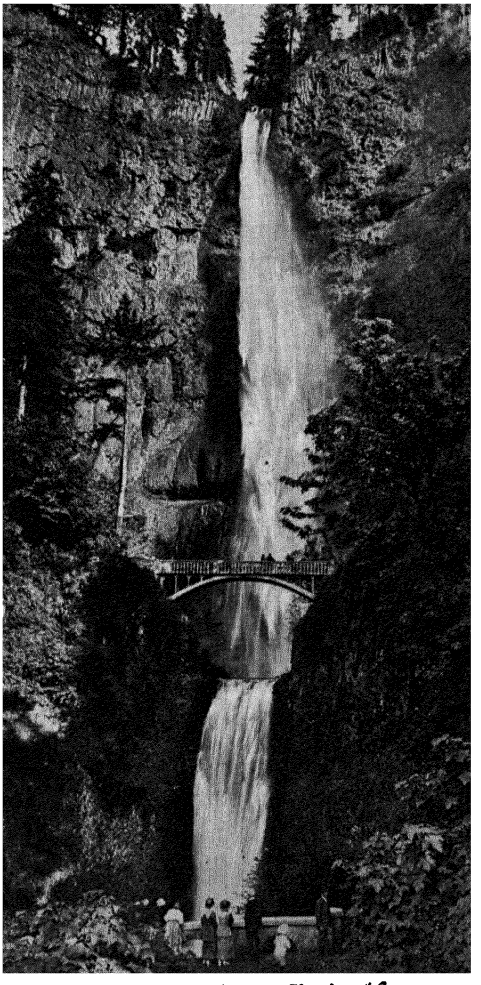
For some fifty years the early history of the St. Lawrence was repeated on the Columbia. The famous Hudson Bay Company established trading posts along the river, trappers ranged the forests, and venturesome voyageurs carried furs by river and portage across the continent to Montreal.

Like the St. Lawrence, the Columbia soon became an international river. Disputes arose between the United States, Spain, and England regarding its control. Spain, by reason of her early explorations along the coast, claimed all the land north to the Russian settlements in Alaska. She finally withdrew and ceded to England her rights on the coast north of California. This left the struggle for ownership between England and the United States, a contest that soon became keen. To keep peace among the settlers, fur traders, and Indians, England and the United States agreed to a temporary government backed by both nations. This arrangement did not attempt to fix definite boundary

lines. Settlers from the States soon outnumbered the English trappers and traders.

When President Polk was elected, one of the campaign slogans was, "54–40 or fight!" This meant that many people wanted our government to take possession of the Pacific coast territory between California and Alaska. If England objected, they were ready to go to war.

In the final settlement, peacefully made, can be seen the great influence of rivers in international affairs. The terri-



Courtesy of Portland Chamber of Commerce

Multnomah Falls

Another view on the Columbia Highway.

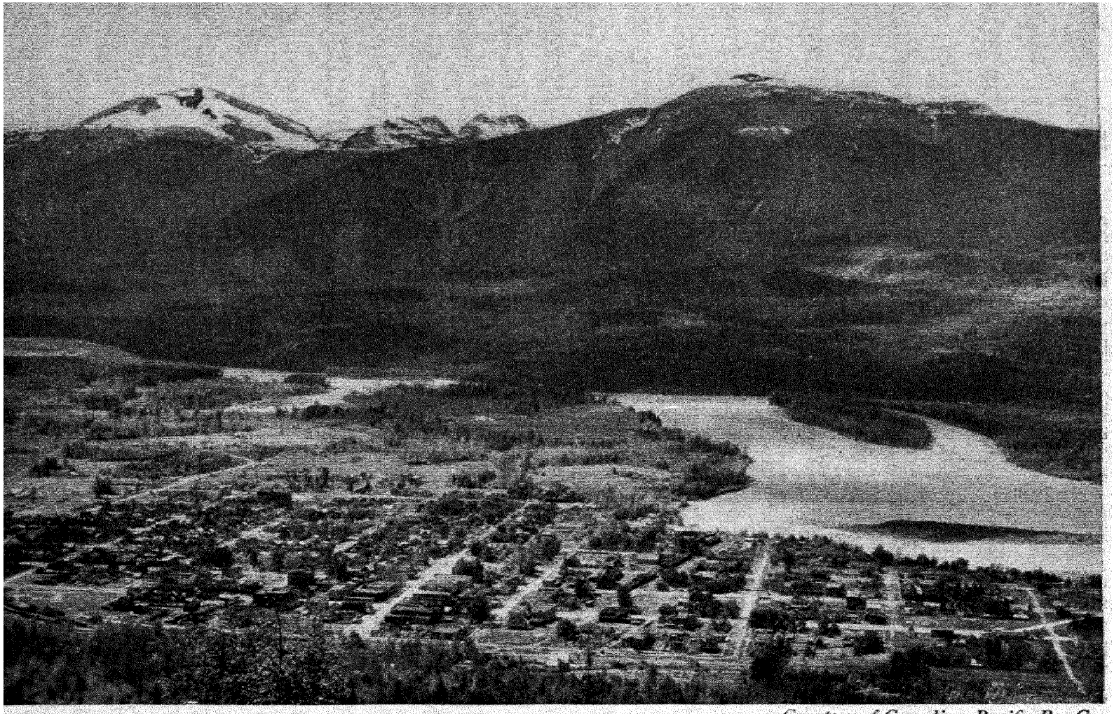
tory in dispute was finally divided on the basis of river exploration and settlements by citizens of these two countries. The northern portion was kept by England. Mackenzie, an English citizen, discovered the Mackenzie River and blazed a northern trail through to the Pacific Ocean. English fur traders had also established settlements in this northern region before the Americans came to the Pacific coast. The United States took the southern portion on the basis of Gray's discovery of the Columbia River, the establishment of Astoria, and the settlement of the Columbia Valley by large numbers of American pioneers.

Another parallel between the early history of the Columbia and of the St. Lawrence is in the prominence of missionaries. Some Indians, noticing the good work of the priests who had come with the fur traders, wished to know more about the white man's religion. In 1832 four Indians actually crossed the mountains and journeyed to St. Louis in order to ask that missionaries be sent to their people. This appeal aroused great interest among the churches of eastern states and a party of men soon started for the Oregon country. One of them, Marcus Whitman, later became prominent in the struggle to hold this territory for the United States. With the missionaries went many families of settlers from the east, anxious to try their fortune in a new land. The glowing reports sent back by these people encouraged others and soon hundreds were following the Oregon trail to the Columbia.

Although the great migration of Americans to California did not begin until after the Columbia Valley became well known, many men from the east found their way there via the Oregon route before the rush for gold in 1849. One of these was Captain Sutter, on whose property the gold was found that started the "Forty-niners."

The Columbia River, so long hidden in the western wilderness, rises far to the north. Counting its principal tributaries, it is nearly one thousand miles from source to mouth. The main river, however, begins at the junction of its northern branch with the Snake River about three hundred fifty miles from the sea. It was originally navigable only part of this distance. Where the river breaks through the Cascade Mountains, dangerous rapids halted navigation and almost ninety miles above the Cascades are the even more treacherous Celilo Rapids. Between these points and on the upper river are long stretches of navigable water, some sixteen hundred miles including all the tributaries.

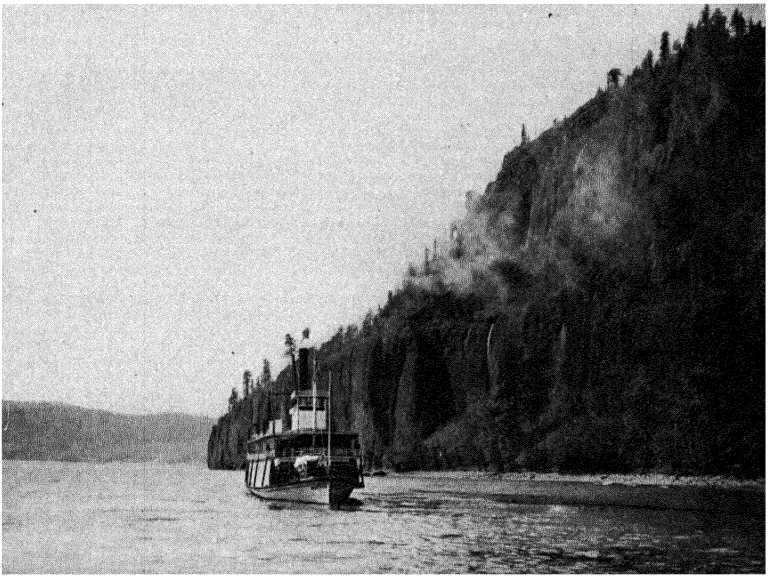
In 1836 steam navigation of the river began. By 1860 there was an immense and very profitable river traffic. It consisted mostly of people and goods going up stream to the mountains. There were miners, cattlemen, and farmers all seeking wealth in this wild, sparsely settled region. Rudely constructed railways carried freight around the rapids. Steamers were built on the upper river and navigation continued all the way to Lewiston, Idaho.



Courtesy of Canadian Pacific Ry. Co.

Town of Revelstoke, Canada, on the Upper Columbia

To make the river more useful for commerce, the United States government has spent nearly ten million dollars constructing canals and locks around the Cascade and Celilo Rapids. To improve the entrance to the

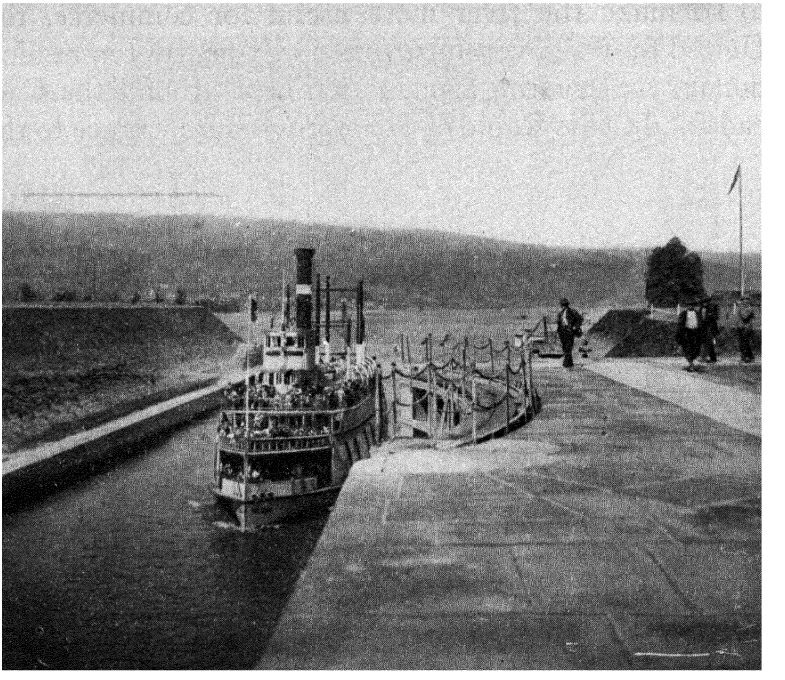


Courtesy of Union Pacific Ry. Co.

The Palisades

river, so dangerous in Gray's time, the government has built long lines of jetties patterned after Captain Eads' work on the Mississippi. Now the river is scouring out its own bed and a deep channel is always open.

The lower river is used by ocean-going vessels, which ascend to Portland on the Willamette about one hun-



Courtesy of Union Pacific Ry. Co.

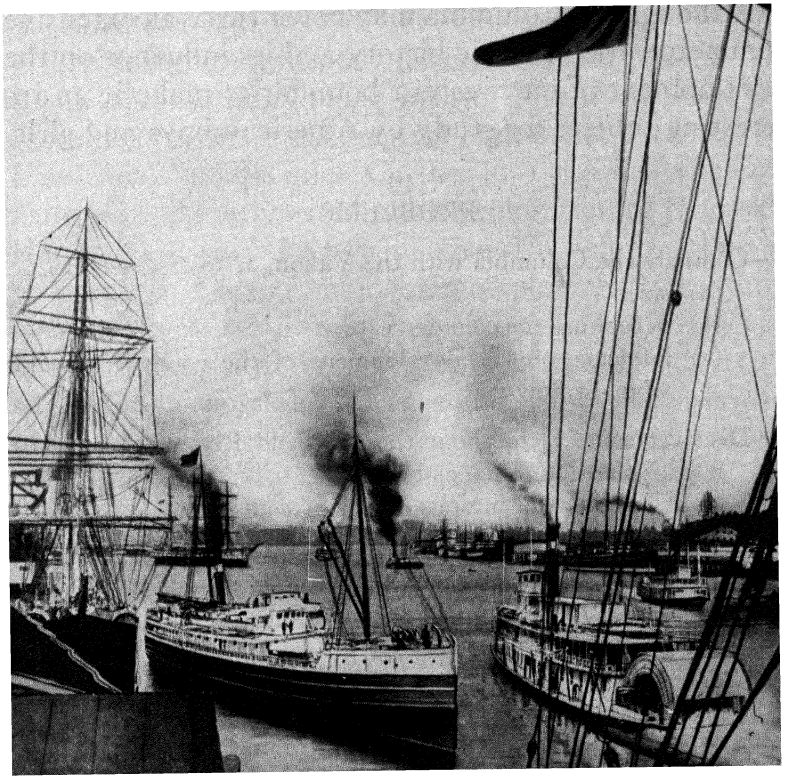
Cascade Locks

These locks and a canal were constructed by the federal government to improve navigation. Vessels can now avoid the rapids where the river breaks through the Cascade Mountains.

dred miles from the sea. At Portland, grain, fruit, and lumber products from the interior are transported by steamers to American coast ports, Europe, and the Orient.

As on the Mississippi, the coming of the railroad has for the time being made navigation of the upper river unprofitable. In spite of the millions spent to provide passage around the rapids, only a few small steamers

now go beyond Portland. Undoubtedly as population in this region increases the river will again become important as a waterway. Faith in its future is shown by the fact that England has requested, and the United States has agreed, through formal treaty, to keep the



Courtesy of Portland Chamber of Commerce

Portland Harbor

Here are many varieties of river and ocean craft.

Columbia River open for navigation. Meanwhile the smaller tributaries are proving useful in other ways. Power plants are planned for some of the Columbia tributaries, and extensive irrigation projects are being constructed in the fertile regions of eastern Oregon and Washington and western Idaho.

Although the Columbia may never carry an extensive commerce, its romantic history and its influence on the development of our western boundaries make it an interesting subject for study by American boys and girls.

PROBLEMS

1—Compare the Columbia with the Yukon, as to:
- (a) size,
- (b) actual use for commerce,
- (c) influence on the development of the country through which it flows.

2– Discover some facts about the Colorado River and compare it with the Columbia, as to:
- (a) chief point of interest at the present time,
- (b) possible use in the future.

3—Railway competition frequently kills river commerce. Why?
- (a) Mention some rivers where railways have taken the traffic that formerly went by water;
- (b) mention some rivers that continue as trade routes in spite of competing railways. Suggest some reasons for this condition.

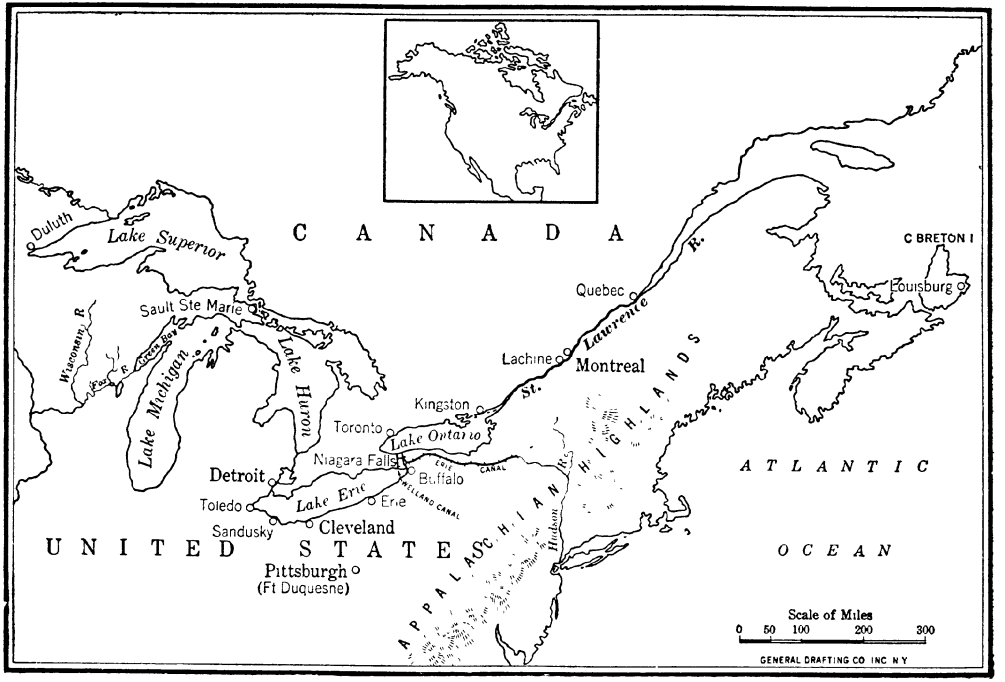
THE ST. LAWRENCE

This river was for more than a hundred years the only route to central North America. On the early maps it was the one river of importance indicated in the northern continent of the new world.

According to tradition, fishermen from Spain, Portugal, and Brittany, long before Columbus, were accustomed to visit the region about the Gulf of St. Lawrence, but Jacques Cartier in 1534 was the first European to really attempt an exploration of the river. He, at least, was the first to give it a definite place in geography. Cartier, like other explorers of his time, was seeking a way around or through North America to the Indies. The broad estuary of the St. Lawrence suggested a possible water connection with another ocean to the west.

Through the voyages of Verrazzano and Cartier, the French proceeded to claim the lands adjoining the St. Lawrence River and thereby entered upon an era of exploration and conquest that was to continue for more than a century.

The St. Lawrence is not a long river. It is only seven hundred fifty miles from Lake Ontario to the Gulf. But from the most distant tributary of the Great Lakes through them down the St. Lawrence to the sea is over seventeen hundred miles, most of the way navigable to vessels of considerable size.



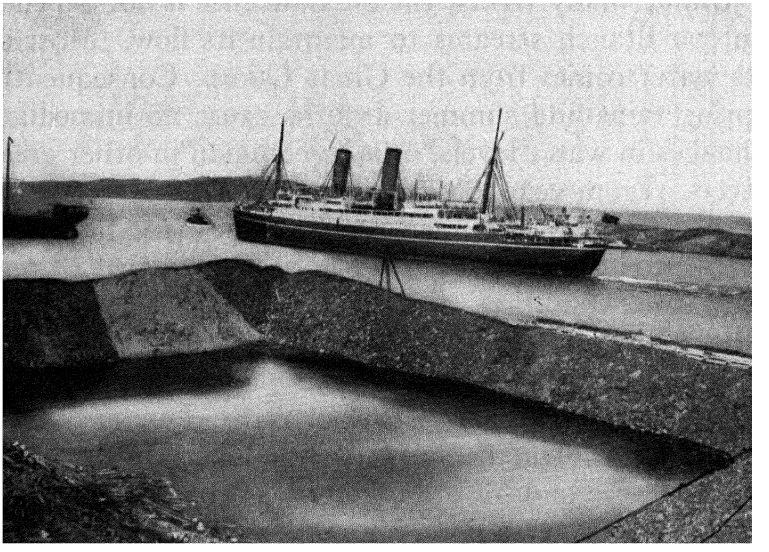
The St. Lawrence

Unlike many rivers, the St. Lawrence is not dependent on branch streams to maintain its flow. Most of its water comes from the Great Lakes. Consequently spring rains and summer drouths cause no immediate changes in water levels, as is so common in other great rivers. From year to year there may be a difference of seven feet in the average depth of the river but from month to month there is little noticeable change. Compare this condition with the fifty-foot rises of the Mississippi and the great annual floods of the Nile and the Amazon!

So deep is the bed of the lower St. Lawrence that ocean tides affect the river one hundred miles above Quebec. Beyond Montreal, which is open to sea-going vessels, the river although averaging nearly two miles in width has shallows and rapids in places. The most famous rapids are at Lachine. Passenger steamers guided by skillful pilots shoot these rapids, but canals with locks have been constructed for cargo boats.

The St. Lawrence was for the French a road to the interior. To them it mattered not that long, dangerous rapids and shallows intervened between Montreal and the Lakes. Time was no object. With their canoes and lightly built boats, men penetrated far inland. There they spent a year or two and then returned to Montreal and Quebec with loads of valuable furs.

Such adventure appealed to the restless French voyageurs. For these people the St. Lawrence offered



Courtesy of Canadian Pacific Ry. Co.

Atlantic Liner Arriving at Montreal from England

the excitement and opportunity for sudden riches that they desired.

Pushing ever westward, the French claimed the lands through which they traveled and attempted to hold such claims by a series of forts and Indian alliances.

Easy portages enabled these adventurers to go from the Great Lakes to streams flowing toward the Mississippi. Such connections with the Mississippi system were made through streams near the present cities of Toledo, Sandusky, Cleveland, and Erie. Another much used route was from Green Bay, Wisconsin, up the Fox

River to the Wisconsin River and then down to the Mississippi. Following one stream after another the French hunters and traders even wandered to the western slopes of the Appalachians and fortified themselves wherever there was possibility of the English attempting to push through. Such a fortification was that at Fort Duquesne, near the site of the present city of Pittsburgh, a place that afterwards became important in the wars between the French and the English.

With the fur traders went another class of Frenchmen for whom the St. Lawrence River opened a new field of usefulness. These were Catholic missionaries who saw in the St. Lawrence a means of reaching and Christianizing vast numbers of Indian savages. Thus through its main stream the great river carried French traders, the French language, and French Catholicism far into North America, and helped to extend French control from the Appalachians nearly to the Rocky Mountains and from the Great Lakes to the Gulf of Mexico.

The nation which controlled the entrance to the St. Lawrence was master of the continent from Montreal to New Orleans, excepting, of course, that narrow section along the Atlantic Ocean held by English settlers. The great strategic value of the St. Lawrence-Mississippi route was destined to play an important part in American history, first in exploration, next in warfare, and later in commercial life.

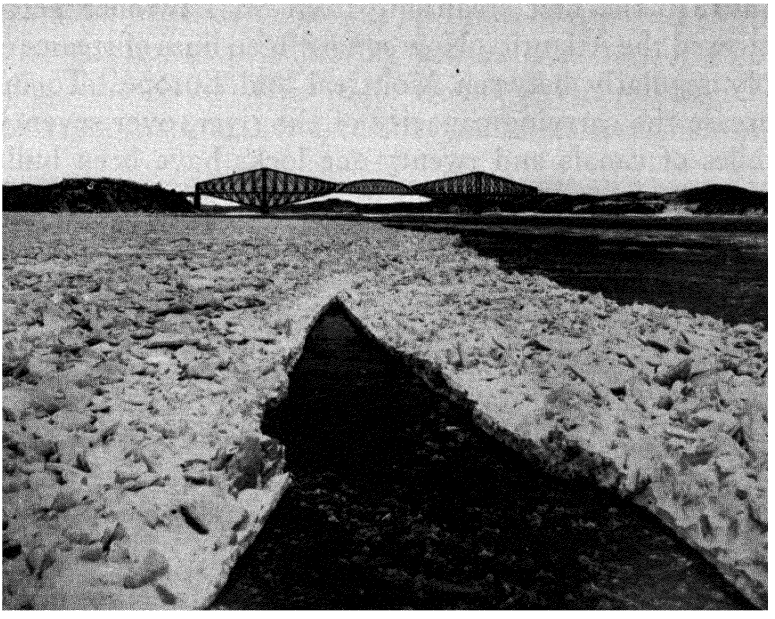
Even among the Indians the river had long been a source of conflict between the Algonquins and the Iro-

quois. Naturally the French and English tried to ally themselves with the Indians among whom they settled. Thus the quarrels of these European nations were soon transferred to opposing Indian groups in the St. Lawrence valley, which became the battle ground of the new world.

The history of the French and Indian Wars is one of struggle up and down and across the St. Lawrence valley. Many times the Indians of the north followed south-flowing streams and raided English settlements. The English retaliated by attempting to capture Louisburg, a fortress on Cape Breton Island, one of the defenses of the St. Lawrence. Finally by taking Quebec, the key to the valley, the great French-American domain came under English control.

When the American colonists revolted from England, the St. Lawrence River again assumed military importance. One of the earliest acts of war by the colonists was an attack on Quebec made by Arnold and Montgomery. Failure to capture it nearly cost them the war. Later, using the St. Lawrence Valley as a starting point, Burgoyne, the English general, attempted to cut off New England by following down the historic Champlain-Hudson water route from the north. His defeat at Saratoga was one of the important colonial victories of the Revolution.

In the War of 1812 many important battles and naval engagements occurred along the St. Lawrence frontier.



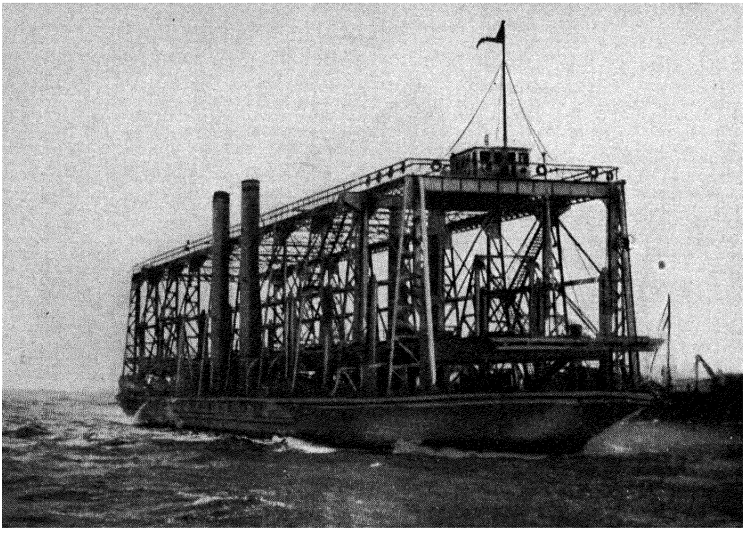
Courtesy of Dept. of Interior, Canadian Govt.

Quebec Bridge across the St. Lawrence

This bridge had to be constructed high enough to permit the passage of vessels beneath it. The first bridge erected here collapsed just before it was finished.

For three hundred years following its discovery, the military and political influence of the St. Lawrence seemed to overshadow its commercial value. The actual trade carried was small in tonnage. Not until the last half of the nineteenth century were the possibilities for large-scale navigation appreciated. Montreal and Quebec are nearer the latitude of England than New York. Consequently the sailing distance from Canada is really much shorter than from New York and Boston.

In 1840 the first steamship from St. Lawrence ports crossed the Atlantic. Now some fifteen lines of steamers ply regularly between Montreal and Europe. To increase the carrying capacity of the river, over seventy miles of canals and twenty-one locks have been built



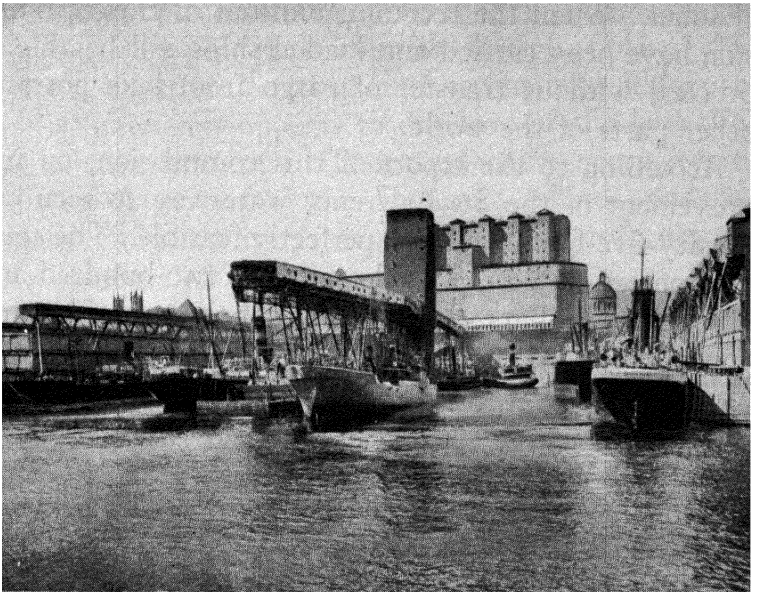
Courtesy of Dept. of Interior, Canadian Govt.

Car Ferry

This picture and the preceding one of the bridge show some of the engineering difficulties when river and land traffic meet.

around dangerous rapids. Now a fourteen-foot channel is available from the lake ports to Quebec and the sea. From Kingston, where the river leaves Lake Ontario, to the Gulf, elaborate systems of lights, buoys, fog signals, and telegraph and wireless systems have been

installed to guide vessels at all times of day and night. The government life-saving service also has stations along the river. This route from the Great Lakes to Liverpool is four hundred fifty miles shorter than via



Courtesy of Dept. of Interior, Canadian Govt.

Harbor at Montreal

From these elevators and docks freight coming from the west via the St. Lawrence is transferred to ocean steamers.

the Erie canal and New York City. Though the St. Lawrence is closed five months of the year on account of ice, immense quantities of grain pass over it bound for Europe during the open season.

Still further improvement of the St. Lawrence River is contemplated. By an act of Congress a joint commission consisting of engineers from Canada and the United States was appointed in 1920 to study the possibility of increasing the capacity of the St. Lawrence channel. When the recommendations of this commission have been carried out, loaded ships will be able to proceed without transfer of cargo from lake ports to other parts of the world.

According to the report of this commission, an improvement of the St. Lawrence waterway to secure a twenty-five-foot channel is perfectly feasible. The commission estimated the total cost to be two hundred and fifty million dollars. It is stated that the sale of electric power produced by stations along the improved river would nearly, if not entirely, pay the expense of the undertaking both for navigation and power. It is claimed that the electric power thus developed could be sent even to New York City and to all sections of New England. The power that may be available along the entire river is estimated by the commission at the equivalent in power to twenty-four million tons of coal. The improved St. Lawrence route would also stimulate the building of ocean-going vessels at points on the Great Lakes where abundant supplies of coal and iron are now available. Already the Canadian government has begun work on an enlarged canal and locks around Niagara Falls, at an estimated cost of seventy-five million dollars.

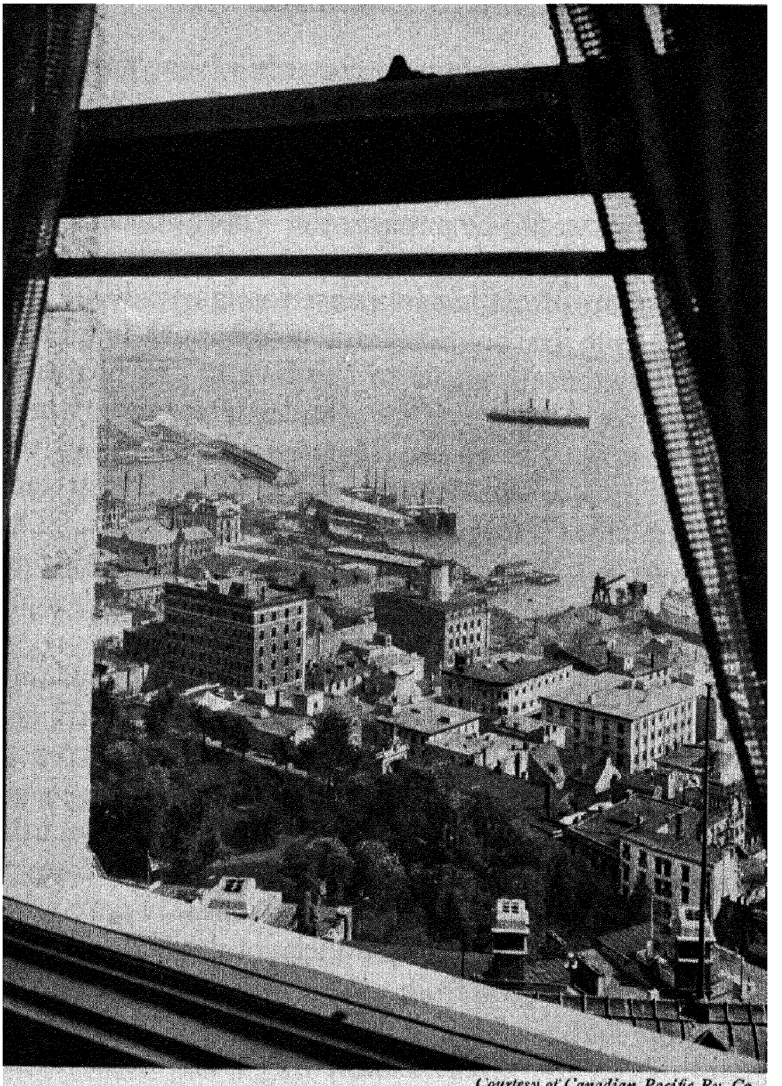
Of course many persons interested in New York City and other Atlantic ports of the United States fear that an improved St. Lawrence route would injure our own trade. They believe that to join with Canada in such an enterprise would be unpatriotic. On the other hand, farmers and business men of the central states seek the cheapest routes for their immense foreign trade.

Apart from its political and commercial influence, the St. Lawrence appeals to our love of the beautiful and sublime in nature. The wonderful scenery, where the river flows among the Thousand Islands, and the majestic force of its great rapids every year attract vast numbers of travellers and pleasure seekers. The St. Lawrence tours, widely advertised by steamship and railway companies, draw to the Canadian border people from all parts of the United States.

No river in the world, unless it is the Yangtze-kiang, is so closely related to the development of a continent and the progress of its civilization as the St. Lawrence.

Rivers that extend in an east-west direction are generally more useful than rivers extending north-south. This is because the best climatic conditions for human activity are found in the temperate zones. Trade flows around the world along parallels of latitude. Comparatively little goes from zone to zone.

As the source of the St. Lawrence water supply is mainly from the Great Lakes, this river seems to be free from the menace of forest destruction that endangers the usefulness of so many rivers. It is said that



Courtesy of Canadian Pacific Ry. Co.

View of the River from a Window of a Famous Hotel in Quebec

the Chicago Drainage Canal may start a current from the lakes toward the Mississippi that will ultimately lessen the St. Lawrence flow, but such a condition could and would be controlled if the level of the Great Lakes were threatened.

The general tendency of the St. Lawrence is, then, toward a union of interests between the people of the United States and the people of Canada. When these nations coöperate in the development of the great river flowing between them, the resulting improvements will have a beneficial effect on all parts of the great central continent regardless of the flag to which its dwellers owe allegiance.

PROBLEMS

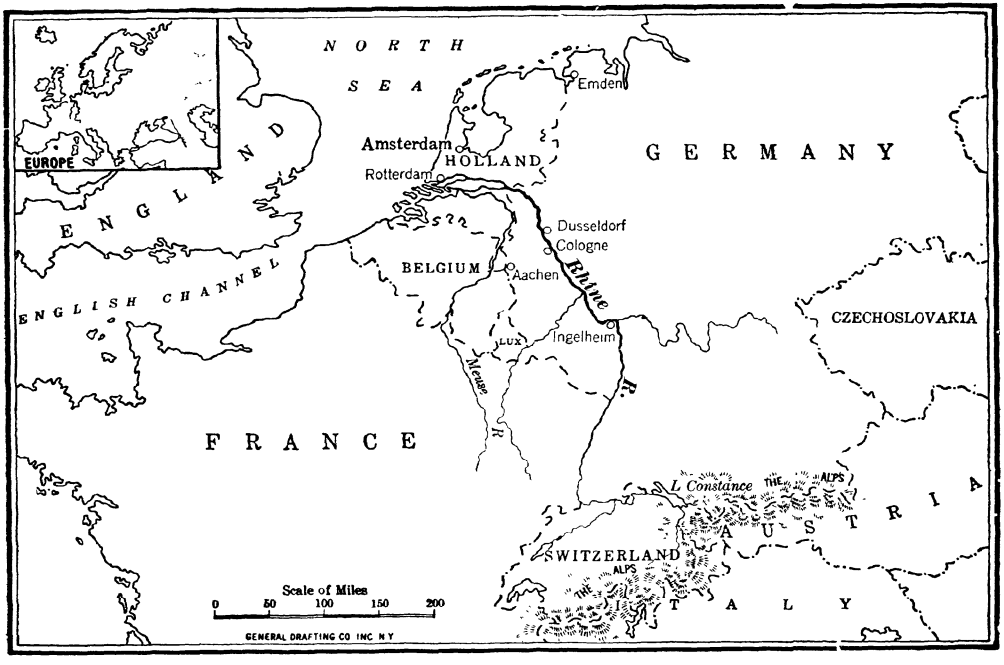
1—Compare the St. Lawrence with the Yangtze-kiang, as to:
   (a) use as a continental gateway,
   (b) actual commercial use and value,
   (c) engineering works to control it.

2—Compare the St. Lawrence with the Columbia, as to:
   (a) early history,
   (b) obstructions to navigation and their removal,
   (c) present commercial importance.

3—The improvement of the St. Lawrence River by joint action of the United States and Canada has been proposed. From the standpoint of a citizen of the United States give reasons for and against this plan.

4—Why has the St. Lawrence had such little influence on the great wilderness just north of it?

5—The question of international development of the St. Lawrence will make an excellent one for class debate. Much material is available in government reports and current periodicals.


EUROPE
NORTH SEA
Emden
Amsterdam
HOLLAND
Rotterdam
GERMANY
ENGLAND
Dusseldorf
Cologne
BELGIUM
Aachen
Rhine R.
ENGLISH CHANNEL
Ingelheim
CZECHOSLOVAKIA
Lux.
Meuse R.
FRANCE
L. Constance
THE ALPS
AUSTRIA
SWITZERLAND
THE ALPS
ITALY
Scale of Miles
0 50 100 150 200
GENERAL DRAFTING CO INC N Y

The Rhine

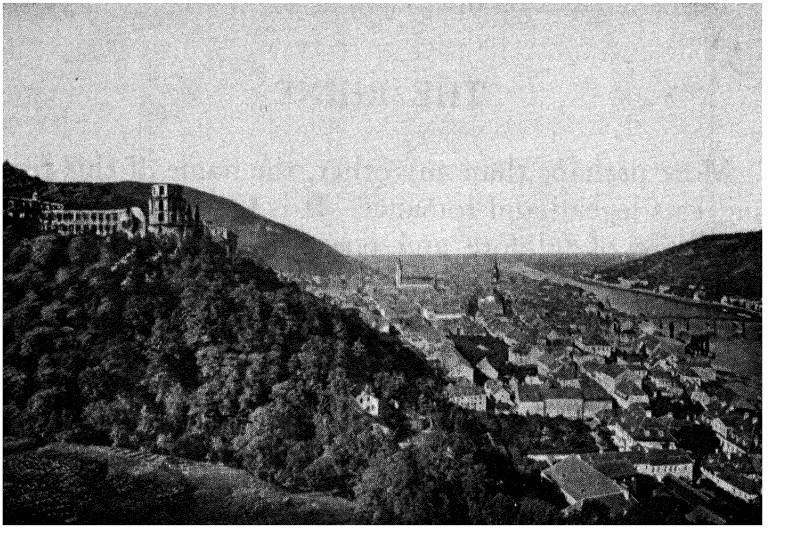
THE RHINE

More perhaps than any other, the name of this river suggests legend and romance. It is famous for the rich literature of folklore and poetry associated with the picturesque promontories, castles, and quaint cities of its valley. Great operas have been developed from Rhine legends. Many Rhine stories have become a part of our own literature through the translations of Longfellow.

A great writer has well said: "The Rhine is unique; it combines the qualities of every river. Like the Rhone, it is rapid; broad, like the Loire; encased, like the Meuse; serpentine, like the Seine; limpid and green, like the Somme; historical, like the Tiber; royal, like the Danube; mysterious, like the Nile; spangled with gold, like an American river; and, like a river of Asia, abounding with phantoms and fables."

Despite its charming qualities the Rhine has been since earliest time the battle front of Europe, a great natural dividing line between the north-central and southwestern sections. Every time people of the north have attempted to cross it and invade lands to the south, the whole civilized world has been disturbed. The World War was an example of such conditions.

To protect the province of Gaul (France) from invaders across the Rhine, Julius Caesar was sent by



©Brown Bros.

Heidelburg—a Rhine City

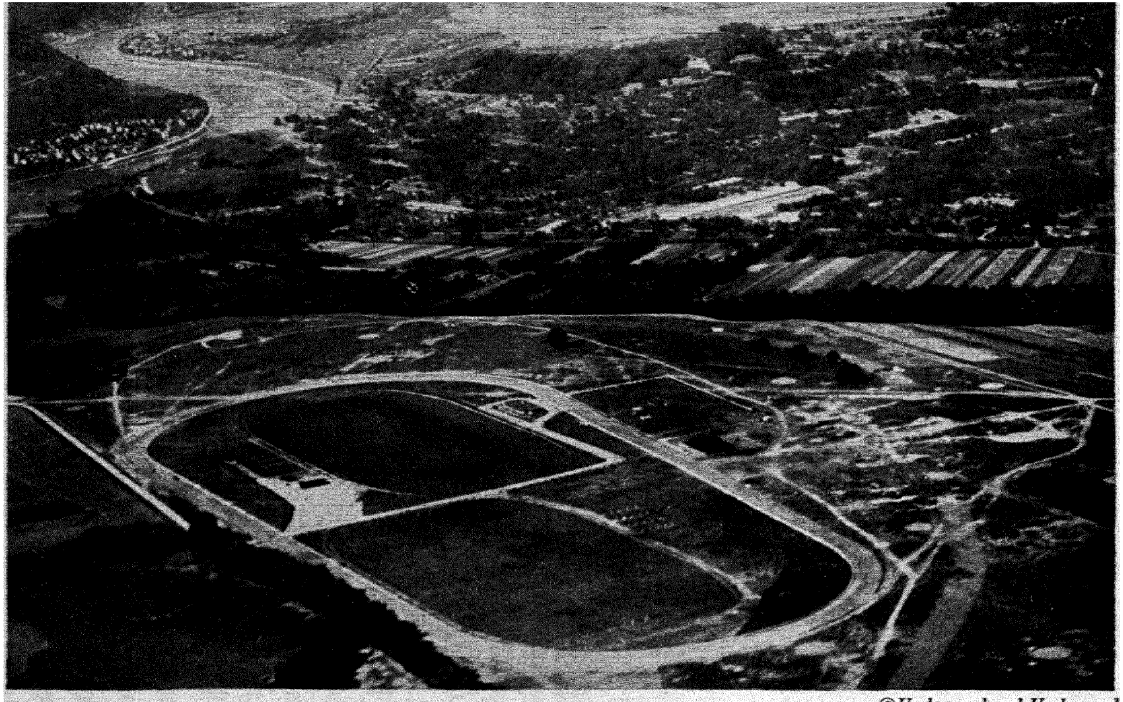
Rome in ancient times. The Romans made the Rhine their western frontier and established along its banks military camps that survive today as prosperous cities. Cologne is one of these. Sheltered by this river, formerly difficult to cross, France and the countries to the south became Romanized, that is, civilized. Southern Europe for several centuries profited by a strong central government, the extension of roads and the progress of art, but when in the fifth century the rough peoples north of the Rhine succeeded in breaking across it, western civilization halted. Charlemagne, in his attempt to create a great European empire, made the

Rhine its center. His palaces were at Aachen and Ingelheim. When he passed away, the Rhine once more became a dividing line between hostile peoples. Again when Napoleon attempted to master Europe, the Rhine Valley was the scene of many bitter struggles. The World War closed with the Rhine guarded by American and allied troops, the one part of all Europe still considered the most vital to a successful conclusion of peace.

From this brief sketch the political importance of the Rhine can be appreciated. Had it been a smaller stream or had it been farther to the north or to the south, the history of Europe might have been quite different.

In times of peace the Rhine has had a commercial importance unequalled by that of any other river. The population of the Ganges and the Yangtze-kiang valleys may be many times greater than that of the Rhine, but by industry and ingenuity the Rhine dwellers have developed a commerce in minerals and manufactured articles that far exceeds that carried by any other inland waterway.

When roads were few and transit by land slow and expensive, the water passage offered by the Rhine together with that of the Danube made possible a route from western Europe to the Orient. The Mediterranean Sea was infested with pirates, the Suez Canal route had not been opened, and the Cape of Good Hope route had not been discovered. Ocean commerce finally took the



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Aerial View of Coblenz

Here some American troops remained after the war.

bulk of this trade, and the Rhine temporarily lost its importance as a waterway.

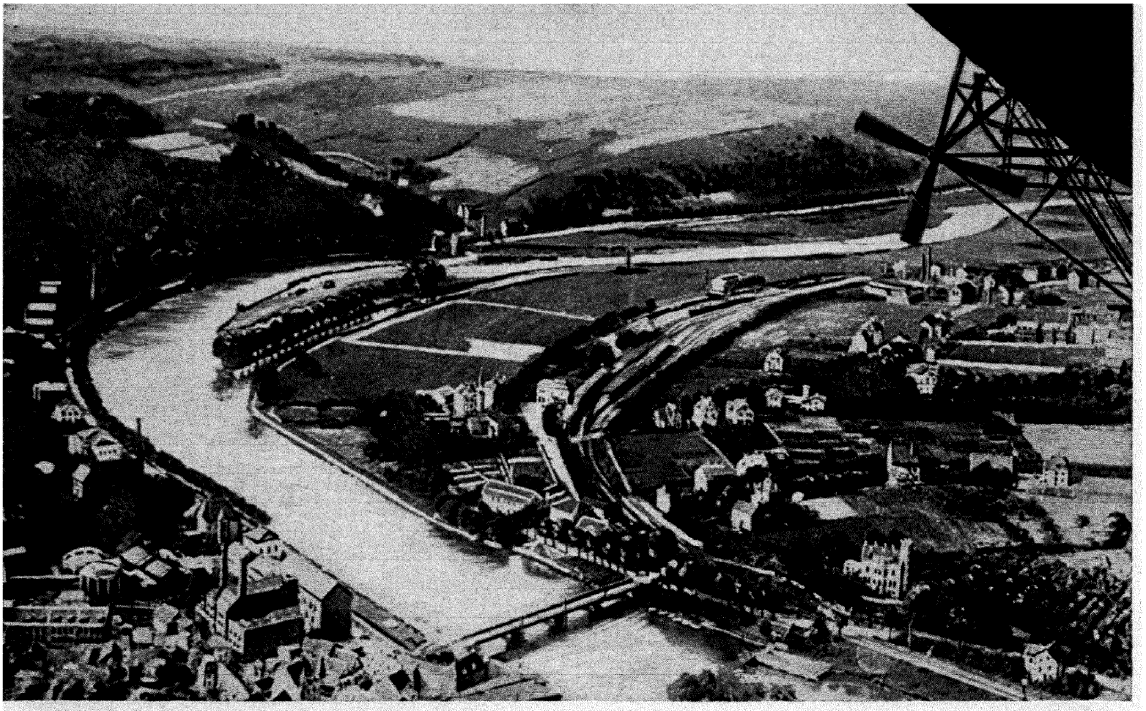
The discoveries and inventions of the nineteenth century gave to this river a value hitherto unsuspected. Great deposits of coal and iron on its watershed made competition with England possible. The fact that these deposits were from one hundred fifty to three hundred miles from the sea did not matter, if the Rhine could be rendered navigable to large ships. Germany saw this



©Beseler Lantern Slide Co.

Castle on the Rhine

These remains of medieval life are numerous along the river.



©Underwood and Underwood

Dusseldorf—One of the Ruhr Towns

possibility and immediately spent enormous sums of money to dredge channels and to protect banks by river walls. Devices for breaking ice were constructed, and piers and harbors were built at convenient points, until today the Rhine is the most highly developed natural waterway in the world. It has an unusually even flow because it is fed partially by melting glaciers of the Alps and partially by the overflow of Swiss lakes. On the average, commerce is interrupted by high water only eight days per year and by low water only seventeen days. Now ocean steamers sail regularly from Cologne, a hundred fifty miles from the North Sea, to England and other countries of Europe. Great barges holding thousands of tons can be towed even as far as Mannheim.

Tributaries of the Rhine have had similar improvement so that the main industrial section of Germany has been brought to the seaboard, as it were. At the junction of the Ruhr and the Rhine, thirty-four million tons of freight pass in a single year toward the sea. As a result, German iron, coal, and manufactured products are able to compete with those of England, France, and even the United States. Some say this competition, made possible only by the navigation of the Rhine, was one of the causes contributing to the World War.

Holland owes to the Rhine even more than does Germany, for just as Egypt was said to be "the gift of the Nile," so Holland has been created by the Rhine. The sand and mud that make up the plains of north-

western Europe were deposited by the powerful Rhine flow. Napoleon is said to have claimed Holland because its soil came from the Alps, which he already controlled. In still other ways the Rhine has made Holland. Rotterdam, one of the world's great seaports, owes its importance to the vast commerce of the Rhine. Germany tried to divert much of this shipping by constructing a canal from the Rhine within her border to a port on her own coast at Emden, but, nevertheless, enough trade still flows by the shorter route to enrich the thrifty Dutch.

Naturally a river valley that has been so prominent in the world's affairs has drawn to it many men of keen and active mind. The art of printing was invented in one of its cities. The great religious movement known as the Reformation was begun by Martin Luther near the Rhine. The *Marseillaise*, although now the war song of the French, was composed at Strasbourg on the Rhine.

One may well wonder what the future has for this river and its valley dwellers. Must it continue to be a battle line or will its commercial and industrial possibilities hold in check war-like tendencies? In modern times a river is not the barrier to armies that it was for the ancients. The discovery of minerals along the watershed of the Rhine makes unified control of the river essential to their use. Long-continued peace in this section, then, may never be assured until this unified control is accomplished.

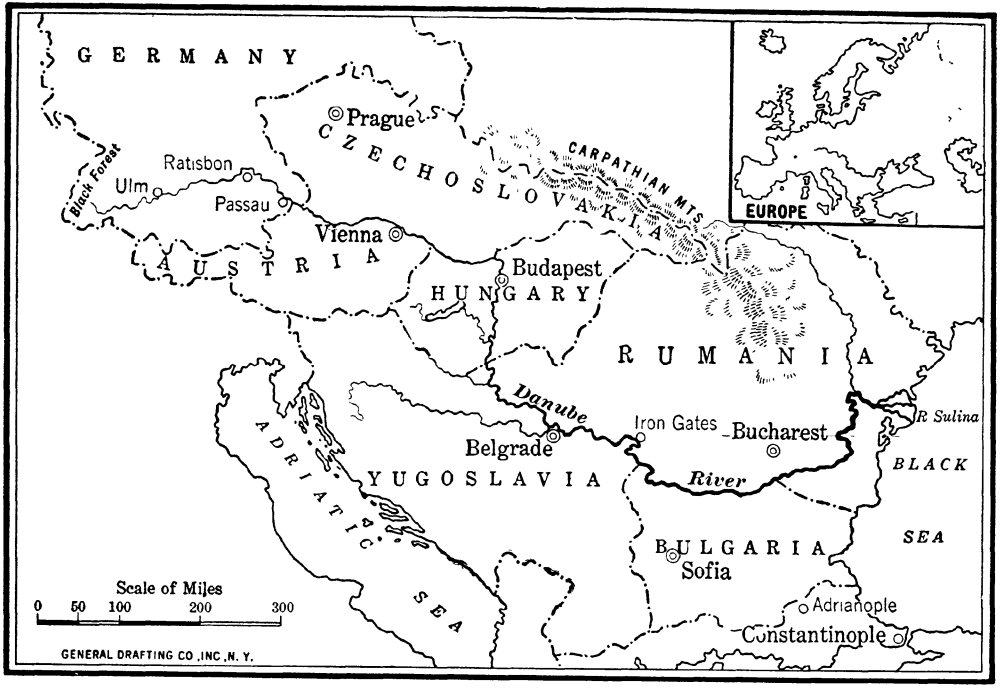
PROBLEMS

1—Compare the Rhine with the Hudson, as to:
   (a) scenic beauty;
   (b) political and military importance,
      (1) at the present time,
      (2) in the past;
   (c) commercial and industrial uses.

2—Show how the Rhine has influenced modern Germany.

3—Outline and discuss the advantages of single governmental control for all the Rhine watershed:
   (a) industrially,
   (b) politically.

4—Collect some literary references to the Rhine.

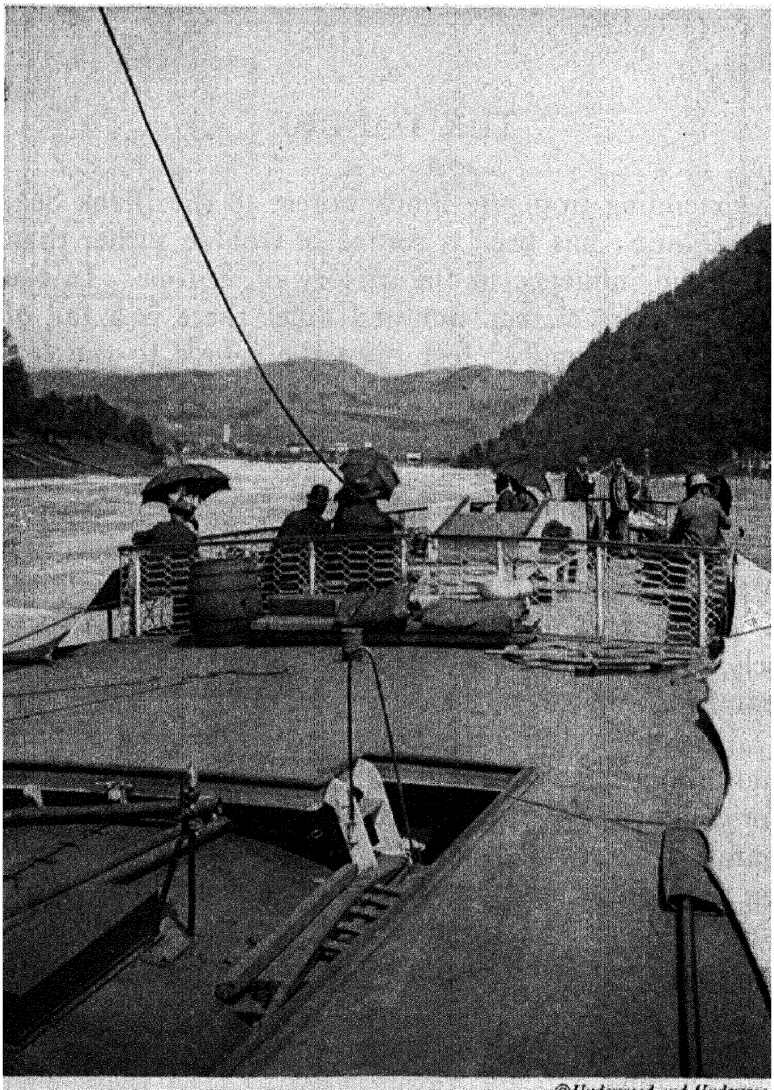

GERMANY
Prague
CZECHOSLOVAKIA
CARPATHIAN MTS.
Black Forest
Ratisbon
Ulm
Passau
Vienna
AUSTRIA
Budapest
HUNGARY
RUMANIA
Danube
Iron Gates
Bucharest
R. Sulina
Belgrade
YUGOSLAVIA
River
BLACK
SEA
ADRIATIC
SEA
BULGARIA
Sofia
Adrianople
Constantinople
EUROPE
Scale of Miles
0 50 100 200 300
GENERAL DRAFTING CO., INC., N. Y.

The Danube

THE DANUBE

Extending from the Black Forest to the Black Sea, the Danube has been a source of trouble rather than a helpful influence in the history of Europe. In the course of its sixteen hundred miles there is a fall of twenty-two hundred feet from the source to the sea. Where the great river breaks through the Carpathian Mountains at the Kazan Pass the rugged scenery is like that of the Canadian Rockies. Just below this pass jagged points of rock, known as the "Iron Gates," project through all parts of the river, causing extensive rapids and rendering navigation extremely perilous. The lower part of the Danube is navigable for ocean vessels, which ascend as far as Passau in Austria. Freight barges can be towed to Ulm in Germany.

Always an international river, the Danube has been more important as a boundary line than as a channel for commerce. Austria, Hungary, Czechoslovakia, Bulgaria, Yugoslavia, Rumania, and Germany all border on the Danube and jealously watch one another. The first treaty ever made for commercial use of a river by a group of nations was for the Danube in the thirteenth century. One of the first attempts to secure free river navigation by peaceful agreement was also made for the Danube in 1368. From 1699 to 1883 there were twenty-eight European treaties in which the Danube



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Through the Mountains of Central Europe

was the chief concern. Fear of Russian aggression on the Danube probably influenced Austria to ally herself with Napoleon. By the Treaty of Adrianople in 1829, Russia secured practical control of the mouth of the river and, like Holland on the Rhine, indirectly profited by its commerce. But such conditions have tended to hinder its development as a trade route.

Napoleon considered the Danube the "king of rivers." A great French statesman said that the political center of Europe was not at Paris or Berlin but at the mouth of the Danube.

The first historic mention of the Danube was by Herodotus about 450 B.C. In 107 B.C. the Romans under Trajan controlled the entire river. They had boat lines along the Danube, which then was a gateway rather than a frontier. Through the Danube Valley their civilization was carried into northwestern Europe. Extensive remains of stations and devices for towing boats have been found. Carved in the natural rock of a high cliff on the Kazan Pass is a Roman tablet dated 103 A.D. marking a great military campaign. Along the sides of the cliffs towering above the river can be seen evidences of a roadway built with wonderful skill.

In later times the Danube became the route for inroads of barbarians from the south and east. Unlike the Rhine invaders, they fought along the river rather than directly across it. Up and down the Danube, waves of invasion flowed back and forth for hundreds of years. Charlemagne went down the Danube to drive

back the Huns and the Avars. In the fourteenth century the Turks used the Danube to invade Austria and lay siege to Vienna. Again in the seventeenth century Austria was threatened by Turkey. The lower Danube, like the lower Rhine and the Tigris and Euphrates valleys, has been one of the world's battle grounds.

During the Middle Ages crusaders from the north and west utilized the Danube as a route to Palestine. At the end of the Dark Ages came a change and from a war path the Danube gradually became a commercial river. Nations of northern Europe even as far as England had trade relations via the Rhine, the Danube, and the Black Sea, with the Mediterranean countries and the far east.

Browning's poem *Incident of the French Camp* relates a story of one of Napoleon's campaigns along the Danube.

High above the Danube near Ratisbon the Germans have erected a magnificent building known as the Walhalla. It is their "Hall of Fame" and commemorates their great leaders.

An American, Isaac Richardson of Baltimore, was the first to seek the privilege of starting a line of steamers on the Danube. The Austrian government declined his offer but finally, in 1831, regular steamer routes were begun by a company of British shipbuilders.

This beginning of power navigation resulted in persistent efforts to secure uninterrupted trade across the various international boundaries. Finally in 1856 a



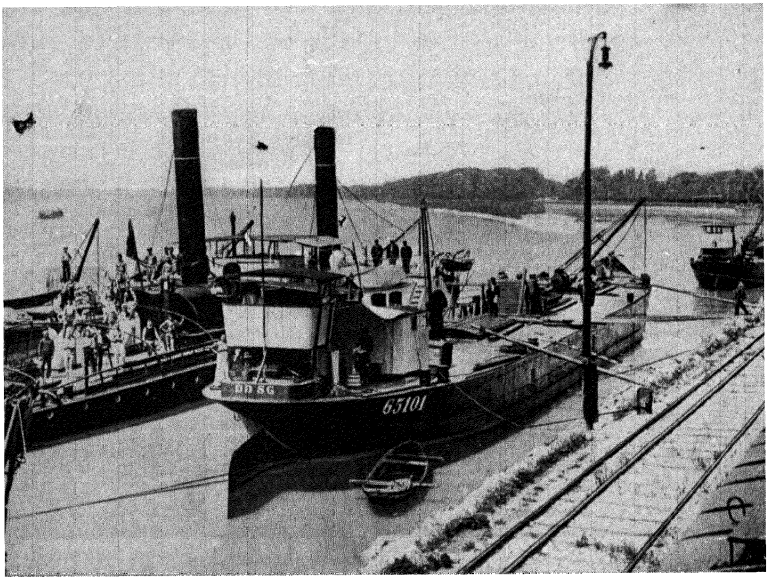
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The Danube as Seen from the Walhalla

Danube Commission was agreed upon. This Commission is made up of representatives from the nations bordering on the river. Its work is to improve navigation and stimulate commerce. Its first action was to order a survey of the river, the only one ever made. Eight million dollars have already been spent in improvements. A channel was excavated around the Iron Gates in 1896. The bars at the mouth of the river

have been removed and by a system of jetties a continuous twenty-four-foot channel secured through the Sulina Pass to the Black Sea.

Now the Danube as far as the Iron Gates is open for



©Ewing Galloway

Steel Grain Barges

Great quantities of grain are exported from the Danube region.

boats of all nations. Above that point it is open only to nations bordering on the river. In 1911, 535 ships sailed from the lower Danube to England; 364 Greek ships cleared and 200 Austrian. These vessels carried grain to western Europe.

Between Braila and the Iron Gates nine nations have

over six hundred boats. Above the Iron Gates there were, before the War, some seventy passenger steamers and over two hundred freight steamers besides numerous barges. During the War, in 1915, over a million and a half tons of grain and fodder were carried via the



©*Brown Bros.*

Fleet of River Boats near the Mouth of the Danube

Danube from Rumania to the armies of the central powers.

At present little or no trade goes between Germany and the Orient via the Danube; competition via the Suez Canal has been too great. But in 1921 plans were seriously discussed for a chain of interior canals to connect German industrial cities with the Danube. These

canals will be large enough for thousand-ton barges to go from the Rhine centers to the Balkans and countries bordering on the Black Sea.

When the commercial importance of the Danube is fully realized and political hindrances to its use removed, this river will begin to assert a peaceful influence on what has been a breeding place for war and anarchy in Europe.

PROBLEMS

1—What information can you recall concerning the Volga River?

2—Compare the Danube with the Volga, as to:
- (a) area of watershed,
- (b) important cities,
- (c) volume of commerce,
- (d) international importance.

3—Show how an all-water route might by established by canals between Cologne and cities on the Volga.

4—On a map of Europe indicate in colors the various nations touched by the Danube.

5—What do conditions shown by the above exercise suggest regarding the Danube, as to:
- (a) its commercial use?
- (b) its military and political importance?

ARCTIC RIVERS

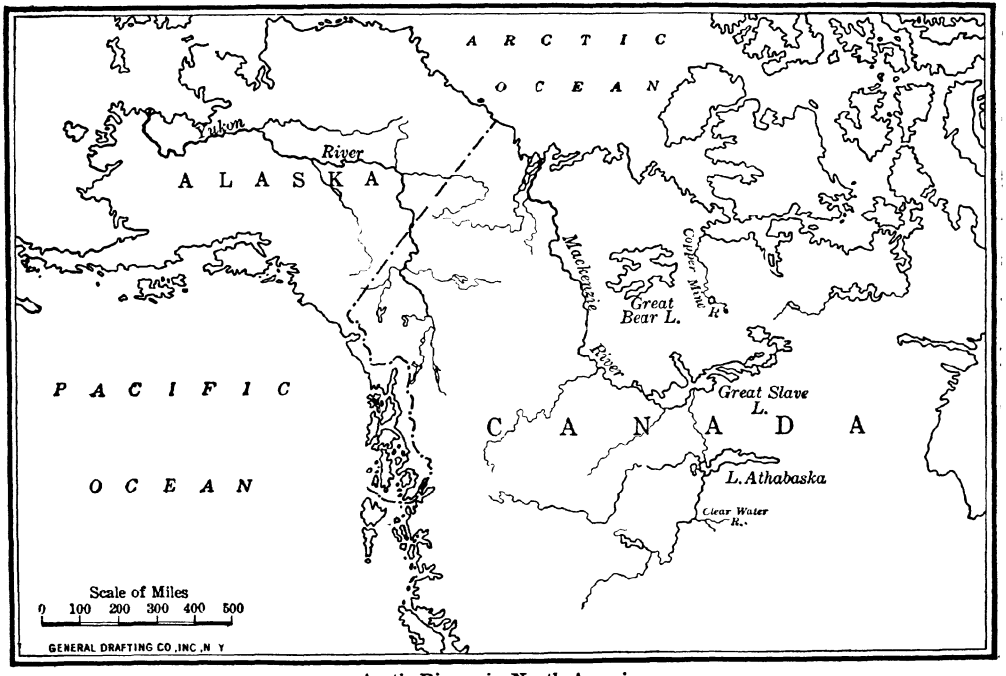
In the far north are several of the world's great rivers. These are the Yukon and the Mackenzie in North America; and the Ob, the Yenisei, and the Lena in Asia. All of these rivers except the Yukon flow in a northerly direction and empty into the Arctic Ocean.

These northern streams flow through sparsely settled regions that have many similar surface and climatic conditions.

The vast tundras and areas of stunted forests on the watersheds of these rivers are perpetually frozen to great depths. During the short, hot summer season the surface may thaw for a few feet and permit the ripening of certain quick-growing crops. The frozen subsoil, however, is impervious to water. Hence we find a bewildering network of small streams and lakes that yield a steady flow to the main channels of the rivers. These lakes and streams, moreover, teem with valuable fish.

The Yukon River is to Alaska what the Amazon is to South America. Both flow through wild, sparsely settled regions. Both rivers, although navigable, are practically uncontrolled and uncontrollable by man.

The search for gold drew many explorers and adventurers to the Amazon. Likewise, in the north, gold first aroused world interest in the Yukon.



Arctic Rivers in North America

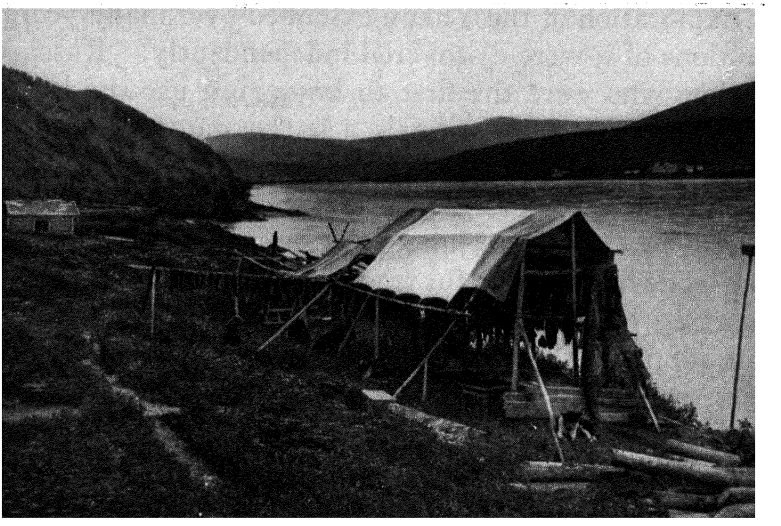
Exploration of the Yukon extended over many years. Sections of it were discovered independently. Russian traders who were the first to know and use the lower river, called it the Kwikpak, a native name. They did not suspect its true length and importance. In fact, one party of men exploring the river reported it as unnavigable beyond its junction with the Tanana.

Meanwhile English fur traders had penetrated eastern Alaska. There they knew and used the upper Yukon but supposed that, like the Mackenzie, it emptied into the Arctic Ocean.

In the decade 1860–70, attention was directed to this part of the world by the Western Union Telegraph Company. The Company planned to erect an overland telegraph line to Europe via Canada, Alaska, and Siberia. So many difficulties were encountered that the work was never completed. But from the engineers employed on this telegraph survey came the first authentic information concerning the length and true course of the Yukon.

The headwaters of the Yukon are in Canada, less than one hundred miles from the Pacific Ocean. The river flows at first toward the northwest until it reaches the Arctic Circle. From this "farthest north" it turns and keeps a general southwesterly direction to Bering Sea.

The Yukon can be ascended by boats, of varying size and design, from St. Michael near its outlet to White Horse some two thousand two hundred miles distant.



A Salmon Fishery on the Yukon

Salmon fishing furnishes a livelihood for many natives along the Yukon and its tributaries. The picture shows the fish on the drying rocks in the process of being cured. In the background appears the hut of the fishermen.

This river is one of the few in the world navigable from tidewater to a point almost in sight of its source.

For the natives and early fur traders, the Yukon and its tributaries furnished a practical route to and from the interior. These people probably never traveled its entire course but, by barter from tribe to tribe, some trade was carried on between Canada and Bering Sea by way of the Yukon Valley. Articles of iron and steel sold by the English trading companies were known and used by the natives as far as the west coast.

For the inhabitants of the large treeless areas near its delta, Yukon driftwood furnishes an unfailing and

important supply of fuel and timber. The salmon of the Yukon supplies food for man and dog. Certain places along the river are regular meeting points for natives engaged in catching and curing fish.

The first steamboat ascended the Yukon in 1869, but extensive commercial use of the river did not begin until the Klondike rush of 1897–98. Prospectors reached the gold fields by the mountain trails from Skagway and Dyea, but supplies could be brought across only on sledges and packs.

The Yukon, even though free from ice only about four or five months in the year, provided during that time a safe and sure route for heavy freight. The demand for transportation was enormous. Steamboats were hastily fitted out and sent from Seattle and San Francisco to St. Michael, the seaport nearest the entrance to the Yukon. Since ocean going vessels could not, on account of bars and shifting channels, enter the river, all freight had to be transshipped at this point.

During the busiest years scores of steamers, tugs, and barges were employed in this river trade. Shipyards were built at St. Michael. River commerce seemed to be a well established and promising business.

Suddenly, however, traffic on the lower river began to fall off and has never regained its former importance. The building of a railway across the trail from Skagway to White Horse opened up a new and much shorter route for supplies. From White Horse, goods were



Winter Scene on a Tributary of the Yukon

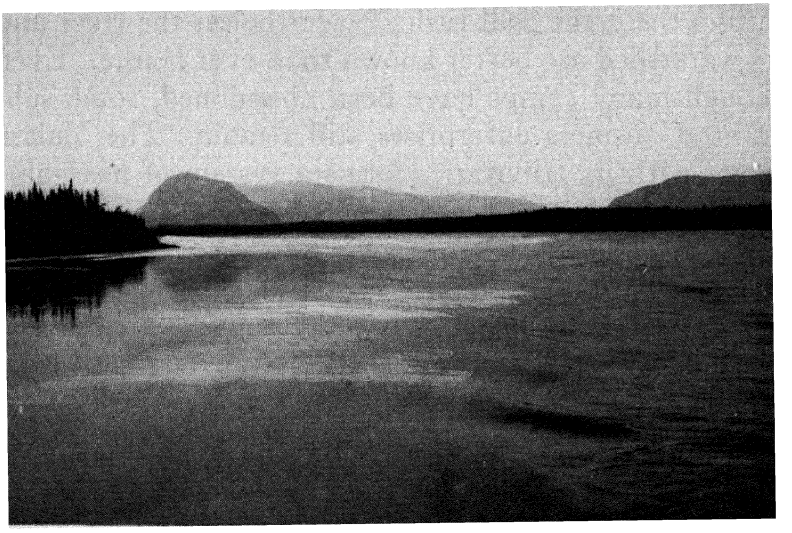
In all seasons the Yukon and its tributaries are important highways in Alaska. Winter travel by dog team is easiest along the frozen river courses. This picture shows winter traffic on the Tanana River. Time, about noon on a subarctic winter day.

carried via the upper Yukon to Dawson, the business center of the Canadian gold fields. Another loss to river trade came when Klondike gold production began to decline. New "strikes" in other places caused miners to scatter. Numerous claims and camps were deserted and the upper Yukon region steadily lost in population and business.

The recent completion of a railroad between Fairbanks and the coast opens a line that competes directly with the Yukon-Tanana river route.

Traffic on the Yukon is now far below what it was during the great gold rush. Nevertheless the river and its watershed are better known than ever before. Even though many camps have been abandoned, some substantial business enterprises still remain. The Yukon River with its tributaries forms a system of navigable waterways covering some five thousand miles of interior Alaska.

In this vast region, comprising nearly one half the area of the territory, are deposits of minerals, extensive coal fields, vast supplies of pulp wood, some timber, and some arable land. Already Alaska has produced to date four hundred seventy-eight million dollars worth of minerals. The output of its fisheries was, in the single year 1921, valued at over twenty-four million dollars. Two agricultural experiment stations have been established in the Yukon-Tanana valleys. It is estimated that there are over one thousand square miles of farming land in the Tanana valley alone. All evidence thus far seems to indicate that Alaska farm land, if developed, could produce food stuffs enough to meet the needs of a large population. These farm products would, moreover, find a ready market right at home in the many mining and industrial communities of this region. United States revenue cutters patrol the Yukon. Telegraph lines and wireless stations connect many settlements with the outside world. Missionaries and teachers have established churches and schools. From this northern frontier of civilization there may come at



Courtesy of Canadian Government

View on the Mackenzie

For many years this river will be the only route through the northern wilderness.

any time reports of new discoveries, of the development of new resources.

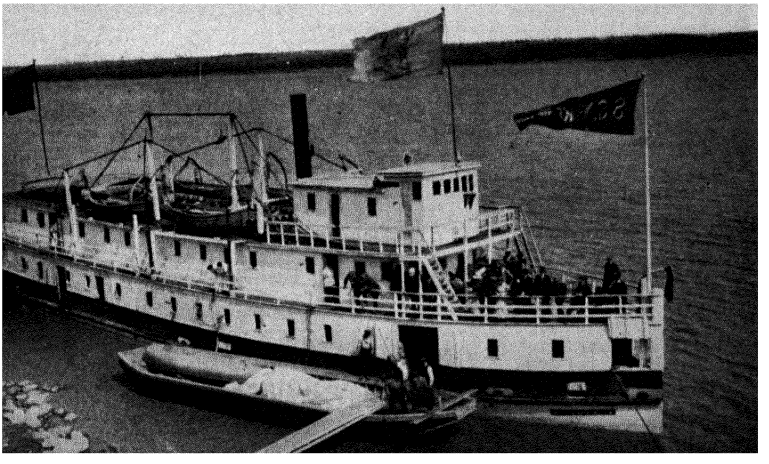
Whoever travels through interior Alaska will sooner or later use the Yukon. Whenever important business projects are started in this region the Yukon will carry in the equipment, and by the Yukon the product will be transported to market. In other words, this river is the key to the greater part of our northern domain.

The Mackenzie River was discovered by Sir Alexander Mackenzie in 1789, yet even today it is rarely visited except by fur traders and occasional mineral pro-

spectors. Twenty-three hundred fifty miles long, this river has an average width of one mile in its main stream. It is navigable for steamers some twelve hundred miles inland from the Arctic Ocean and, passing a few obstructions, it can be used by boats for six hundred miles farther south.

Owing to the feeble tides of the Arctic Ocean, the mouth of the Mackenzie is not scoured by currents, hence alluvial deposits have formed an enormous delta. Ice obstructs the lower or northern end of the river during nearly nine months of the year. Only from the middle of June to October is the river free from ice.

The basin of the Mackenzie is estimated to include five hundred ninety thousand square miles of territory

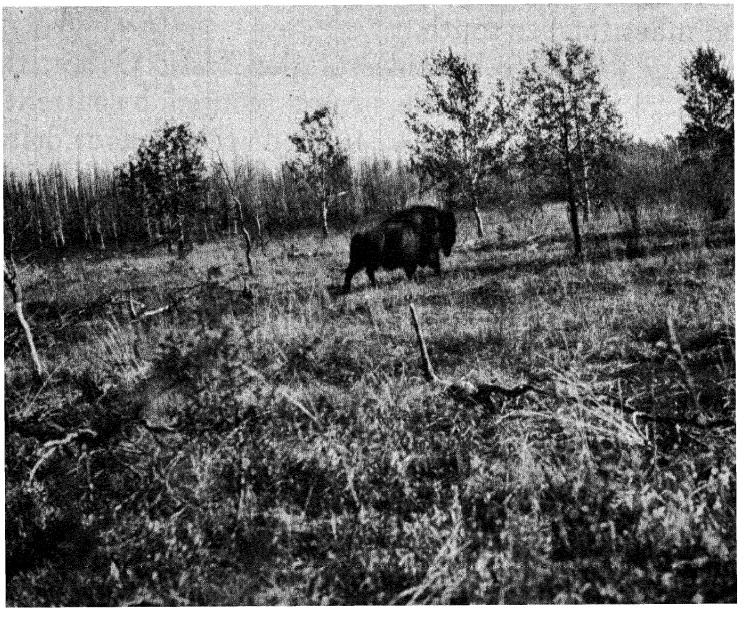


Courtesy of Canadian Government

Mackenzie River Steamer

Many boats of this type operate during the open season.

or nearly one half that of the great Mississippi system. The small number of people now living in this section is more the result of its remoteness than of an inhospitable climate. Already a railroad extends north to the



Courtesy of Canadian Government

Bison in the Northern Territory

A few of these once numerous animals still survive in this region.

Clearwater River, a tributary of the Mackenzie. Railway connection with the great transcontinental lines is made at Edmonton, a center of growing importance.

The winter's cold is often moderated by a sudden warm wind from the south, known as the Chinook. Con-



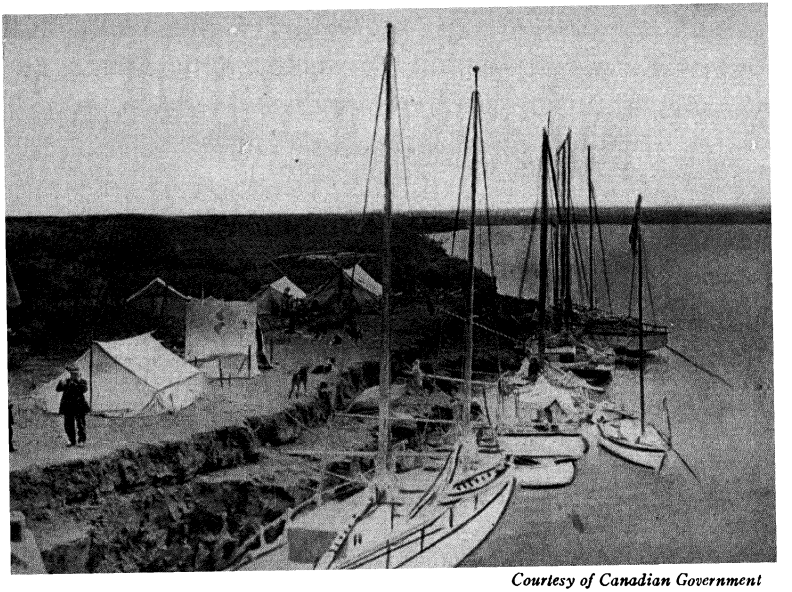
Courtesy of Canadian Government

Prospecting for Oil near the Mackenzie

Deposits of coal and oil have been found. They will play an important part in the development of this region.

sequently the winters are actually milder and spring comes earlier than in places farther east that are hundreds of miles nearer the equator. The Province of Vologda in Russia, similarly situated on an arctic river, produces quantities of grain. It has been estimated on good authority that the Mackenzie Basin could support three million people.

Other resources of the Mackenzie Basin are its oil and mineral deposits. Along the Copper Mine River, east of Great Bear Lake, are known to be vast deposits of copper. Numerous beds of coal have been located. On the lower Mackenzie near the Arctic some of these coal



Courtesy of Canadian Government

Eskimo Boats on the Lower Mackenzie

The Eskimos sell quantities of furs and other arctic products to the trading companies.

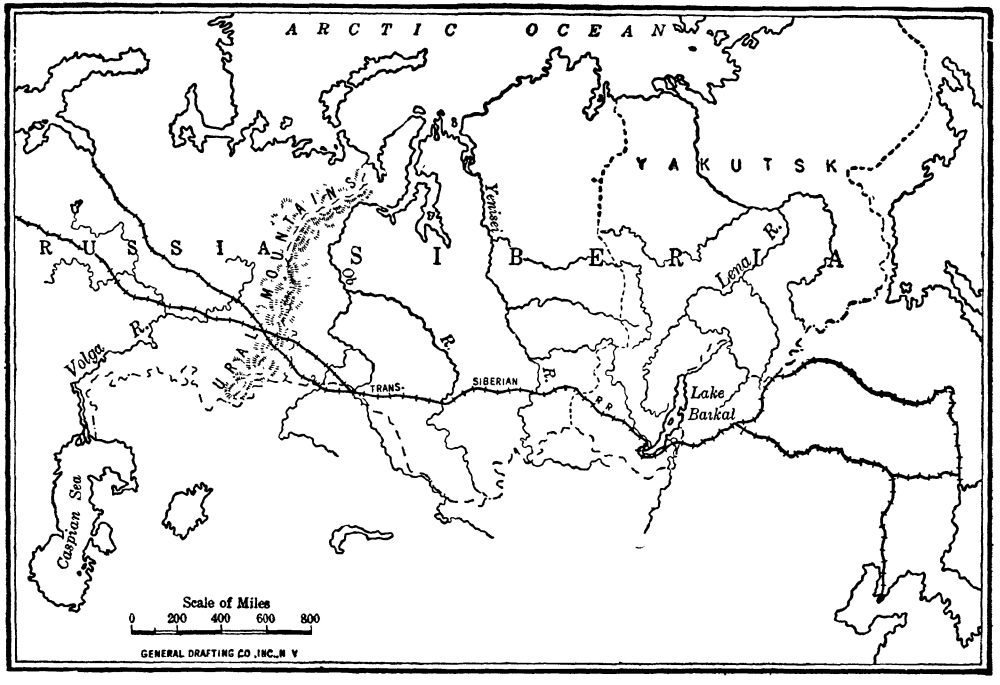
deposits, doubtless ignited by forest fires, have been burning for many years. The Indians resort to this place to dry fish and meat. A large oil company has recently driven several deep wells near the confluence of the Great Bear and Mackenzie. An oil flow of seventy-five barrels a day was secured.

In the northeastern watershed of the Mackenzie are one hundred fifty thousand square miles of practically unexplored territory that has never been accurately mapped. This area is nearly as large as all the New England states including New York and Penn-

sylvania. Only hunters and trappers trail across it. The Hudson Bay Company, which has trading posts on the principal rivers, and the Canadian Mounted Police are the only outside agencies in touch with this great wilderness.

The northern rivers of Asia, the Ob, the Yenisei, and the Lena, flow in a generally parallel direction and through such similar territory that they have much in common. All of these rivers, together with the Mackenzie, are, by their north-flowing direction, affected by the earth's rotation. These rivers, flowing at right angles to this west to east rotation, tend to wear excessively on their right or eastern banks. As a result the east bank is almost invariably much higher than the west bank on which is deposited the wash from the opposite side. There is evidence that the channels of these rivers are slowly working eastward.

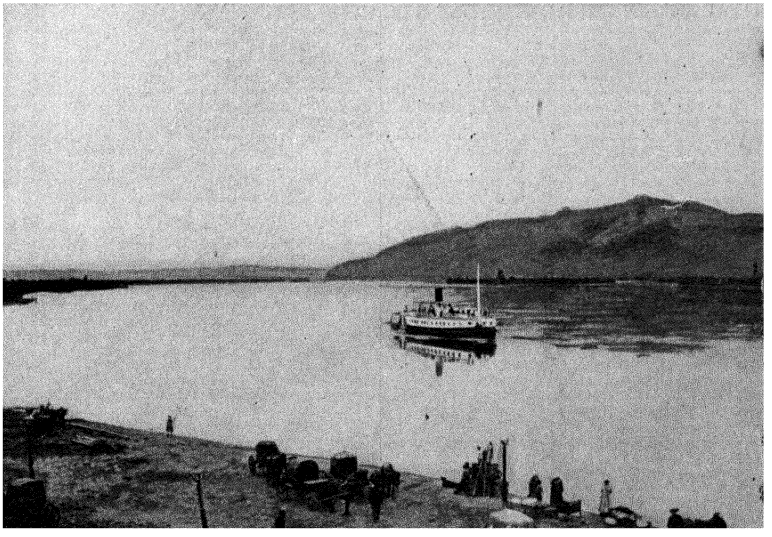
The erosion of the river banks has uncovered strange evidence of prehistoric life in this region. Along the Yenisei and Lena are found remains of a now extinct animal called the mammoth, in form and size somewhat like our present-day elephant. So well are the bodies of these animals preserved in the frozen ground that carcasses are frequently found almost intact, with skin and flesh in such condition that it can be eaten by dogs and sometimes by men. The tusks of the mammoth are so numerous that they furnish a steady income for the natives. From the province of Yakutsk alone, some ten or fifteen tons are collected and ex-



Arctic Rivers in Northern Asia and Russia

ported annually. They are used in the manufacture of ivory articles. How these great animals could have met death and been overwhelmed by ice and cold so suddenly that their remains did not decay is a mystery as yet unsolved.

The Ob, the Yenisei, and the Lena, although running



Courtesy of Russian Administration.—Loaned by American Geographical Society

Landing Place near a Health Resort on Lake Shira, West of the Yenisei

across rather than with the usual lines of trade, have been very influential in the development of Siberia. Their navigable tributaries extend east and west and so nearly meet on the crests of the low watersheds that they furnish useful lines for exploration and commerce.

By constructing canals it has become possible to travel by water from the Urals almost to the Pacific.

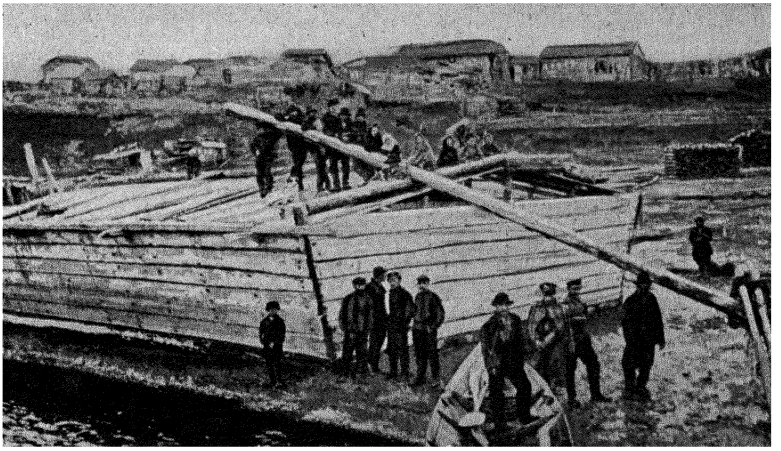
Seven hundred miles from its mouth the Ob is three miles wide. This river, over three thousand miles long, drains a basin of over a million square miles. It is connected by waterways with the Yenisei and the Volga systems. In this one basin are some ninety-three hundred miles of navigable streams.



Courtesy of Reports of Russian Administration.—Loaned by American Geographical Society

Travel by Raft on the Yenisei

Pioneer conditions here are somewhat similar to life on the Mississippi River one hundred years ago.



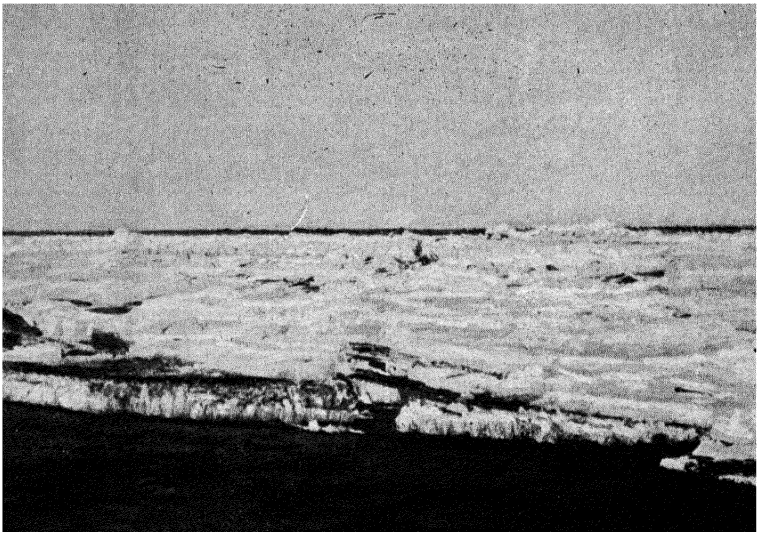
Courtesy of Russian Administration.—Loaned by American Geographical Society

Yenisei Barge

These crude boats carry bulky products down stream. They are then broken up and sold for their timber.

The Yenisei basin is nearly equal to that of the Ob but extends farther to the south and embraces a greater variety of territory. Its source is in the mountains of Mongolia. With its longest tributary, it is three thousand miles from the point of rising to the Arctic. Eighteen hundred miles are navigable. Lake Baikal, one of the three largest lakes in the old world, drains indirectly into the Yenisei.

The steppes of the upper Yenisei have been inhabited since remotest time. Along its lower course, its basin is peopled by various tribes of Asiatics difficult to classify. Fishing is their main occupation. Under Russian direction this business is growing in importance.



Courtesy of Russian Administration.—Loaned by American Geographical Society

Ice Jam on the Yenisei

Note the great width of the stream at this point.

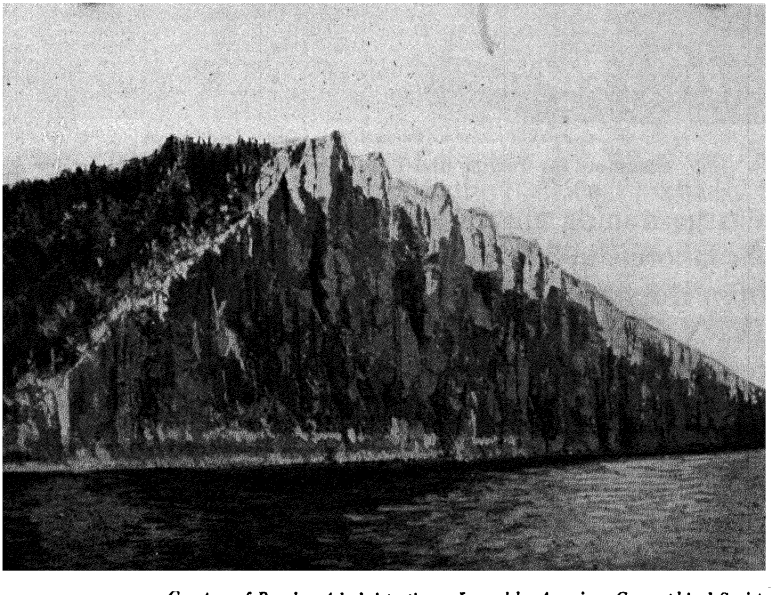
In 1907 over three thousand tons of fish were sold and carried away by steamers.

The Lena, the third great northern river and the one farthest east, is navigable for over three thousand miles. Some twenty steamers and many barges collect native products and distribute manufactured goods. This river has an enormous delta of eight thousand square miles and is less accessible to steamers from the Arctic than the Ob, with its gulf, or the Yenisei, with its fairly open estuary.

Maritime trade, that is, entrance and navigation by

sea-going vessels, is hampered in all these rivers by the uncertainty of ice conditions, which vary considerably from year to year. In the ten years, 1877 to 1886, twenty-seven ships tried and fifteen failed to make the Yenisei. From 1886 to 1896, twenty-two tried and nearly all reached their destination on the river. It is believed that, with the assistance of wireless stations to report wind and ice conditions, successful sea routes between Atlantic ports and the Arctic could be established.

Gold mining has long been profitable on the Lena. At one place over seven thousand men are employed in



Courtesy of Russian Administration.—Loaned by American Geographical Society

View on the Lena

On many of these high banks of Siberian rivers are exposed views of coal and other minerals.



Courtesy of Russian Administration.– Loaned by American Geographical Society

Steamers for Towing and Passenger Service on the Lena

a large mining enterprise. Formerly a great many of the laborers in Siberia were exiles. These were criminals from Russia and persons who had conspired against the Tsar's government. They were sent to Siberia for long terms as a means of punishment. An interesting account of this exile system is found in books by Mr. George Kennan. Deposits of copper and iron have been located in the lower Lena basin. It is known that there are miles of coal deposits. In some places the coal near the surface has been burning for years.

Of course the influence of these northern rivers on human life has been small as compared with that of

rivers like the Yangtze-kiang and the Rhine. Climatic conditions have made occupation and use of the valley resources very difficult. Undoubtedly, however, as central Siberia becomes settled, the influence of these great rivers will increase.

As feeders of the Trans-Siberian Railway, they already offer valuable north and south lines of communication. If the deposits of coal, copper, and gold known to exist in the great north plains are ever developed, it will be only through the use of these rivers and their tributaries which offer ready-made routes to the interior.

The following quotation from Simpson's book *Sidelights on Siberia*[1] refers to the Ob and well describes the majesty and loneliness of these northern rivers:

> Alone on that great, silent mass of water that yet moves ever quietly onward in fulfilment of its destiny! Alone, surrounded by forests that have never as yet resounded to the foot of man! Alone in the depths of Asia! Follow the Ob to the Polar Sea. Ah, there is desolation! And even at that moment we are skirting banks clad with lithe birches that stood out on the promontory, a windy wall; for their branches have grown in the direction of the prevailing breeze, like subjects bowing before their lord. And the gold and pink where the sun has died give place to the pink alone, and the pink gives place to a delicate blue, and the delicate blue loses itself in the twilight, and then the night covers all.

PROBLEMS

1—On a map of the world, trace a line connecting the northernmost cities.

[1] J. Y Simpson: *Sidelights on Siberia.* Wm Blackwood & Sons.

2—What useful products may we expect to get from latitude 60° north and beyond?

3—What conditions tend to lessen the use and influence of arctic rivers?

4—On a map of North America trace:

(a) An all-water route from Seattle to Dawson, Alaska; to Fairbanks.

(b) Two railroad lines that compete with the Yukon route to interior Alaska.

(c) The Canadian railroad that connects the transcontinental lines with the head waters of the Mackenzie River.

5—On a map of Asia note where the Trans-Siberian Railway crosses the Ob, Yenisei, and Lena rivers. Compare the latitudes of these places with Quebec, Winnipeg, and Edmonton in North America.

RIVER TYPES

Our knowledge of world rivers will be increased and our thinking about them greatly simplified if we can classify them according to their most striking services to mankind.

The great rivers already studied are each conspicuous for certain leading values—the Nile for its enrichment of the land, the Rhine for its commercial utility, the Amazon for its route to the interior of South America, and so on.

There are in the several continents countless streams. Only those will be mentioned that empty directly into the sea. The numerous branches and sub-branches of such rivers, complicated as the veins of a leaf, usually lose their individuality in the system of which they are a part and frequently are characterized by the uses made of the main stream.

If the main stream has commercial value, its branches will be developed in so far as possible to extend lines of trade. An illustration of this is the Ohio, with its movable dams and temporary pools designed to utilize the commercial value of the navigable Mississippi. Another example is seen in the great improvement of the Rhine tributaries to extend the commercial utility of that river. If the main stream is industrial, useful for power, the tributaries will usually have industrial

possibilities that will be developed according to the tendencies and intelligence of the dwellers in its valley.

With these points in mind, we can group many river systems. Some, it is true, may fall into two or more groups because their influence, due to physical features, such as fall, depth, and length, may also be increased by their positions as natural boundaries and their strategic values in time of war.

Continental Gateways

Early exploration and settlement of new territory usually has depended on the existence of some great river that could be readily ascended. Such rivers are the St. Lawrence, the Mississippi, the Amazon, the Plata, the Yangtze-kiang, the Danube, the Yukon, the Ob, the Yenisei, and the Lena river systems.

The story of American exploration is filled with incidents connected with the use of the St. Lawrence-Mississippi routes to the interior. Numerous wars and treaties aimed to secure and hold the privilege of using these extensive routes are recorded in American history.

Much of what we have learned of central South America in the last four hundred years has been due to the existence of the Amazon route. Central Africa, lacking such a route, continued to be the "dark continent" for centuries after its coast line was known.

The Plata and its tributaries permitted the early

Spanish conquerors to penetrate to the rich mineral lands of Bolivia and southern Peru long before practicable roads and railways made this region attainable from the near-by Pacific.

The Yangtze-kiang offers the only practical road to interior China. Near its mouth European nations first established those "spheres of influence" that have had such a powerful part in awakening China and bringing it into contact with the modern world.

The Danube in ancient times was the great channel through which Roman culture entered northeastern Europe. Later, as Rome declined and northern power increased, the Danube became a route for the penetration of the Orient from the west.

When the discovery of gold made the penetration of Alaska desirable, the Yukon became a highway for miners and storekeepers. Later railway routes have linked some places with the coast, but at first the Yukon offered the only practicable route.

The arctic entrances to the Ob, Yenisei, and Lena rivers have never been important, but these systems through their east and west branches offer almost continuous water routes from the Ural Mountains to the Pacific. Along these lines Siberia was first penetrated by Yermak, who had been exiled from Russia by Ivan the Terrible. When the great Russian railroad was constructed across Asia, much material and heavy equipment for it were brought into central Siberia by river transport.

Agricultural Rivers

Certain rivers have been noted for the agricultural values created by their regular inundations and by the great alluvial deposits of arable land they have made. Such rivers are the Nile, the Ganges, the Euphrates, the lower Yangtze-kiang, and the lower Mississippi. These rivers have tended to develop industrious, stable, peace-loving peoples and indirectly have promoted progress in the arts and sciences.

Even though isolated from one another, similar conditions have almost invariably produced similar effects on river populations. It should be noted, however, that beyond a certain point, an agricultural people ceases to develop unless, by commerce and contact with other groups, new ideas and ambitions are awakened. Competition among peoples as well as among individuals is a necessary stimulus to continuous progress.

Rivers with Religious and Literary Associations

Dependence on a river has frequently given it a prestige and spiritual glamour that has caused people to love it and even worship it. These rivers have inspired literature and art. Such a river is the Ganges. Others are the Nile, the Rhine, the Jordan, and the Danube.

Nile worship and the sacred Ganges pilgrimages have already been described. The significance of the Jordan

in our own religious history is well known. The mythology, poetry, and music inspired by the Rhine and the Danube testify to the appeal of those rivers.

Political Rivers

Certain rivers, by their position, have had unusual political and military importance. Some of these are the Rhine, the Danube, the Tigris and Euphrates, the Mississippi, the St. Lawrence, and the Rio Grande.

The Rhine and the Danube first assumed prominence as northern boundaries of the Roman Empire. Later they figured in nearly every great European war. Taken together these two rivers seem to form a water line between the opposing cultures of northern Europe and the Mediterranean region. The World War was but a repetition, on a larger scale, of the struggles that have been going on up and down and across these rivers for thousands of years.

In North America, the Rhine-Danube situation was paralleled by the Mississippi-St. Lawrence rivers. These also formed a water line dividing a continent. Their history is briefer because they have been known to us but a comparatively short time. The story of these rivers, too, is filled with struggles to control them. Even previous to the coming of the white man, the St. Lawrence was the dividing line between the great Algonquin tribes on the north and the fierce Iroquois on the south. During the first three hundred years of North American history these rivers formed the frontier between two

standards of living: that of the French and Indian wanderers and traders on the north and west; and that of the permanently settled, industrious English on the south and east.

The political importance of the Tigris-Euphrates dates long before that of the Danube and Rhine, yet even today the control of Mesopotamia and its water routes is a live issue in European-Asiatic diplomacy.

Commercial Rivers

The progress of civilization and especially of steam navigation has tended to magnify the importance of rivers as trade routes. Some of these are the Rhine, the Volga, the Danube, the Mississippi, the Yangtze-kiang, and the St. Lawrence.

In the transportation of heavy or bulky products like coal, iron, grain, or timber, railroads can never meet the needs of modern trade. Our own great railroad systems frequently are congested and often trade is hampered through their inability to carry raw materials in sufficiently large quantities. This means a renewed interest in water transportation, a greater effort to improve old lines and open new ones.

With its ten thousand steamers and barges, the Rhine leads all the commercial rivers in tonnage. Its preëminence as an outlet for German industry is assured.

The Volga, by its tributaries and canals, supplies

water transportation facilities to all interior Russia. Lack of a direct outlet to the ocean has hindered its connection with international routes.

For a long time the political importance of the Danube overshadowed and even hampered its commercial use but now, through its control by an international commission, its trade possibilities are being realized. With the completion of the Danube-Rhine canal and other connecting waterways in Germany, commerce on this river is bound to increase and with it the progress of its peoples.

The introduction of railroads temporarily checked Mississippi commerce but the demands of a growing population have outrun railroad facilities and now plans are under way that may ultimately revive the lost trade on this river.

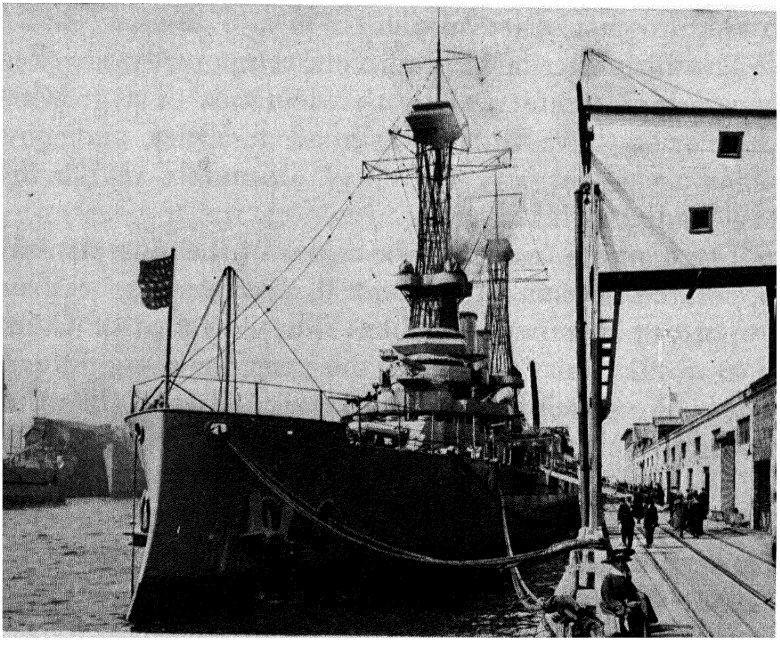
The Yangtze-kiang, in the center of the most densely populated section of the world, has always been an important commercial route. The entrance of China into world affairs will make the Yangtze-kiang influential in the development of mineral lands and the other natural wealth of eastern Asia.

The St. Lawrence has attained great commercial importance since canals around its rapids have made it possible for large boats to pass from the Lakes to the ocean. Now Montreal and Quebec rival New Orleans and New York in the tonnage of exports brought by way of the St. Lawrence from central North America.

Harbor Rivers

Great navigable rivers, by their very size and volume, create deltas at their entrances so that ocean-going vessels must thread tortuous channels long distances inward to secure safe anchorage. Hence, though much commerce passes through these rivers, the greatest cities do not always develop on them.

But there is another group of commercial rivers de-



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A Harbor River

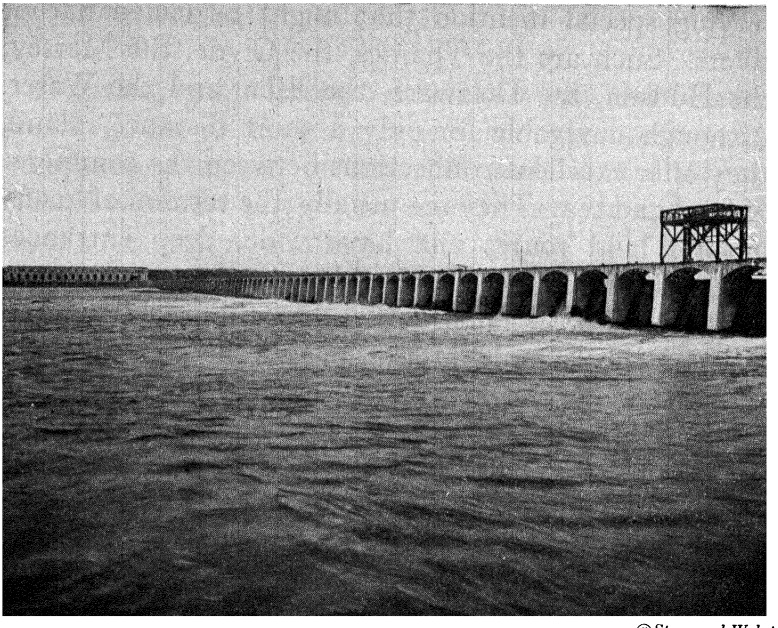
The connecting point between water and land transportation.

serving special mention that might be called harbor rivers. Such are the Thames, the Clyde, the Mersey, the Hudson, the Delaware, the Elbe, and the Weser. Although navigable for only a short distance inland, they offer excellent connections between the commerce of land and sea. They are usually the termini of many natural land routes and have wide, deep entrances where ships can meet land and coastwise routes.

On the short Thames is London, the world's largest city; on the Elbe, Hamburg, one of the great ports of the world; on the Mersey, Liverpool; on the Weser, Bremen; on the Delaware, Philadelphia; and at the mouth of the Hudson, New York, a great transfer point for continental and ocean traffic.

Industrial Rivers

The use of rivers to furnish power for industries has grown enormously with the development of science, particularly since the transmission of power by electric current became practicable on a large scale. Many streams in their upper courses have considerable fall, but the remoteness of such falls has retarded their use for power. Some shorter rivers, however, with considerable volume and fall, accessible to existing lines of railways and roads, have been used for power to such an extent that they may be classed as industrial rivers. Such are the Merrimac, the Connecticut, the Androscoggin, the Hudson, the Kennebec, and the Chattahoochie. The energy of the Merrimac in use is over



©Stone and Webster

An Industrial River

On many streams the water is used at every fall to generate electric power or directly to operate mills.

sixty thousand horse power; of the Connecticut, one hundred thousand horse power. The increasing cost of mining and transporting coal, together with the uncertainty of the supply due to labor troubles, is turning the attention of engineers and manufacturers to further use of water power. The great dam across the Mississippi at Keokuk, with locks for the passage of boats, illustrates a possible combination of trade and industrial use of a great river.

Power installations have been made on the upper Rhine. The electrification of many French railways only awaits the construction of generating plants on the Rhone.

PROBLEMS

1—Classify some rivers not already mentioned according to the groupings in this chapter.

2—Locate on a map of the United States:

(a) some harbor improvement projects,

(b) some national irrigation projects,

(c) some great water power projects.

CONSERVING RIVER RESOURCES

Throughout the preceding chapters we have seen the many ways in which rivers are of service to man. We have seen the close relation between rivers and extensive exploration, profitable commerce, fruitful agriculture, and factory power. The flow of rivers is often accepted as a gift of nature, everlasting and unvarying from year to year. But we are now learning that here, as in older countries, the careless management of watershed regions may in a few generations destroy much of the river service man has so laboriously learned to use.

The utility of rivers depends upon a constant flow of water varying little from season to season. Rivers that flood their valleys in the spring and have but a scanty flow in summer are a menace as well as an unreliable ally to commerce and industry. Human ingenuity may, by dikes and channels, meet these conditions in a way; but the biggest problem is that of conservation. The water supply should be protected at its source on the slopes of the hills and along the sides of narrow valleys where the rivers are supplied by springs and brooks.

Careless cutting of timber and failure to prevent and extinguish forest fires always affect the quantity and regularity of the water flowing from month to month.

Forests serve to cover the ground and by protecting it from the sun permit it to hold the rain and melting snow until water can permeate the soil and crevices of rock from whence it finally comes forth in numerous springs.

In China are many illustrations of the disastrous results from waste of forests. Already some far-sighted Americans are pleading for the conservation of our own timber tracts. Scientific forestry is now taught as a profession. Many states are recognizing the need for employing experts to care for their forests and direct



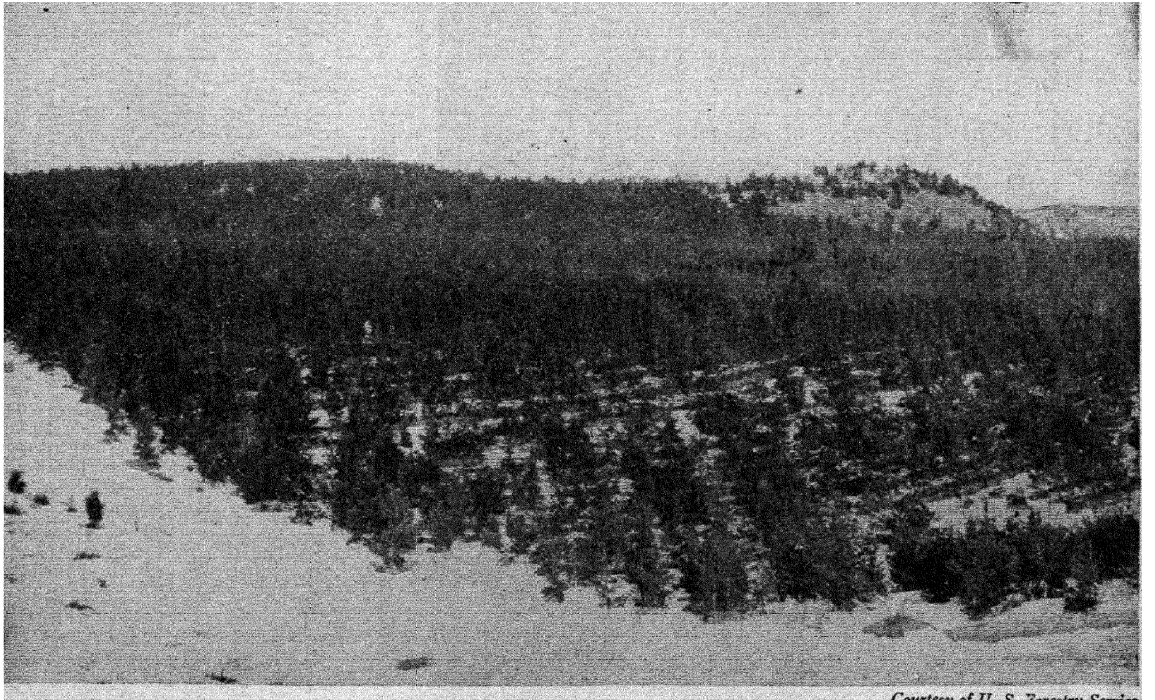
Courtesy of U. S. Forestry Service

Careless Lumbering on a Watershed

the cutting of timber in them. In Europe the need for scientific forestry long has been recognized. The relation of forest control to river utility is very close and our growing dependence on streams for power and light makes it the duty of every citizen to support all sound plans for the protection of our water supply.

The following quotations from a message of President Roosevelt to Congress eloquently set forth the need for conservation:

"If there is any one duty which more than another we owe to our children and our children's children to perform at once, it is to save the forests of this country, for they constitute the first and most important element in the conservation of the natural resources of the country. There are of course two kinds of natural resources. One is the kind which can only be used as part of a process of exhaustion; this is true of mines, natural oil, gas wells, and the like. The other, and of course ultimately by far the most important, includes the resources which can be improved in the process of wise use; the soil, the rivers, and the forests come under this head. Any really civilized nation will so use all of these three great national assets that the nation will have their benefit in the future. Just as a farmer, after making his living from his farm all his life, will, if he is an expert farmer, leave it as an asset of increased value to his son, so we should leave our national domain to our children, increased in value and not worn out. There are small sections of our own country, in



Courtesy of U. S. Forestry Service

An Attempt to Renew a Forest

A planting of pines in Nebraska National Forest.



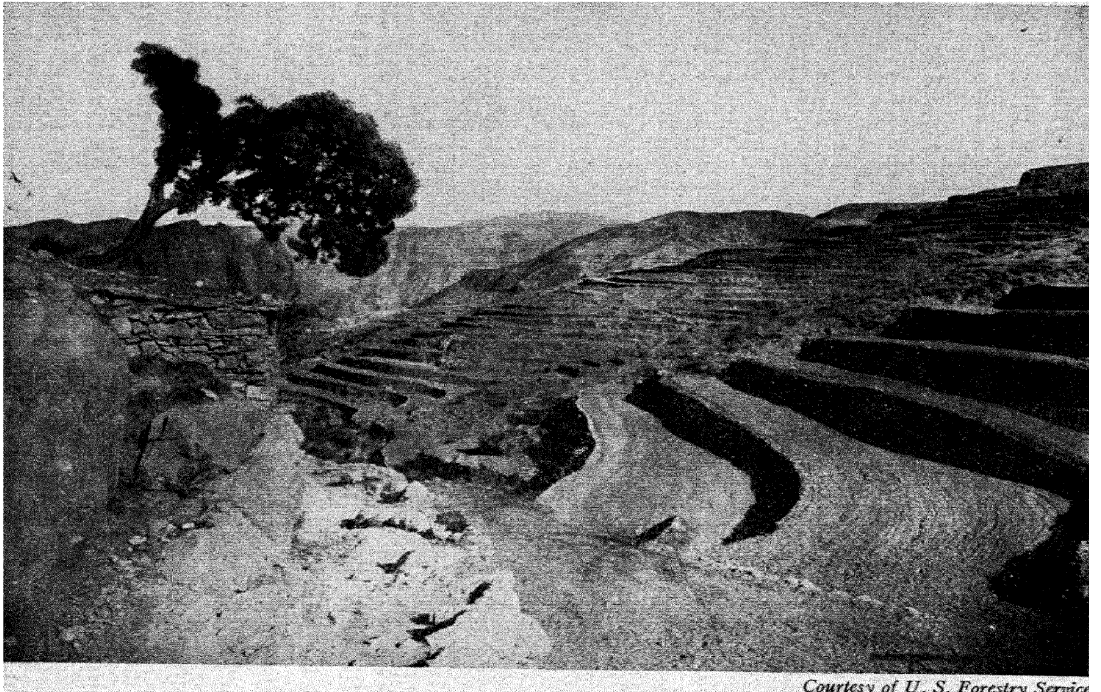
Courtesy of U. S. Forestry Service

Destruction of Timber by Fire in an Arizona Forest

the East and in the West, in the Adirondacks, the White Mountains, the Appalachians, and in the Rocky Mountains, where we can already see for ourselves the damage in the shape of permanent injury to the soil and the river systems which comes from reckless deforestation. It matters not whether this deforestation is due to the actual reckless cutting of timber, to the fires that inevitably follow such reckless cutting of timber, or to reckless and uncontrolled grazing, especially

by the great migratory bands of sheep, the unchecked wandering of which means destruction to forests and disaster to the small home makers, the settlers of limited means. . . .

"All serious students of the question are aware of the great damage that has been done in the Mediterranean countries of Europe, Asia, and Africa by deforestation. The similar damage that has been done in Eastern Asia is less well known. A recent investigation into conditions in North China by Mr. Frank N. Meyer, of the Bureau of Plant Industry of the United States Department of Agriculture, has incidentally furnished, in a very striking fashion, proof of the ruin that comes from reckless deforestation of mountains, and of the further fact that the damage once done may prove practically irreparable. . . . We know this not only from the old Chinese records, but from the accounts given by the traveller, Marco Polo. He, for instance, mentions that in visiting the provinces of Shansi and Shensi he observed many plantations of mulberry trees. Now there is hardly a single mulberry tree in either of these provinces, and the culture of the silkworm has moved farther south, to regions of atmospheric moisture. As an illustration of the complete change in the rivers, we may take Polo's statement that a certain river, the Hun Ho, was so large and deep that merchants ascended it from the sea with heavily laden boats; to-day this river is simply a broad sandy bed, with shallow, rapid currents wandering hither and thither across it.



Courtesy of U. S. Forestry Service

Results of Forest Destruction

The loss of forests has caused a waste of much agricultural land in China. These terraces have been constructed to save what is left of the soil.



Courtesy of U. S. Forestry Service

Results of Forest Destruction

Hundreds of square miles of this land in China were once heavily wooded. They furnished much valuable timber.

"The lesson of deforestation in China is a lesson which mankind should have learned many times already from what has occurred in other places. Denudation leaves naked soil; then gullying cuts down to the bare rocks; and meanwhile the rock-waste buries the bottom lands. When the soil is gone, men must go; and the process does not take long. . . .

"What has thus happened in northern China, what has happened in central Asia, in Palestine, in North Africa, in parts of the Mediterranean countries of Eu-

rope, will surely happen in our country if we do not exercise that wise forethought which should be one of the chief marks of any people calling itself civilized. Nothing should be permitted to stand in the way of the preservation of the forests, and it is criminal to permit individuals to purchase a little gain for themselves through the destruction of forests when this destruction is fatal to the well-being of the whole country in the future."

PROBLEMS

1—Locate the principal national forests on the map of the United States.

2—Observe and report on careless forestry in your vicinity.

3—Should cities and factories be permitted to turn sewage and waste into rivers?

BIBLIOGRAPHY

For teachers and pupils desiring to make studies of particular river regions, the list of selected titles on pages 194 to 197 is submitted.

It includes, besides recent books, some others that may be obtainable in public libraries.

Very few complete studies of river regions are available. Information regarding specific river conditions and their uses must be found through readings in descriptive geography and books of travel on the countries through or near which these rivers flow.

In government bulletins relating to commerce, irrigation, forest conservation, hydro-electric plants, and waterways, much interesting material can be found.

Another source is the *National Geographic Magazine* and some of the numerous travel periodicals. In their files one frequently can find new material bearing on some phases of river conditions and development.

In the advertising matter issued by steamship companies, railroads, and tourist agencies, much material on scenic and recreational values of river regions can be obtained.

For capable pupils, an interesting project would be the collecting of pictures, literary references, economic facts, and descriptive material bearing on a particular river. The results of such a study, put in the form of a booklet, might have real value for teacher and class.

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