THE INUNDATION OF THE SALTON BASIN BY THE COLORADO RIVER AND HOW IT WAS CAUSED.

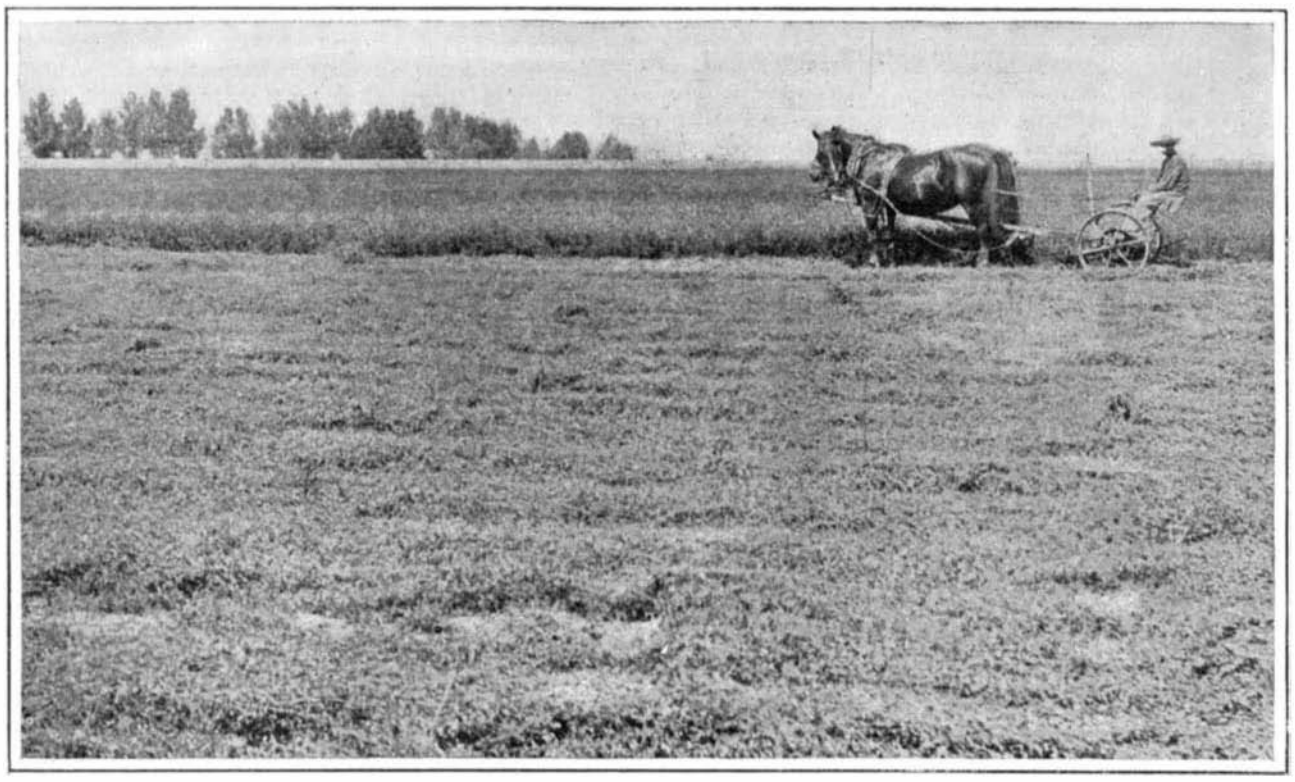
BY ALLEN DAY.

If the Colorado River continues to flow through the channel which it has been occupying during the last six months, the geography of the Southwest must be radically changed, for at the present time but little water from the river reaches the Gulf of California, which until recently has formed its main estuary. Except when the river is in flood, the bulk of the water flows into what is known as the Salton Sink in southern California—a distance of fully 160 miles from the gulf. The new channel of the Colorado takes a northwesterly course, while the channel it formerly occupied is nearly south.

It is perhaps needless to say that this watercourse is not only one of the most important in the Southwest, but is notable for the immense volume of water which it carries, especially during the flood seasons. But the quantity of detritus which it holds in solution is enormous, and is nearly equal to that carried down by the Mississippi at certain seasons of the year, owing to the topography of the region which drains into it. An idea of the quantity of water carried by the Colorado at different times of the year can be gained, when it is stated that actual measurements indicate a flow ranging as high as 30,000 cubic feet per second. It is estimated that if the silt and other material brought down the river in the course of a year were spread evenly over a given surface, it would cover no less than 35,000 acres to a minimum depth of one foot. Consequently, the Colorado is almost as much of a "land maker" as the Mississippi, acting like a gigantic suction dredge in carrying away the material in its vicinity and depositing it upon the lowlands near its mouth and in the Gulf of California.

It is a well-known fact that the Sink, as well as the desert around it, was once a portion of an ocean bed, as is shown by the remains of marine animals as well as the immense deposits of salt. Readers of the SCIENTIFIC AMERICAN are aware that these deposits have created an important industry in southern California, the salt being secured from the surface by plowing and then carried away by the carload.

The Salton Sink or basin is the name given to that part of the Colorado desert that is below sea level. As shown on the accompanying map, this area begins a little north of Indio, on the main line of the Southern Pacific, and extends in a southeasterly direction, generally widening out until it passes Old Beach or Imperial Junction, leaves the railway to the east and extends south away down to a point near Signal Moun-

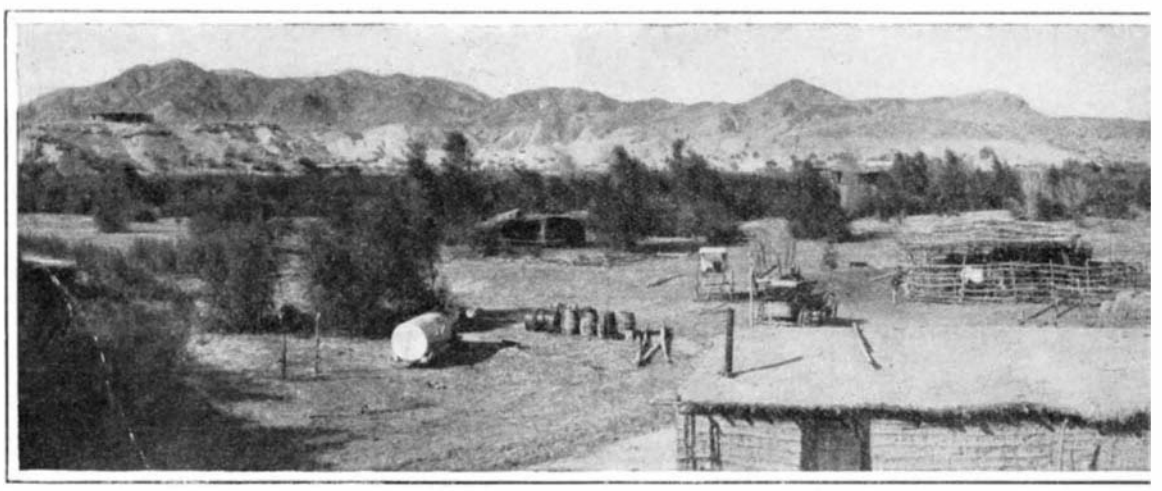


Alfalfa Growing in the Former Desert After Irrigation

The Arid Sandy Waste of the Imperial Valle

One of the Canals Fed by the Waters of the Colorado.

A Corn Field After Irrigation, Showing One of the Irrigation Ditches.

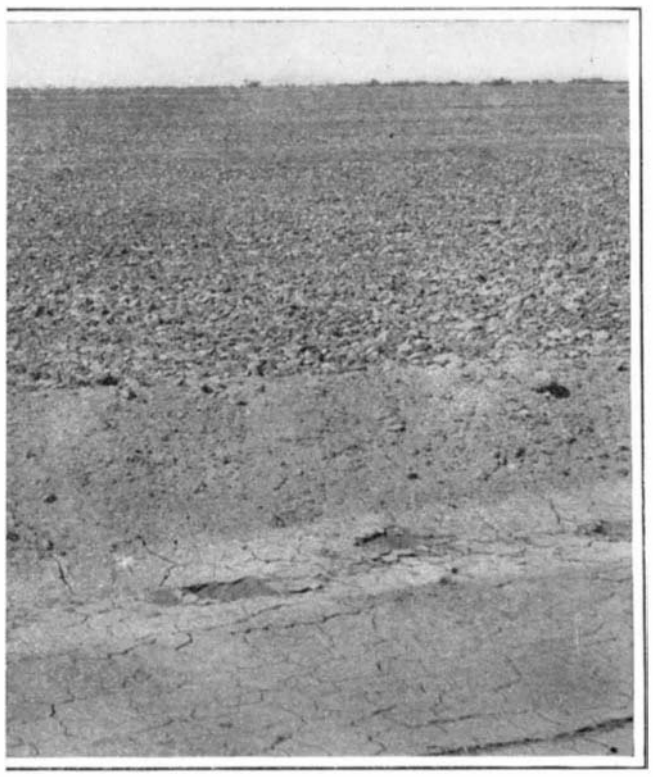


Section of the Imperial Canal Which Caused the Ov

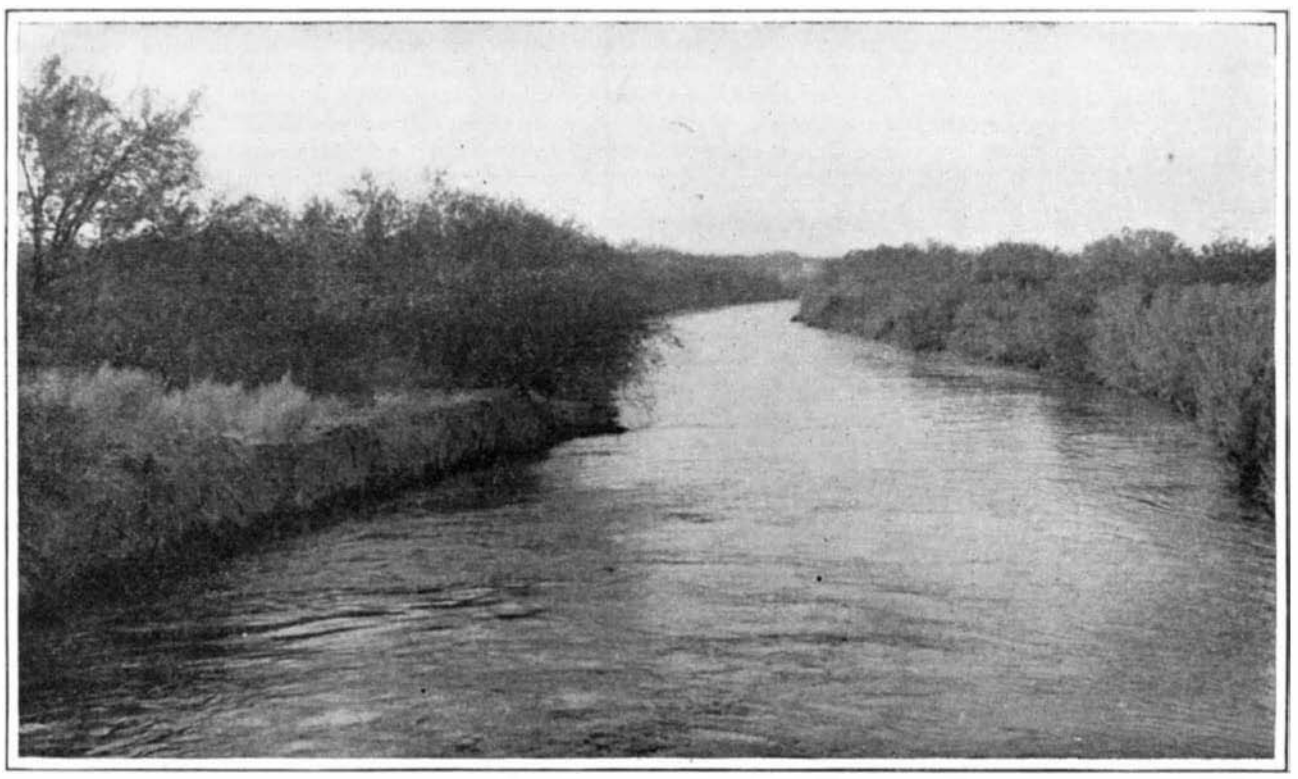
The Inland Sea Spreadi

tain, which is across the boundary in Mexico. This basin is surrounded by mountains on three sides, and is limited on the south by sedimentary deposits of the delta of the Colorado River which have piled up 40 feet above sea level. It was undoubtedly, within a comparatively recent time, a portion of the Gulf of California, which then extended farther north than it does now. The Colorado River, at that period, emptied into the Gulf at about where Yuma now stands.

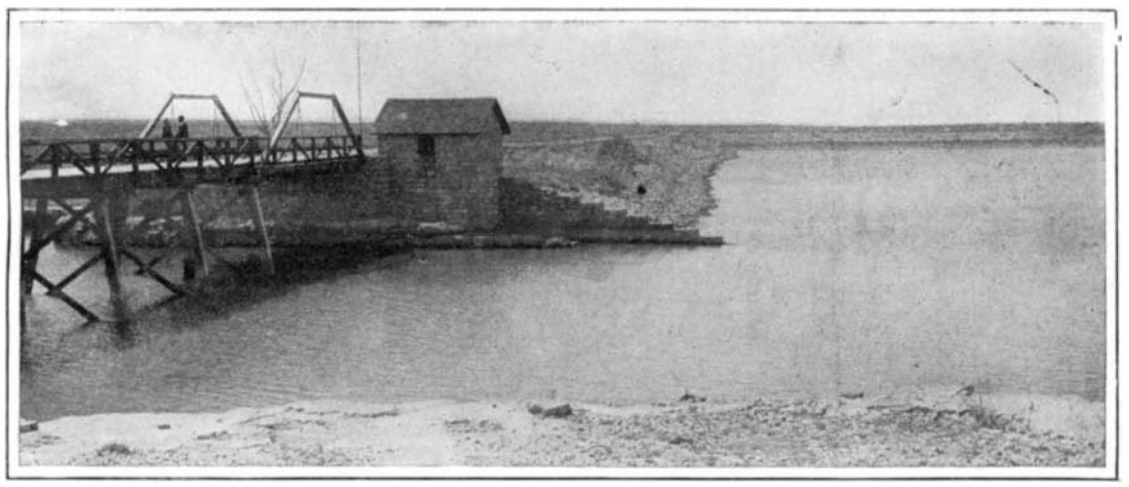
In the latter part of May and throughout June and part of July of each year the melting snows of the far-away mountains send a raging torrent through the canyons and out into the more level plain of the Colorado. Overflows at such times are not uncommon, and, at Algodones, in Mexico, some dozen miles below Yuma, it is an almost annual occurrence for the river to overflow its banks. This overflow finds three channels for its distribution, some of it entering the bed of an ancient river, known to the Mexicans as the Alamo, and flowing westward for some forty to fifty miles, then turning north for over fifty miles, where it emptied into the Salton Sink. Another portion went by devious channels and also by way of the Rio Padrones into Volcano Lake, where a strange separation of the water takes place. Some portion of it flows north by way of a channel recently called New River to Salton, while the remainder flows south by Hardy's



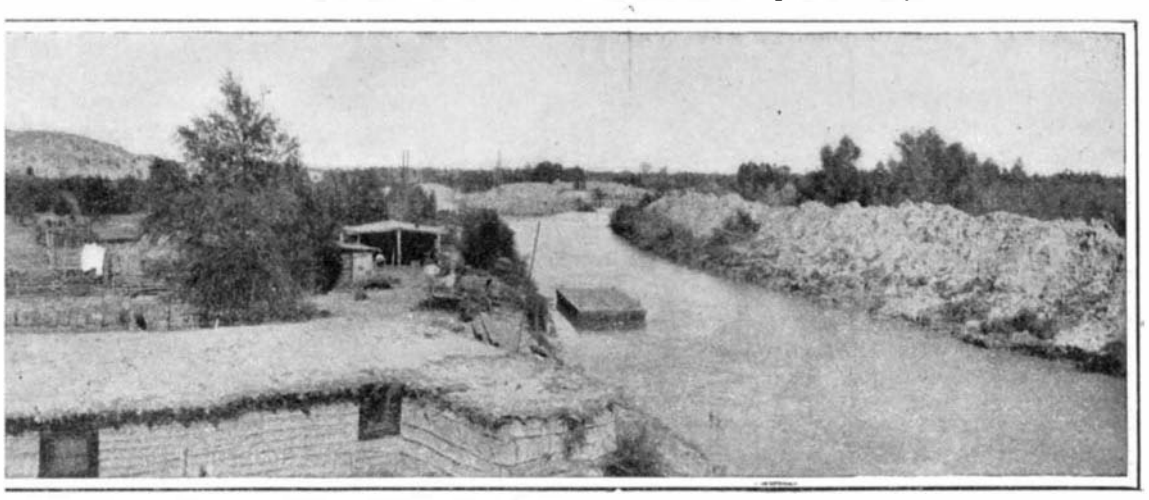
y Before the Colorado Burst Its Barriers.



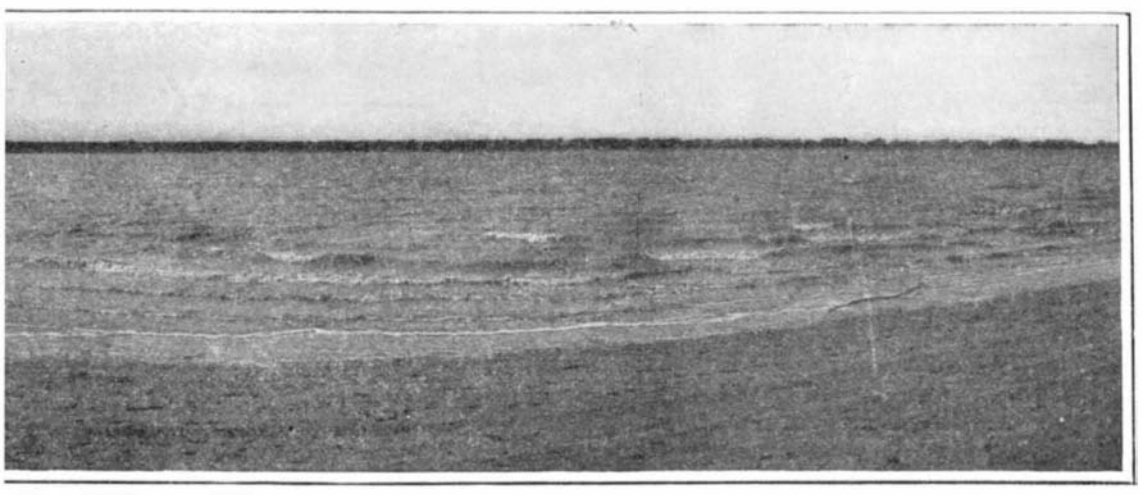
A Watercourse by Which the Colorado is Flowing upon the Desert. Vegetation Has Grown Along Its Banks.



A Section of One of the Reservoirs in Imperial Valley.



erflow. Also a Ranch on the Reclaimed Territory.

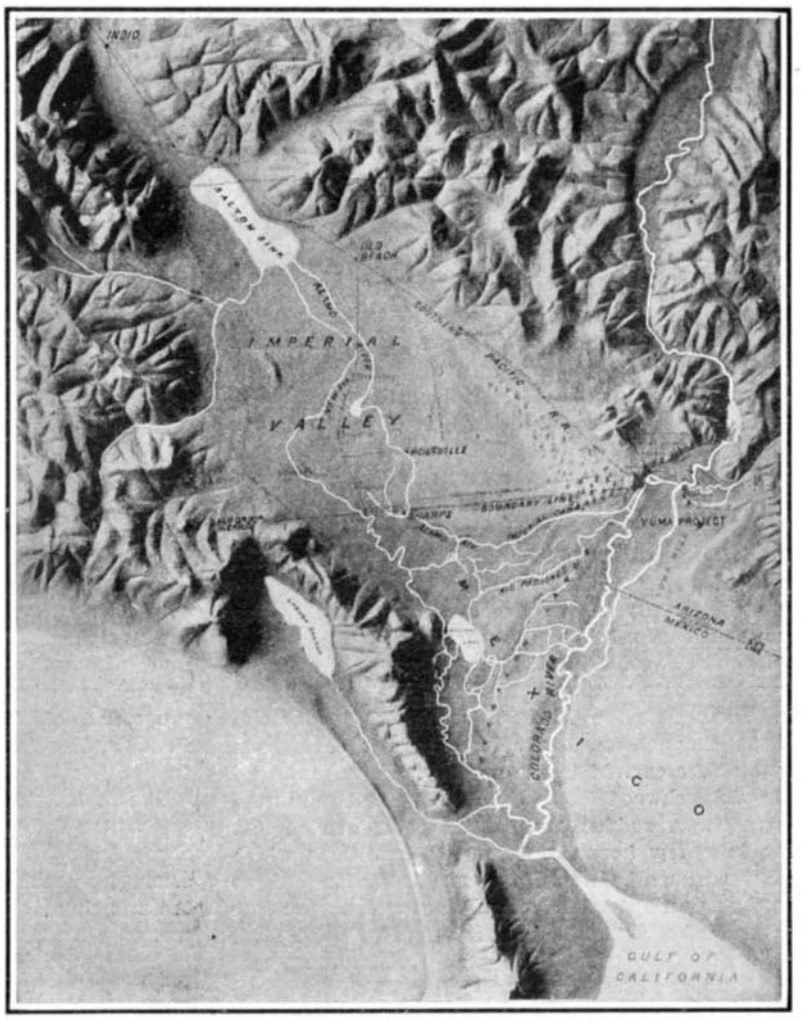


g Out Upon the Desert.

River to the Gulf. The water thus emptied into the Salton Basin was subjected to the evaporative processes of the sun and a Saharan atmosphere, so that it speedily disappeared, leaving the bed practically dry until the floods of another year sent in a fresh supply of water.

With the view of reclaiming a portion of the Colorado desert, as it is called, by means of an irrigation system, a company began operations in 1901, taking advantage of the channel of the Alamo River to excavate what is known as the Imperial canal system. About ten miles of the river channel were dredged out, and connected with a series of waterways extending over an area embracing about 100,000 acres. A portion of the irrigated territory is in Mexico and the balance in southern California. The extent and variety of the crops induced the settlement of this region on such a scale that at present about 12,000 people are residing in the villages and upon the irrigated farms, while the Southern Pacific Railroad has constructed a branch line through the territory. A description of the Imperial Valley, which represents perhaps the most notable reclamation work yet undertaken in the United States, recently appeared in the SCIENTIFIC AMERICAN.

Unfortunately, the diversion of the water into the canal was checked



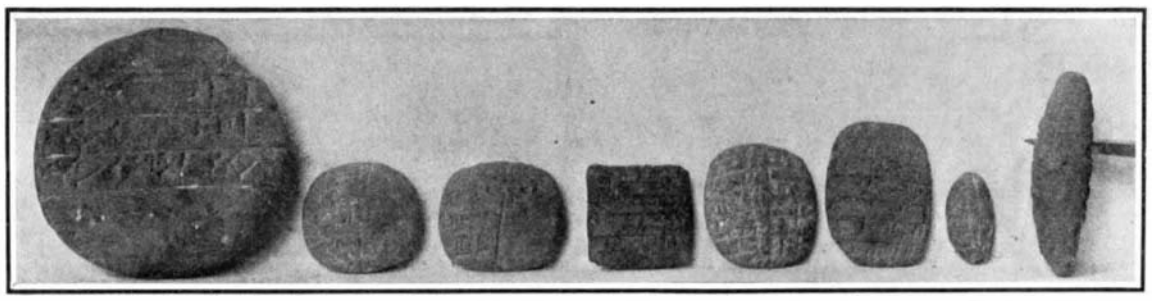
The Imperial Valley, the Colorado River, and the Inundated Country.

E COLORADO RIVER AND HOW IT WAS CAUSED.

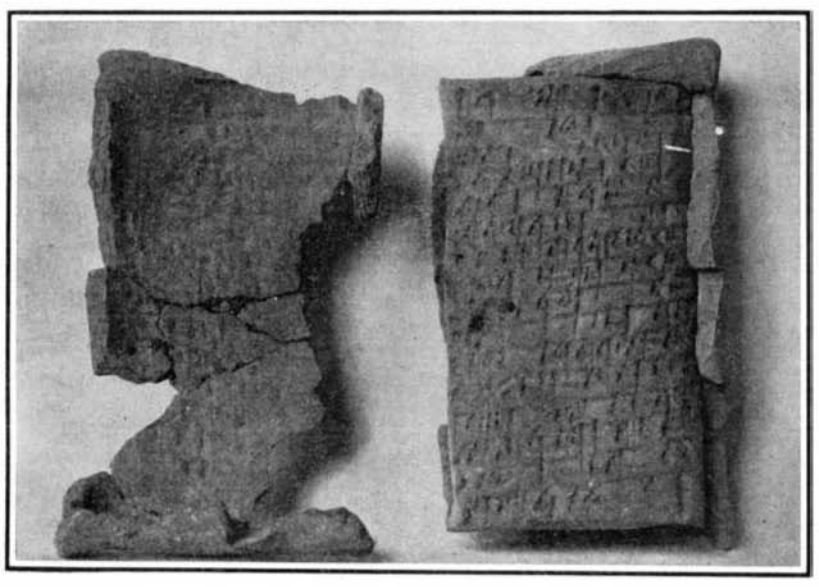
to such an extent by the accumulation of detritus at the head of the canal that the irrigation company determined to secure another supply rather than go to the enormous expense of dredging the clogged canal head. With this idea in view, they excavated a channel a few miles below the head of the Alamo channel, connecting it with the Colorado. This work was completed in November, 1904. The excavation was merely a ditch less than a mile in length and about fifty feet in width, but a flood which occurred a few weeks after it was completed enlarged it to such an extent, that a considerable volume of the water in the river began flowing through it into the main canal. The flow of water was too great to be absorbed by the irrigation system, and as already stated, it worked its way along the lower Alamo channel to the Salton Sink, into which it is still flowing. Owing to the friable formation of the river banks at the head of the new channel, and the force of the current during flood season, it was found impossible to prevent the ditch from being enlarged to such an extent that within six months after the first crevasse occurred, nearly all of the water in the Colorado was being diverted in a northwesterly course into the Sink.

The greatest volume of water in the river is usually during the months of June and July, when the drainage from the mountains along the upper river and its tributaries is greatly increased by the melting snow and ice. Measurements taken by engineers in July last showed that no less than 25,000 cubic feet per second were flowing through the new channel. Since then there have been times when the river bed between the channel and the Gulf of California has been practically dry, except when the river was abnormally high. The effect of the current aided by the erosion of the sediment held in solution enlarged the new channel from its original dimensions to a width varying from 600 to no less than 2,000 feet in some places, and considerably deepening it. As a result, the water contained in the Salton Sink has been steadily increasing, until fears have been entertained lest the entire valley between the San Jacinto and San Bernardino mountains, which inclose the Sink on three sides, will be flooded. Recent measurements of this new sea which is forming show that it is at present about 50 miles in length, having a maximum depth of about 25 feet. The daily increase in depth varies of course according to the quantity coming down the river, but it has been as high as nearly three inches in twenty-four hours, varying from this to three-fourths of an inch. While the salt industry has been practically ruined by the flood, as yet the irrigated district has not been harmed, owing to its elevation. The basin must be filled to a maximum depth of at least 150 feet before the water would cover the farms of the Imperial Valley. Consequently a period of years would elapse before the irrigation district would be affected; but the heaviest loss is that of the Southern Pacific Railroad, for it has been compelled to alter the location of its roadbed, and rebuild about fifty miles of track at a greater elevation to prevent it from being submerged.

The question of confining the river to its ordinary channel presents a somewhat difficult engineering problem. Soon after the Colorado began flowing through the new channel, an attempt was made to change the course of the current to the south by a diverting wall made of brushwood fastened with wire and reinforced by gravel. A sudden rise in the river carried this away in a few hours, and created conditions which were worse than before. An attempt was also made to lead the water into the Padrones channel, thence into Volcano Lake, but this was unsuccessful, the river forming another channel between the Padrones and the Alamo and continuing on to the Sink. The final plan determined upon, which is now being carried out, is the construction of two massive barriers, one protecting the head of the original channel, and the other the head of the channel through which the river has changed its course. The first barrier, which will be 175 feet in length, is being built of concrete and steel on a rock foundation, and contains head gates which will allow a sufficient volume of water to flow into the canal for irrigation purposes if desired. The lower work is about 200 feet in length, also composed of concrete and steel, but is being constructed in connection with wing dams and levees of timber and earth. This is also provided with gates. The concrete and steel portion of the barrier is being built at such an angle that it will offer the principal resistance to the flood currents, while the dams and levees are intended to prevent the bank from being washed away by eddies or other back water. It is expected that the two barriers will be completed before the summer floods reach the lower river, the engineers working partly on the theory that the mass of silt which will be carried down at this time will tend to scour out the original channel, and aid in confining the volume of water. In short, the principle is the same as has been so successfully employed in the deepening of the Mississippi near its mouth by the construction of the jetties, the river partly making its own channel. Since the Colorado has been flowing into the northwest passage, its former bed has been steadily filling up by the accumulation of sediment in the vicinity of the cut-off. If the flood currents remove this deposit, it is believed that the work which is now being done will permanently keep the river in its original course, and prevent further flooding of the valley to the northwest. A more complete account of the dams which are now in course of construction, and which are intended to control the Colorado River, will appear in next week's SCIENTIFIC AMERICAN.



School-boy exercise tablet. Spherical tablet. Corners begin to appear. The tablet has become square. Less oval. An oval tablet. Tag of clay. Plano-convex tablet.



A Babylonian "Case Tablet" or clay letter with its envelope broken and half removed.

A letter and its envelope. The letter shows beneath the broken portion of the envelope.

LETTER WRITING FIVE THOUSAND YEARS AGO.

LETTER WRITING FIVE THOUSAND YEARS AGO.

BY EDGAR JAMES BANKS.

While Babylonian clay tablets of various forms and sizes have been known and collected by the large European museums for fully half a century, it is only in recent years that tablets of an exceedingly ancient date have been found in sufficient numbers to reveal their origin and early development. Of the two thousand tablets discovered in the Babylonian ruin Bismya by the expedition of the University of Chicago, a large proportion of them date from the fifth millennium B. C., and present such a variety of shapes and sizes that their origin has for the first time been ascertained.

The first Babylonian tablets, and therefore the oldest written documents in the world, were of clay. The original shape was round like a ball, and in size it resembled a small orange. The early scribe drew upon the soft clay the rough pictures by which his language was expressed, and then placed the written document in the sun to dry. As writing became more common, the tablet lost its spherical shape and the inscription was confined to its flattened sides. A number of such tablets, almost spherical, came from Bismya. As the centuries passed, the sides became flatter, corners began to appear in the circular edge, and by 4000 B. C. the tablet suggested the square into which it soon developed.

Side by side with the evolution of the square tablet from the clay ball, a similar tablet was developed from the early building brick. The first Babylonian brick was rectangular; its sides were plano-convex—plane on the bottom where it rested upon the ground to dry, and convex on the surface, because while drying the edges ran down the sides. To the first tablets which were not spherical or nearly so, this plano-convex form was imparted, but the convex side became less convex, and by 3800 B. C. both sides were nearly alike, and its form became identical with the tablets which developed from the clay ball. The tablet, square or nearly so, retained its shape for a considerable period; but if the inscription to be recorded upon it was long, the length of the tablet was increased, while its width remained practically the same. This elongated form of the square tablet thus became the standard for all of the later ages of the Babylonian empire.

In size the tablets vary exceedingly. While some measure hardly more than half an inch in length, others are fully eighteen inches long and a foot wide, yet the average of the hundreds of thousands of Babylonian tablets which are now in the museums of Europe may be not far from three inches in length and half as wide.

Although the rectangular form of the clay document prevailed, other shapes were adopted for special purposes as occasion demanded. The schoolboy's exercise tablet was invariably round, and the clay labels which were attached to merchandise were egg-shaped and their longer diameters were pierced with a hole for the string. An exceedingly interesting form of tablet was that given to the Babylonian letter of 2400 B. C. and later. The clay of the letter was molded and inscribed as were the ordinary business documents, and when finished, a thin coating of clay was wrapped about it, serving as an envelope to protect the writing within, or to conceal it from the eyes of the curious. The envelope was then stamped with the seal of the writer, or sometimes engraved with a few words, and the letter with its envelope was placed in the sun to dry, or in the furnace for baking. It was then ready for delivery.

The discovery of these early documents at Bismya has not only revealed the original form of the tablets, but has also assisted in explaining the development of the cuneiform or wedge-shaped writing. How does it happen that the Babylonians committed their thoughts to writing by stamping combinations of wedges upon clay? The wedge is an accidental result of the use of clay. The very earliest inscriptions, found mostly upon stone vase fragments, are not composed of wedges, but of straight lines. The Babylonians first wrote by drawing pictures of the objects which were in their minds. In time the pictures became conventionalized, as is the case with Chinese, and the original objects could no longer be recognized. When clay was substituted for stone, it was difficult to draw an even straight line upon it, for the edge of the style which first touched the clay sank deeper, leaving a wedge-shaped impression. The wedge thus arose; and as clay was practically the only material employed by the scribe, the wedge became so thoroughly identified with the language, and the old linear writing was so entirely forgotten, that during the last three millenniums of the Babylonian empire, the scribes, even when engraving upon stone, gave their characters a wedge-shaped form.

An engineering firm at Pittsburg has patented a new type of universal plate mill, and has received a contract from the Illinois Steel Company for the building of one of these mills at South Chicago. The mill will be driven by an electric motor of 6,000 to 8,000 horsepower capacity, this being the first time that a mill of this character and size has been electrically driven.