

# Scientific American.

ESTABLISHED 1845

MUNN &amp; CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

## TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico ..... \$3.00  
 One copy, one year, to any foreign country, postage prepaid, 50 10s. 6d. 4.00

## THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... \$3.00 a year.  
 Scientific American Supplement (Established 1876) ..... 5.00  
 Scientific American Building Edition (Established 1885) ..... 2.50  
 Scientific American Export Edition (Established 1876) ..... 3.00

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN &amp; CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, FEBRUARY 3, 1900.

## THE ERIE CANAL PROBLEM.

In the course of a masterly review of the report of the Special Committee on Canals, Governor Roosevelt strongly indorses the recommendation of the committee that the Erie Canal be enlarged to accommodate boats of 1,000 tons burden, and that the improvement be pushed to completion at a cost of \$62,000,000. The text of the report has reached us too late for insertion in the present issue; but we hope to publish a full digest with maps and illustrations in next week's issue of the SUPPLEMENT.

The first question to be considered by the committee was, necessarily, whether the canal should be kept or abandoned — whether the financial condition of existing canals elsewhere warranted any further effort to operate the Erie Canal either in its present condition or after the proper enlargements had been made. This question is answered strongly in the affirmative in the report of Mr. F. S. Witherbee, who, after a personal investigation of the European systems, finds that there has been a steady development in the number and size, equipment and receipts of the canal systems in the great industrial centers, and that it has been found desirable to maintain the development of the canals in spite of the rapid development of the railroads. It has been urged that although this may be true under European conditions, the remarkable economy realized in the operation of American railroads renders successful competition by canals impossible. To this the committee reply that although this may be true of a canal of small capacity like the present Erie Canal, or the improved canal contemplated by the scheme of 1895, the conditions would be so far reversed, if the canal were enlarged to accommodate boats of 1,000 tons burden, that freight could be transported from Buffalo to New York for about *one-third of the cost of rail.*

Having decided that the canals ought not to be abandoned, three alternative plans presented themselves for consideration: 1. To complete them on the lines proposed in 1895. 2. To make them ship canals capable of accommodating ocean-going vessels. 3. To adopt an intermediate course.

1. SCHEME OF 1895. — The plan of 1895, familiarly known as the Aldrich plan, provided for deepening the canal from 7 feet to 9 feet, enlarging the locks to accommodate boats of 450 tons burden; providing a single pneumatic or other mechanical lift at Cohoes and Lockport, as illustrated on the first page of this issue, and making changes at important points in the location of the canal. The estimated cost of this project is \$21,161,645. The commission is of the opinion that this plan "is at best a temporary makeshift," and that were it carried out, it is certain that the benefits resulting would not justify the heavy outlay.

2. SHIP CANALS. — The committee considers that a ship canal is "a proper subject for consideration by the Federal Government, but not by the State of New York." They have seen various statements placing its cost at from \$125,000,000 to three times that sum, and none of these estimates is based on data sufficiently accurate to justify careful examination. The object of a ship canal is to enable a ship to load at Chicago and not uncover its hatches until it reaches London or Liverpool. To do this the vessel must be built to withstand Atlantic storms, and such a vessel costs \$71 per ton of its carrying capacity; vessels of the lighter construction suitable to the lakes cost about \$36 per ton; while a canal fleet of the kind proposed by the committee, with a combined cargo capacity of 3,900 tons, would cost only \$7.31 per ton. Hence the committee very justly conclude that the economics of the situation call for the three existing types of vessel (ocean, lake and canal) with a change of cargo at Buffalo and New York; or the use of 1,000-ton canal boats going direct from lake ports to New York and there transferring their cargo to ocean steamers.

3. THE SCHEME PROPOSED. — There remains the third course, which is to determine upon the size of boat which will give the best economic results, and enlarge the canal and the locks to accommodate it. After a careful consideration of the question in all its bearings, the Committee recommend practically the

construction of a new canal from Lake Erie to the Hudson River, following the present canal for about two-thirds of the distance and new routes for the remaining distance, and utilizing as far as possible the existing structures and canals. The proposed canal, compared with the present canal, will be 12 feet deep, 75 feet wide at the bottom and 122 feet wide at the surface, as against a depth of 9 feet, a bottom width of 49 feet and a surface width of 73 feet. It will accommodate boats 150 feet in length, 25 feet in width and 10 feet in draught, capable of carrying 1,000 tons of freight. Such a canal would have a capacity of 20,000,000 tons per annum, and on that tonnage the saving as compared with the present canal would be \$12,200,000 per annum. It could transport freight at one-third the cost of transportation by rail, and as compared with the lowest rail rate ever quoted across the State of New York, the saving on a tonnage of 20,000,000 would be nearly \$18,000,000 per annum.

Since the completion of this project will call for the expenditure of over \$60,000,000, the question arises as to whether the benefits to be gained are commensurate with such a heavy outlay. The answer is that they are not only commensurate, but greatly in excess of the cost; for the issue at stake is not merely the commercial prosperity of the State at large and the Port of New York in particular, but it is a question as to whether the great and enormously valuable wheat-carrying trade of the West shall be retained in the United States or drift over the border into the hands of the Canadians. The last link in the chain of improvements by locks and canals of the St. Lawrence River has just been completed, with the result that vessels 255 feet long, of 12 to 14 feet draught and 2,200 tons capacity, can now pass from the lakes to Montreal. Chicago and Buffalo capitalists have made a proposition to the harbor commissioners of Montreal involving the immediate construction of fifteen 2,200-ton barges, besides grain elevators and wharf facilities at Montreal to cost \$4,000,000, the result of which would be to divert about 35,000,000 bushels of grain from the New York route. Add to this that the railroads are discriminating in favor of other Atlantic ports, and it can be seen that the construction of the proposed canal is of vital importance to the future development of the Empire State.

It seems to the committee that the expenses of completing the water routes should be borne by those counties through which these routes pass, a proposition that is justified by the fact that a large proportion of the traffic of the old canals was strictly local. The necessary \$62,000,000 would be raised by an issue of bonds, the interest and sinking fund to redeem which would amount to only 10 cents per \$100 of the assessed valuation of the counties through which the canal would pass. Of this sum, two-thirds would be borne by New York city alone; and in view of the fact that she is about to spend nearly this amount to secure improved transportation facilities, there is no question that the great metropolis will gladly perform her share in an undertaking which is so necessary to protect the threatened commercial interests of the State.

## EXCAVATIONS AT SUSA.

Half a century ago Mr. Kennet Loftus directed attention to the archaeological importance of the explorations on the site of ancient Susa. At that time nothing was known of the ancient and powerful Elamite kingdom of which Susa formed the capital. The position of the two great tumuli which marked the site of the ancient Elamite capital showed that the points were of great strategic value. The larger of the tumuli is about 5,000 feet long and 3,000 feet wide. It marks the site of the Achæmænian capital, and at its northern extremity M. Dieulafoy uncovered palaces of Artaxerxes, Mnemon and Darius during his explorations in 1884-86.

On his resignation of his position as Director of the Gizeh Museum, M. de Morgan, the well known Egyptian explorer, was intrusted, says The London Times, with a special scientific mission to make a thorough exploration of the site. The first results were made known in his report to the Minister of Public Instruction and very fully justified the expectations that were formed. No explorers in Mesopotamia have produced such astonishing results or opened so many new problems. As Loftus and Dieulafoy have been unable to find any extensive pre-Achæmænian remains in the larger tumulus, work was commenced in a smaller but loftier mound some 800 feet to the west. It rises to the height of about 100 feet above the surrounding plains and gave every indication of being a more ancient work. On his arrival at Susa, in December, 1897, M. de Morgan prepared for a thoroughly scientific exploration of the site, and here his previous training as a geologist stood him in good stead. A skilled explorer knows that in all ancient sites, specially in the East, the law of stratification holds good, and that to ascertain the various strata and their ages is the first task before more minute examination can be made.

He first pierced the slope of the mound with five tunnels until the first historic stratum was reached at a

distance of about 24 feet below the upper surface of the mound. It was in the lower tunnels that most important discoveries were made in finding no less than three strata of prehistoric times, the pottery affording as usual the most important data. The first stratum, which was about 40 feet above the plain, showed traces of civilized people. The pottery was remarkable for the fineness of its glaze and was decorated with patterns in red, black, and brown. These patterns were chiefly geometrical. In the next stratum, 46 feet above the base, the pottery was not so fine, being mostly vases of rough earth, but the flints became more numerous. Some of them were the flint teeth of sickles.

The discovery greatly pleased M. de Morgan, as he had always maintained that cereal growing was not indigenous to Egypt, but had been introduced by the Asiatic race, who naturally brought with them the instruments with which to reap the crops. In the strata above, remains of these instruments were still more numerous, and the teeth were polished and worn from usage. Stone maces began to appear, and rising to another stratum 68 feet above the base line, were first found burnt bricks and traces of buildings, but no inscriptions, and 13 feet higher the first town was discovered, the remains of the most ancient Susa. Above this, some 14 or 15 feet, we come upon the ancient Elamite citadel, which was destroyed by Assurbanipal about 640 B. C. Having ascertained the order of strata, M. de Morgan intrusted the work of opening the trenches to one of his assistants, and the Persian, Arabian and Greco-Persian levels were reached. The things found may be said to cover a period of about five centuries from the Macedonian conquest to the rise of the Sassanian dynasty; that is, B. C. 330 to A. D. 226. Below this the Elamite stratum was reached.

The terrible destruction by fire and the deliberate razing of the walls made it impossible to ascertain accurately the general plan, but many discoveries of great archaeological importance were made. Along the walls were found many fragments of enameled bricks bearing inscriptions or decorative patterns with figures of men and animals. The use of this decoration by the Elamite rulers in the eighth century B. C. shows us the source from which the Achæmænian artists derived their inspiration, and there are many other indications of this influence of the older Susanian civilization. The bases of the columns were also found.

The most important discovery of the historic period were certain monuments which escaped removal and destruction on account of their weight. The explorers unearthed a large stele of yellow limestone covered by an elaborately sculptured picture. It compares favorably with the sculptures of the Assyrians and is the record of an important campaign. The inscription upon it reveals the astonishing fact that it is a monument erected by Naram-Sin to commemorate his great campaign some time about B. C. 3750. M. Maspero and Dr. Schiel consider that it was carried away from Chaldea by the Elamites, but considering its great size and weight this hardly seems possible. The more probable solution is that the stele had been set up by the Chaldean king in Susa or in that region. There was also found a great obelisk of granite 6 feet in height, the sides of which were covered with a long inscription of some 1,200 lines written in very archaic characters.

The discoveries at Susa are most important, and the archaeological world will look with interest at the photographs when they are sent home.

## AUTOMATIC MACHINERY AND THE RUSSIAN PEASANT.

An incident has recently come under our notice which suggests that while our industrial success results largely from the invention of automatic machinery, it is also due to the readiness with which the American workman appreciates its value and the alacrity with which he makes haste to furnish himself with the very latest labor-saving improvements. We all remember how, during the great strike in the English engineering trades, it transpired that one of the chief grievances of the men was the introduction of automatic tools into the machine shops—the Trades Unions claiming the right to regulate the amount of output from each machine. That opposition, of course, was based upon the exploded theory that labor-saving machinery was inimical to the interests of labor. The prejudice was not against the machine, but against its supposed economic results.

Now, however, it appears that in some districts in Europe there is a positive prejudice against automatic mechanical devices as such, the laborer preferring to work by hand. The Russian peasant favors such automatic machinery as comes nearest to the hand operations to which he has been accustomed from time immemorial, and, as a matter of choice, in many cases, he will perform laborious operations on the machine rather than accept one which ignores hand labor altogether. A correspondent informs us that so pronounced is this prejudice, that he is designing an automatic harvester which will conform to the time-honored habits of the people with as little sacrifice as possible of its automatic features.