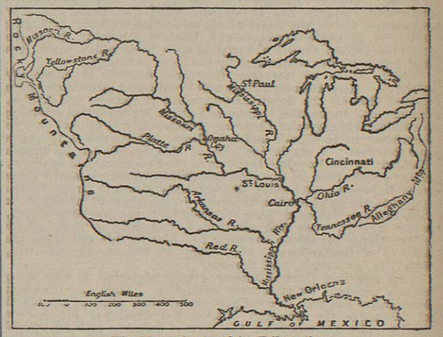
tionally rapid. In Cuddapah, *e.g.*, in the Telugu territory, the Society for the Propagation of the Gospel and the London Missionary Society laboured side by side for upwards of thirty years without winning over more than 200 converts. Then on a sudden there sprang up a revival among the non-caste population, and the 200 became nearly 11,000. Among the Kols, after five years' waiting, the Gossner missionaries baptized their first converts in 1850; now in the German and English stations together these amount to about 40,000. Since the famine, however, in 1878–79, the increase of new converts has been still more rapid, and the practical experience of the superiority of Christian pity to heathen selfishness and of the helplessness of their heathen deities, united with the effect produced by persistent missionary labour in past years, brought thousands into the fold of the church. Thus in the Tinnevelly district, where the Church Missionary Society carries on its operations, upwards of 11,000 heathens applied in 1878 to Bishop Sargent and his native clergy for instruction preparatory to baptism.[1] In the same district, in connexion with the Society for the Propagation of the Gospel, between July 1877 and the end of June 1878 upwards of 23,564 persons betook themselves to Bishop Caldwell and his fellow-labourers for Christian teaching. Thus the English Church missions in Tinnevelly and Ramnad received in little more than a year and a half an increase of 35,000 souls,[2] and the Propagation Society is now proclaiming the gospel in nearly six hundred and fifty villages in the Tinnevelly district, amongst not merely food-seeking "rice Christians" but those who have had the courage to face severe persecution for joining the Christian church. Encouraging progress has also been made among the Santals and the Karens in Burmah and Pegu. Speaking generally, it may be said that the largest proportion of native converts is in the south, in the presidency of Madras; next to southern India the most fruitful field is Burmah, where the American Baptist missions are carrying on a successful work among the Karens, while the Propagation Society has founded many schools on the Irawadi, and penetrated up to Rangoon, and beyond British territory to Mandalay; next in point of numbers stand Bengal and the North-West Provinces. Here the largest contingent is supplied by the missions in Chutiá Nagpúr, among the aboriginal tribes of the Kols, while the Santal mission also presents many promising features. For the Punjab district and that of Sind, the Church Missionary Society has planted in Lahore a flourishing theological seminary for Christian Hindus, Sikhs, and Mohammedans, and Christianity has advanced thence by way of Peshawar into Afghanistan and Kashmir. It thus appears that by far the greatest measure of success has been obtained amongst the aboriginal races and those who are either of low caste or of no caste at all, while the real strongholds of the Hindu religion and civilization still stand out like strong fortresses and defy the attempts of the besiegers. Still the disintegrating agency of contact with Christianity is working out its slow but sure results. "Statistical facts," writes Sir Bartle Frere, "can in no way convey any adequate idea of the work done in any part of India. The effect is often enormous where there has not been a single avowed conversion. The teaching of Christianity amongst 160 millions of civilized industrious Hindus and Mohammedans in India is effecting changes, moral, social, and political, which for extent and rapidity in effect are far more extraordinary than any that have been witnessed in modern Europe." "The number of actual converts to Christianity in India," says Lord Lawrence, "does not by any means give an adequate result of missionary labours. There are thousands of persons scattered over India who from the knowledge they have acquired either directly or indirectly through dissemination of Christian truth and Christian principles have lost all belief in Hinduism and Mohammedanism, and are in their conduct influenced by higher motives, who yet fear to make an open profession of the change in them lest they should be looked upon as outcasts and lepers by their own people." To some such a negative result may at first sight appear discouraging; but, read by the light of history, it marks a natural, almost a necessary, stage of transition from an ancient historical religion to Christianity. The Brahma Somaj is not the first instance where a system too vague and shadowy and too deficient in the elements of a permanent religion has filled the interval between the abandonment of the old and the acceptance of a new faith. The cultured classes amongst the Greeks and Romans experienced in their day, after the popular mythology had ceased to satisfy, a period of semi-scepticism before Christianity had secured its hold. Meantime in India the indirect agencies which are at work—the results of war and conquest, of European science and European literature, of the telegraph and the railway, the book and the newspaper, the college and the school, the change of laws hallowed by immemorial usage, the disregard of time-honoured prejudices, the very presence of Europeans in all parts of the country—all these various influences are gradually bringing about results analogous to that to which Sir James Mackintosh referred in a conversation with Henry Martyn, when the Oriental world was made Greek by the successors of Alexander in order to make way for the religion of Christ. But when to these indirect influences we add the effects of direct missionary instruction, of training schools like those of the Free Church of Scotland in Madras, of Bishop Sargent in Tinnevelly, of Bishop Cotton in the North-West Provinces, of Zenana missions now carried on on an extensive scale amongst the female population, of the numerous missionary presses at work circulating thousands of copies of the Holy Scriptures and of Christian books, it is obvious that, small and insignificant as these agencies may seem compared with the magnitude of the work required to be done, there has been a great advance made during recent years. The present century of missions may favourably compare with the primitive and mediæval ages of the church, and the continuity of the missionary spirit operating, as we have seen, after long periods of stagnation and depression is the best guarantee of its ultimate and more complete success at the close of the present epoch, during which, to use Karl Ritter's expression, "almost all the rivers of the earth have begun to run in double currents, and nearly all the seas and rivers have become the seas and rivers of civilization." (G. F. M.)

[1] *Abstract of Church Missionary Society's Report for* 1879, p. 13.
[2] *Report of the Propagation Society for* 1879, p. 31 *sq.*

MISSISSIPPI. The territory drained by the Mississippi river and its tributaries includes the greater part of the United States of America lying between the Alleghany Mountains on the east and the Rocky Mountains on the west, and has an area (1,244,000 square miles) considerably larger than all central Europe. The central artery through which the drainage of this region passes is called the Mississippi river for about 1300 miles above its mouth. The name is then usurped by a tributary, while the main



The Mississippi and its Tributaries.

stream becomes known as the Missouri. From its remote sources in the Rocky Mountains to the Gulf of Mexico the total length of the river is about 4200 miles. The other principal tributaries are the Ohio, the Arkansas, and the Red River, but the Yazoo and the St Francis often make dangerous contributions in seasons of flood.

The tables given below exhibit the hydraulic features of the Missisippi and its principal tributaries.

Below the influx of the Ohio the Mississippi traverses alluvial bottom lands liable to overflow in flood seasons. The soil is of inexhaustible fertility, producing large crops of corn in the northern portion, cotton in the middle district, and sugar, rice, and orange groves near the mouth. These bottom lands, averaging about 40 miles in width, extend from north to south for a distance of 500 miles, having a general southern slope of 8 inches to the mile. The river winds through them in a devious course for 1100 miles, occasionally on the east side washing bluffs from 100 to 300 feet in height, but usually confined by banks of its own creation, which, as with all sediment-bearing rivers of like character, are highest near the stream itself. The general lateral slope towards the foot hills is about 6 inches

in 5000 feet, but the normal fall in the first mile is about 7 feet. Thus apparently following a low ridge through the bottom lands, the tawny sea sweeps onward with great velocity, eroding its banks in the bends and rebuilding them on the points, now forming islands by its deposits, and now removing them as the direction of the flow is modified by the never-ending changes in progress. Chief among such changes is the formation of cut-offs. Two eroding bends gradually approach each other until the water forces a passage across the narrow neck. As the channel distance between these bends may be many miles, a cascade perhaps 5 or 6 feet in height is formed, and the torrent rushes through with a roar audible for miles. The banks dissolve like sugar. In a single day the course of the river is changed, and steamboats pass where a few hours before the plough had been at work. The checking of the current at the upper and lower mouths of the abandoned channel soon obstructs them by deposit, and forms in a few years one of the characteristic crescent lakes which are so marked a feature on the maps.

The total area of the bottom lands is about 32,000 square miles, of which only a narrow strip along the immediate banks of the main river and of its principal bayous and tributaries has even yet been brought under cultivation. A proper system of protection against overflow would throw open 2,500,000 acres of rich sugar land, 7,000,000 acres of the best cotton land in the world, and 1,000,000 acres of corn land of unsurpassed fertility.

The work of embankment began in 1717, when the engineer De la Tour erected a dyke or levee 1 mile long to protect the infant city of New Orleans from overflow. Progress at first was slow. In 1770 the settlements extended only 30 miles above and 20 miles below New Orleans; but by 1828 the levees, although quite insufficient in dimensions, had become continuous nearly to the mouth of Red River. In 1850 a great impulse was given to systematic embankment by the U.S. Government, which gave over to the several States all unsold swamp and overflowed lands within their limits to provide a fund for reclaiming the districts liable to inundation. The action

Tributaries of the Lower Mississippi.

River.	Distance from Mouth.	Elevation above Sea.	Width between Banks.	Range between High and Low Water.	High Water Cross Section.	Remarks.
Missouri—	Miles.	Feet.	Feet.	Feet.	Square Feet.	
Source	2,908	6,800?	...	...	...	Area of basin, 518,000 square miles; rainfall, 20·9 inches; annual discharge, $3\frac{7}{100}$ billions [*i.e.*, 3,780,000,000,000] cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 120,000 cubic feet.
Three Forks	2,824	4,319	...	...	...	
Fort Benton	2,644	2,845	1,500	6	...	
Fort Union	1,894	2,188	1,500	...	...	
Sioux City	842	1,065	2,500	...	...	
St Joseph	484	756	3,000	20	75,000	
Mouth	0	381	3,000	35	75,000	
Upper Mississippi—						
Source	1,330	1,680	...	...	...	Area of basin, 169,000 square miles; rainfall, 35·2 inches; annual discharge, $3\frac{1}{10}$ billions cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 105,000 cubic feet.
Swan River	998	1,290	120	...	...	
St Paul	658	670	1,200	20	100,000	
Rock Island	310	505	5,000	16	100,000	
Mouth	0	381	5,000	35	100,000	
Ohio—						
Coudersport	1,265	1,649	...	...	...	Area of basin, 214,000 square miles; rainfall, 41·5 inches; annual discharge, 5 billions cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 158,000 cubic feet.
Pittsburg	975	699	1,200	45	50,000	
Cincinnati	515	432	...	42	...	
Mouth	0	275	3,000	51	150,000	
Arkansas—						
Source	1,514	10,000	150	...	...	Area of basin, 189,000 square miles; rainfall, 29·3 inches; annual discharge, 2 billions cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 63,000 cubic feet.
Bent's Fort	1,289	3,672	5,000	6	30,000	
Great Bend	992	1,658	5,000	...	...	
Fort Smith	522	418	1,500	25	70,000	
Little Rock	250	252	1,500	35	70,000	
Mouth	0	162	1,500	45	70,000	
Red River—						
Near source	1,200	2,450	2,000	8	12,000	Area of basin, 97,000 square miles; rainfall, 39 inches; annual discharge, $1\frac{4}{10}$ billions cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 57,000 cubic feet.
Preston	820	641	2,000	...	...	
Shreveport	330	180	800	25	40,000	
Mouth	0	54	800	45	40,000	

The Lower Mississippi.

	Distance from Mouth.	High Water Elevation above Sea.	Fall per Mile.	Width between Banks.	Least Low Water Depth upon the Bars.	Range between High and Low Water.	Area of Cross Section at High Water.	Remarks.
	Miles.	Feet.	Feet.	Feet.	Feet.	Feet.	Square Feet.	
Mouth of Missouri	1,286	416·0	...	...	2·0	37·0	...	Drainage area, 1,244,000 square miles; rainfall, 30·4 inches; annual discharge (including three outlet bayous), $21\frac{5}{10}$ billions of cubic feet; ratio between drainage and rainfall, $\frac{1}{100}$; mean discharge per second, 675,000 cubic feet.
St Louis	1,270	408·0	0·500	...		51·0		
Cairo	1,097	322·0	0·497	4,470	5·0	47·0	191,000	
Columbus	1,076	310·0	0·571			40·0		
Memphis	872	221·0	0·436			...		
Gaines landing	647	149·0	0·320			51·0	199,000	
Natchez	378	66·0	0·309	4,080	6·0	44·3		
Red River landing	316	49·5	0·266			31·1		
Baton Rouge	245	33·9	0·220	3,000	...	24·3	200,000	
Donaldsonville	193	25·8	0·156		...	14·4		
Carrollton	121	15·2	0·147		...	4·5	199,000	
Fort St Philip	37	5·2	0·119	2,470	...	2·3		
Head of Passes	17	2·9	0·115		...	0·0	...	
Gulf	0	0·0	0·171	...	...			

resulting from this caused alarm in Louisiana, for the great bottom lands above were believed to act as reservoirs to receive the highest flood wave; and it was imagined that if they were closed by levees the lower country would be overwhelmed whenever the river in flood rose above its natural banks. The aid of the Government was invoked, and Congress immediately ordered the necessary investigations and surveys. This work was placed in charge of Captain (now General) Humphreys, and an elaborate report covering the results of ten years of investigation was published just after the outbreak of the civil war in 1861. The second of the tables given above, and indeed most of the physical facts respecting the river, are quoted from this standard authority.

To understand the figures of the table it should be noted that at the mouth of Red River, 316 miles above the passes, the water surface at the lowest stage is only $5\frac{2}{10}$ feet above the level of the Gulf, where the mean tidal oscillation is about $1\frac{2}{10}$ feet. The river channel in this section is therefore a freshwater lake, nearly without islands, 2600 feet wide and 100 feet deep along the deepest line. At the flood stage the surface rises 50 feet at the mouth of Red River, but of course retains its level at the Gulf, thus giving the head necessary to force forward the increased volume of discharge. Above the mouth of Red River the case is essentially different. The width increases and the depth decreases; islands become numerous; the oscillation between high and low water varies but little from 50 feet until the mouth of the Ohio is reached—a distance of about 800 miles. Hence the general slope in long distances is here nearly the same at all stages, and the discharge is regulated by the varying resistances of cross section, and by local changes in slope due to the passage of flood waves contributed by the different tributaries. The effect of these different physical conditions appears in the comparative volumes which pass through the channel. At New Orleans the maximum discharge hardly reaches 1,200,000 cubic feet per second, and a rising river at high stages carries only about 100,000 cubic feet per second more than when falling at the same absolute level; while just below the mouth of the Ohio the maximum flood volume reaches 1,400,000 cubic feet per second, and at some stages a rising river may carry one-third more water than when falling at the same absolute level.

The percentage of sedimentary matter carried in suspension by the water varies greatly at different times, but is certainly not dependent upon the stage above low water. It is chiefly determined by the tributary whence the water proceeds, but is also influenced by the caving of the banks, which is always excessive when the river is rapidly falling after the spring flood. In long periods the sedimentary matter is to the water by weight nearly as 1 to 1500, and by bulk as 1 to 2900. The amount held in suspension and annually contributed to the Gulf constitutes a prism 1 mile square and 263 feet high. In addition to this amount a large volume, estimated at 1 mile square and 27 feet high annually, is pushed by the current along the bottom and thus transported to the Gulf.

The mean annual succession of stages for long periods is quite uniform, but so many exceptions are noted that no definite prediction can safely be made for any particular epoch. The river is usually lowest in October. It rises rapidly until checked by the freezing of the northern tributaries. It begins to rise again in February, and attains its highest point about the 1st of April. After falling a few feet it again rises until, early in June, it attains nearly the same level as before. After this it rapidly recedes to low-water mark. As a rule the river is above mid-stage from January to August inclusive, and below that level for the remainder of the year.

It has been established by measurement and observation that the great bottom lands above Red River before the construction of their levees did not serve as reservoirs to diminish the maximum wave which passed through Louisiana in great flood seasons. They had already become filled by local rains and by water escaping into them from the Mississippi through numerous bayous, so that at the date of highest water the discharge into the river near their southern borders was fully equal to the volume which the wave had lost in passing along their fronts.

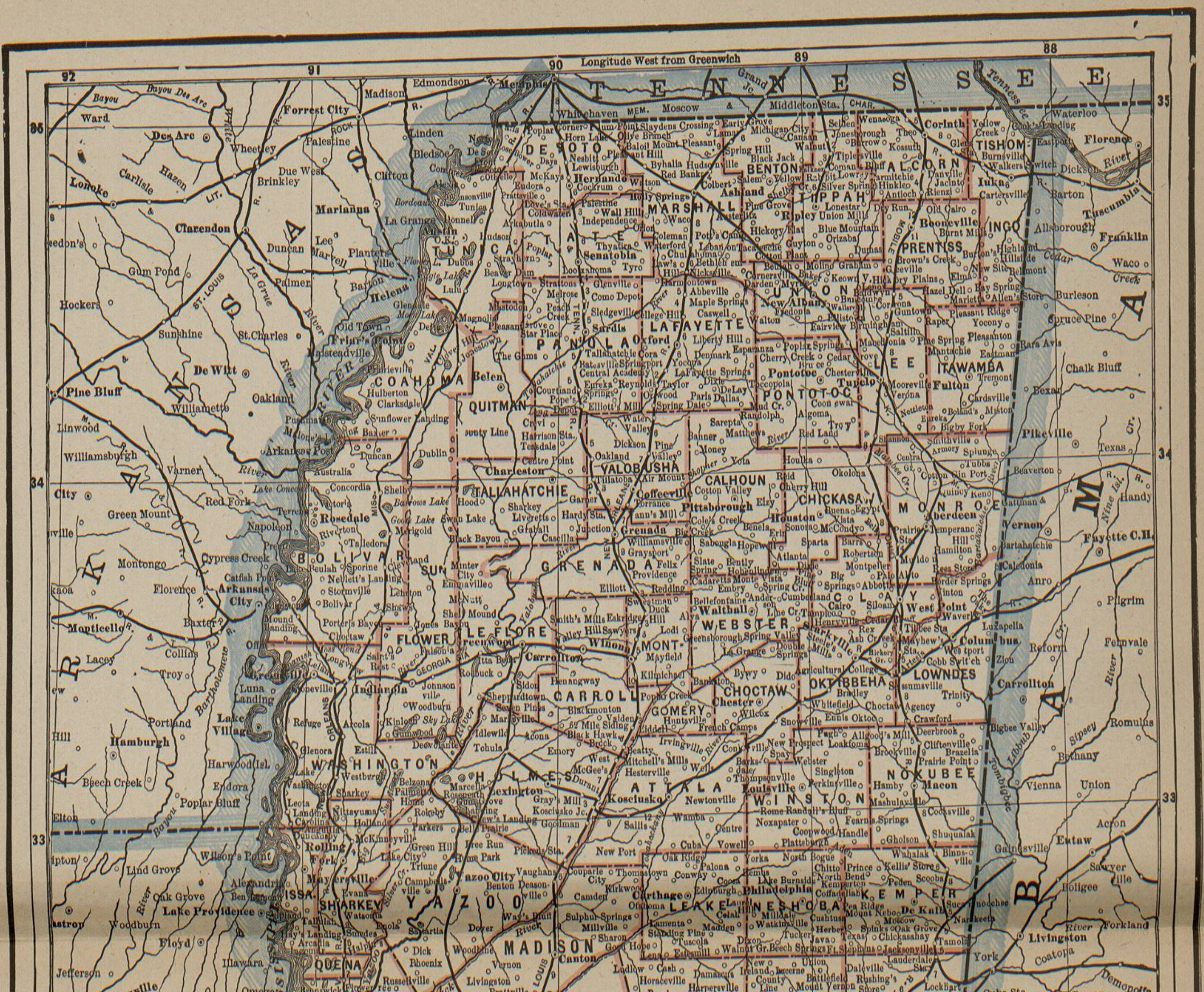
In fine, the investigations between 1850 and 1860 established that no diversion of tributaries was possible; that no reservoirs artificially constructed could keep back the spring freshets which caused the floods; that the making of cut-offs, which had sometimes been advocated as a measure of relief, so far from being beneficial, was in the highest degree injurious; that, while outlets within proper limits were theoretically advantageous, they were impracticable from the lack of suitable sites; and, finally, that levees properly constructed and judiciously placed would afford protection to the entire alluvial region.

During the civil war (1861–65) the artificial embankments were neglected; but after its close large sums were expended by the States directly interested in repairing them. The work was done without concert upon defective plans, and a great flood early in 1874 inundated the country, causing terrible suffering and loss. Congress, then in session, passed an Act creating a commission of five engineers to determine and report on the best system for the permanent reclamation of the entire alluvial region. Their report, rendered in 1875, endorsed the conclusions of that of 1861, and advocated a general levee system on each bank. This system comprised—(1) a main embankment raised to specified heights sufficient to restrain the floods; and (2), where reasonable security against caving required considerable areas near the river to be thrown out, exterior levees of such a height as to exclude ordinary high waters but to allow free passage to great floods, which as a rule only occur at intervals of five or six years. The back country would thus be securely protected, and a safe refuge would be provided for the inhabitants and domestic animals living upon the portion subject to occasional overflow. An engineering organization was proposed for constructing and maintaining these levees, and a detailed topographical survey was recommended to determine their precise location. Congress promptly approved and ordered the survey; but strong opposition on constitutional grounds was raised to the construction of the levees by the Government.

In the meantime complaints began to be heard respecting the low-water navigation of the river below the mouth of the Ohio. Forty-three places above the mouth of Red River afforded depths of less than 10 feet, and thirteen places depths less than 5 feet, the aggregate length of such places being about 150 miles. A board of five army engineers, appointed in 1878 to consider a plan of relief, reported that 10 feet could probably be secured by narrowing the wide places to about 3500 feet with hurdle work, brush ropes, or brush dykes designed to cause a deposit of sediment, and by protecting caving banks, when necessary, by such light and cheap mattresses as experience should show to be best suited to the work. Experiments in these methods were soon begun upon the river above Cairo, and have since proved of decided benefit.

In June 1879 Congress created a commission of seven members to mature plans to correct, permanently determine, and deepen the channel, to protect the banks of the river, to improve and give safety to navigation, to prevent destructive floods, and to promote and facilitate commerce. Up to 1882 appropriations amounting to £1,285,000 were made to execute the plans of this commission, but with provisos that none of the funds were to be expended in repairing or building levees for the protection of land against overflow, although such levees might be constructed if necessary to deepen the channel and improve navigation. Acting under this authority, the commission have allotted considerable sums to repair existing breaks in the levees; but their chief dependence is upon contracting the channel at low water by promoting lateral deposits, and upon protecting the high-water banks against caving by mats of brush, wire, &c., ballasted where necessary with stone,—substantially the plans proposed by the army board of 1878.

The bars at the efflux of the passes at the mouth of the Mississippi have long been recognized as serious impediments to commerce. The river naturally discharges through three principal branches, the south-west pass, the south pass, and the north-east pass, the latter through two channels, the most northern of which is called Pass à l'Outre. The ruling depth on the several bars varies with the discharge over them, which in turn is controlled by the successive advances of the passes. In the natural condition the greatest



MISSISSIPPI
SCALE OF MILES
Longitude West from Greenwich
Longitude West from Washington
TENNESSEE
ARKANSAS
LOUISIANA
ALABAMA
GULF OF MEXICO
MISSISSIPPI SOUND