

**M. J. DE MORGAN'S EXCAVATIONS IN THE AKROPOLIS AND PALACES OF SUSA.**

The excavations of M. Jacques de Morgan at Susa in Persia, are of the greatest possible importance owing to the proof which they present of the Asiatic origin of Egyptian civilization, and also as indicating that the ancient Elam was the cradle of the Aryan race. Through the courtesy of the Rev. Henry Mason Baum, D.C.L., editor of *Monumental Records*, we are enabled to present some interesting particulars of M. de Morgan's work at Susa largely in his own words, and also to give a portrait of this archaeological explorer in his study at Susa, where he is superintending the work of 600 men. M. de Morgan was sent to make these excavations for the French government which has secured from the Shah the monopoly of archaeological excavations, and the French explorer sends regularly reports to the French Secretary of Public Instruction.

We cannot give in extenso the report of M. de Morgan's work, but we will review the most important results obtained. In the current SUPPLEMENT will be found an account of M. de Morgan's trip from Teheran to Susa and an additional account of certain of his excavations. On his arrival at the latter place the explorer first examined the mounds to see if the observations that had been made during his previous visit in 1891 were correct. He considers that the "tells," or mounds of Susa were formed by the accumulation of rubbish and debris left by the successive occupants of the city. At the present time M. de Morgan speaks only of the archaeology, reserving for a later report notices of the natural history, ethnography, modern linguistic geography, meteorology, architecture, etc. During the first season spent at Susa he encountered all kinds of difficulties which are always met with in a country so little civilized and as fanatic as Arabistan is. The population although tractable enough had to get used to European methods of labor and the local government in spite of the Shah's firmans did not realize at once their meaning.

M. de Morgan spent the entire winter busying himself in organizing the work, assisted by M. G. Lecquier who directed the diggings at the Apadana and a scientific and executive staff. M. de Morgan's first care was to carry through the mound of "The Citadel," mining galleries were run in order to study the various levels before starting any open cuts. Guided by the inspection of the debris met with on the ground he opened five galleries at the east of the extremity of the mound. In 1891, he noticed that the slopes of this part of the tumulus contained more cut flints and a greater number of fragments of painted vases than any other part of the ruins. He was positive that while working through these thick beds he would find the remains of the oldest civilization.

M. de Morgan describes his researches in detail, and goes on to say:

"I have found at various levels, and also at the surface of the tell, quite a great number of pieces from sickles, some having retained the bitumen used in fastening them to the wood, nearly all show on the edge a polish that has been given by use. The same fact is always observed in Egypt. I have previously made the remark in my '*Recherches sur les Origines de l'Egypte*,' that the culture of wheat could never have originated in the Nile Valley, cereals not existing in an aboriginal state in Egypt. I have relied on this fact among others in my attempt to prove the Asiatic origin of the first Egyptians, or at least of their civilization. This argument would have had a far greater value had I known, as I have today observed, that the same tool provided with flint flakes was used in Mesopotamia, as well as in Egypt, for harvesting grains, which here are growing naturally all over the country, and even on Susa's tells."

The sixth gallery, which was only 29 feet below the summit of the mound, was most interesting, a well lined with large terra cotta tubes, cemented with plaster, being found and at last a baked brick wall. The small amount of material extracted from the galleries did not permit of determining with absolute certainty the nature of the various beds forming the mound of the Susa citadel, but the excavations have supplied valuable information to guide the explorer. We know now that the level of the first or Anzanite city is 12 feet below the one that was destroyed by Assurbanipal's soldiers.

Assurbanipal tells us that before his coming to Susiana, Susa had never been captured by foreigners, so we must expect to find in perfect order the remains of the various Anzanite civilizations. For we know from the informations furnished by the galleries that at all times the site of Susa was inhabited.

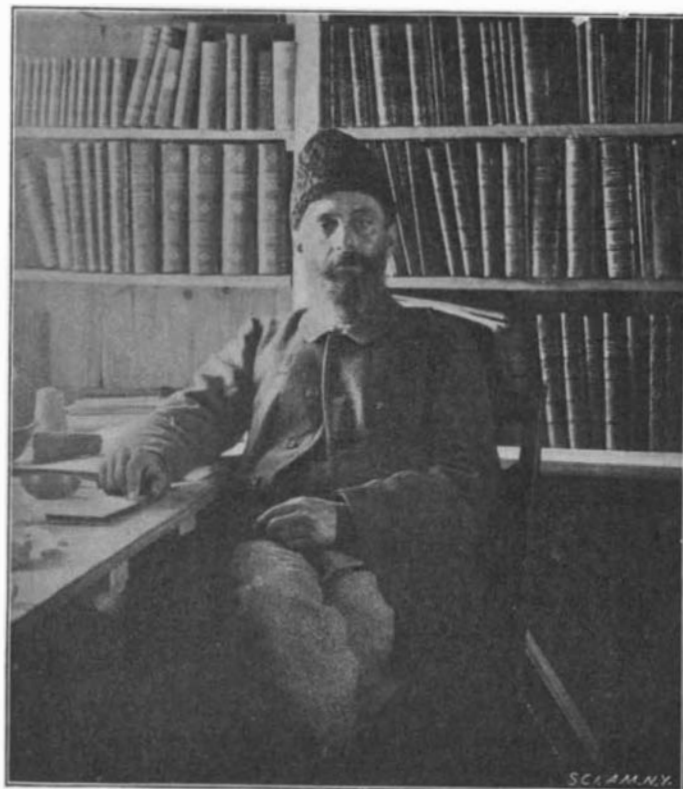
We also know that the levels of the various epochs are coming in regular sequence down to the beds containing the remains of the prehistoric period. Then it will be sufficient to successively remove the various beds in order to be able to draw the plans and separate the documents of



**THE GREAT STELE DISCOVERED AT SUSA—ERECTED BY KING NARAM-SIN 5,650 YEARS AGO.**



**MAP OF EXCAVATIONS OF SUSA IN PERSIA.**



*J. de Morgan*

the various epochs. The trenches are indicated on the diagram and some of the finds were very important. The first trench was 536 feet long, 13 feet wide and 16 feet deep, and was intended for exploring the southern portion of the mound known as the "Royal City." At a depth of about 3 feet we found substructions and foundations of buildings of a late period (Seleucic, Parthian and Sassanian. The walls were of flat square bricks, and the houses were divided into small rooms. The dwellings were provided with water mains intended to gather the products of the rain on the terraces and to collect it into cisterns or reservoirs.

About 6 feet below the level of the deepest Greco-Persian foundations M. de Morgan began to strike massive walls made of sun-dried bricks made of fine yellow clay worked with chopped straw. The composition is similar to the building materials still in use in all Persia and Arabistan. He found in these ruins debris of gray limestone similar to that used by Darius I. and Artaxerxes, Mnemon to embellish their palaces at Susa, also many Greco-Persian funerary shafts, which are sometimes cut through the walls. The "Citadel" and the "Royal City" were naturally given the most attention as being the probable site of the most important Anzanite buildings, the city itself covering both sides of the river, a territory of some 3,000 acres. An alabaster vase fragment found in trench No. 3 bears an inscription with the name of Xerxes. This is the first text of this king found in Susa. Assurbanipal tells us of his soldiers' eagerness in the destruction of the kings of Anzan palaces. "They upset the winged bulls guarding the gates." Excavation teaches us that they upset also the steles, the obelisks, all the written traces of their enemies' past grandeur. In the report of Assurbanipal we see the reason why the walls have been torn down nearly to their base. On their bricks were inscribed the names of the kings, and they were destroyed because the Assyrian conquerer did not want that even the memory of the kings of Anzan should outlive their kingdom.

M. de Morgan gives an account of the various objects which have been found including a bronze table granite obelisk and most important of all the stele shown in our engraving, the largest monument exhumed at Susa. It is 6½ feet high, and 40 inches wide.

He says: "At the top are three singular representations of the sun with its rays. Below is the helmeted king, armed with an arrow in the right hand, a bow in the left hand, he wears a semi-long costume and sandals, a dagger is passed through his belt. His beard is long according to the Chaldean and Assyrian fashion. This figure treads under his feet dead enemies, while in front of him another one falls wounded and attempts to pull out the arrow which pierces him; further still another one raises his hands as a sign of supplication. Under the king's feet are heaped up dead bodies, some of them remarkably treated, their attitude is correct and very elaborate. Below the king, and ascending a grade, are three standard bearers, the left hand resting on the dagger fastened in their belt, the right holding the banner. These figures wear a long dress and a helmet.

"The whole scene takes place in the mountains; the king, followed by his standard bearers and soldiers, is pursuing his enemies as far as an abrupt peak entirely covered by a long inscription. Other enemies are playing in the forests or making their submission. Unfortunately, this stele had to stand the effects of a big conflagration; the stone has been split in many points and one of its scalings has carried away the whole text that stood above the king's head. I had to consolidate the base with plaster in order to be able to take a substantial squeeze of this monument and so preserve this document, for I fear that it will not stand transportation. In spite of these injuries this stele is a very important monument of Elamite art. The composition is well put together and the execution entirely satisfactory; the figures are of good proportion, well treated in the ensemble and in the details, showing that the Anzanite had reached to an artistic skill in no way inferior to what we know of their neighbors, the Assyrians and the Chaldeans." Father Scheil considers that it was of Babylonian origin and that it was erected by King Naram-Sin, the son of the famous Sargon, about 5,650 years ago.

The buildings in the citadel may possibly have been used as a treasure house by the Persian kings, for when Alexander captured Susa, he found there 9,000 golden talents. In trench No. 3, M. de Morgan found important remains of Anzanite buildings, and the aspect of the place proves that the Anzanite Susa was set on fire. Assurbanipal says: "I destroyed the tower of the city of Susa, whose base was of marble. I turned its walls upside down. During a month and a day I swept the country of Elam from one end to the other. I took away from its fields the voices of men, the sound of joyous music. I brought into it savage animals, serpents, the beasts of the desert, and the gazelles." The old king truly waged bloody wars, and he describes them in true Asiatic

fashion, his language glowing with Oriental imagery.

M. de Morgan's conclusions are most important. He thinks that the main Anzanite spots are the citadel and the "Royal City." At the time of Susa's destruction by the Assyrians all the monuments that could not be carried away were upset without being damaged. After Susa's capture by Alexander the Great, no important buildings seem to have been erected at Susa, and it seems to have disappeared entirely before the beginning of the Sassanian dynasty. He considers that the Archæmian ruins will hardly repay extensive investigation as they will add nothing to history. He says that he intends to concentrate his labors on the Elamite remains, their importance making this a duty. He hopes that the inscriptions will add to history the names of whole dynasties, and it is the life of a nation during 3,000 years that must be reconstructed with the aid of the monuments. During the last season he had ten small railway cars at trench No. 7 and next season he will have fifty for transporting material. He thinks that in four or five years the whole of the hill can be cleared down to the most ancient Anzanite level. He intends next year to open five trenches in the mound of the citadel. With the material at hand he expects to be able to have the whole mound reveal its secrets, possible within ten years, certainly within twenty years. The abandonment of Susa was brought about, thinks M. de Morgan, by a change in the course of the river. The ancient Anzan, or Elam, is held by many to be the cradle of the Aryan races. There was a high degree of civilization there 8,000 to 11,000 years ago. The mounds hold one of the keys of history.

M. de Morgan is now in Paris preparing for next season's work.

#### Automobile News.

An automobile club has been organized in Baltimore.

There are five automobile clubs in Belgium and their combined membership is 740.

An automobile race will take place in France during four days of the last week in July.

The Chicago aldermen are considering the advisability of requiring automobile owners to provide their vehicles with fenders.

An automobile cab almost demolished a coupe in Fortieth Street, near Sixth Avenue, New York city, on March 6. The vehicle was an electric one and in some unknown manner the driver lost control of it.

The Western Electrician states that an arch is soon to be erected at the extremity of the Avenue de la Grand Armee, in Paris, to the memory of Levassor as he did much to promote the interests of the automobile. The arch is to be surmounted by a reproduction of the latest type of automobile. The French do not give arches lightly so we cannot vouch for the truth of this statement. Their taste, however, can be relied upon to soften the shape of an automobile if it becomes necessary to make it a detail in a work of sculpture.

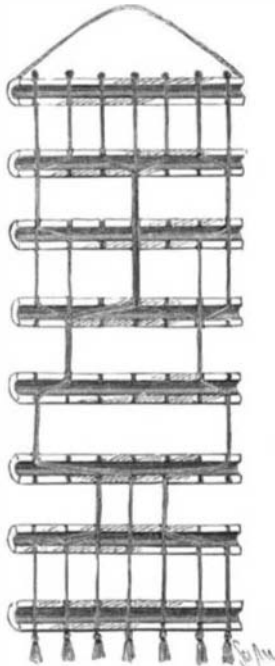
A steam automobile was left unguarded with gear reversed a few days ago in front of a theater. A mischievous boy climbed into the vehicle and opened the throttle. He jumped just in time and the carriage started backward at a high rate of speed for Broadway; the thoroughfare being crowded with pedestrians. The vehicle suddenly swerved and leaped the curb and pinned an unfortunate pedestrian against a lamp post. The driver by this time had reached the scene just in time to be arrested. The injured man was taken away to a hospital and the automobile was loaded into a wagon and taken to a repair shop. The driver was arrested on the charge of violating a city ordinance in leaving a vehicle unguarded. It is stated that there was no way to lock up the machine so malicious or inquisitive persons could not tamper with it. There have now been so many accidents of this nature that it would really seem as though no automobile should ever be left without a guardian.

A curious accident occurred in the store-rooms of an automobile company in New York city. A cleaner was inspecting machines on the cleaning and polishing floor. Orders had been given not to move the machines by motor power on the floor. The steam had been generated in the boiler over a gasoline burner for the usual tests and when it became necessary to move the vehicle, the young man jumped abroad and started the motor. The seat had been removed in order to watch the test of the boiler so that the cleaner stood upright. The carriage was run near the opening to the elevator shaft; it was then stopped and the man intended to back it into its place, but instead of moving the reverse lever he moved the throttle lever and the heavy vehicle plunged against the steel gate of the shaft. Unfortunately it gave way and both man and machine went over the edge. The man first reached the ground some 60 feet below, and the vehicle banging from side to side of the shaft fell on him and crushed his skull so that death was instantaneous.

#### THE CHINESE RODS AND CORDS.

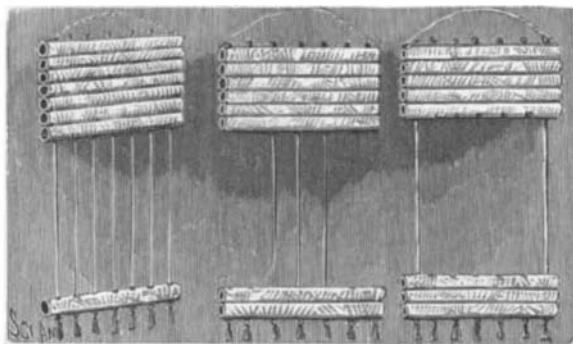
Nothing excites curiosity in the public mind more than a simple and clever puzzle, and the "Fifteen Puzzle" and "Pigs in Clover" have given enjoyment to hundreds of thousands. The Chinese rods and cords which forms the subject of our engraving is in the line of ingenious disposition and is really more in the nature of a trick than a toy.

It is of Chinese origin and the example shown in our engraving was purchased in Chinatown, San Francisco, Cal. The puzzle consists of eight pieces of bamboo or hollow ivory tubes, each containing seven holes spaced equidistantly. Through these holes are seen to pass seven silken cords, each with a bead at the top and a tassel at the bottom. The toy is held by the loop at



THE ILLUSION EXPLAINED.

the top, which serves to hold the upper rod. When it is first picked up, its condition is shown in our second engraving at the left. There are seven of the rods at the top, and one at the bottom. Now the lower bar of the upper set is moved down to the bar at the bottom, the two lower bars will appear to be supported by three cords at the center, as shown in our engraving, four of the cords having vanished. If the next bar is brought down, another change is observed, only the two outer cords being seen. This is shown to the right of our engraving. If the next bar is brought down, the end cords have approached the center, and five of the seven cords have vanished. The next rod brought down brings five cords into view, the two end ones and the center one being visible. When the next bar is pulled down, the center and the outer cords only remain, so that if all the bars between the top and bottom bars are brought together, the seven cords appear to pass entirely through them. Our first engraving gives a clew to the mystery. The rods are all hollow, and each contains seven holes, and our engraving shows the course of the silk cords. It will be noticed that where a number of cords pass through a single hole the strand which is formed is much thicker than are the single cords; as they are of different colors, the



THE CHINESE RODS AND CORDS.

effect is most pleasing. It will be observed that the strings go clear through the top bar, but in the next bar, although they enter the seven holes at the top, they emerge from three holes at the bottom; three of the strands going through the center hole and two through each of the end holes, and so on throughout the entire number of bars, the strings changing their course, as is clearly shown in our engraving, thus causing the increase and decrease in their number.

#### A Memorial of the Centuries.

Colossal crosses are to be erected this year on nineteen mountain peaks of Italy to commemorate the nineteenth century of the Christian era. A religious society will have charge of the matter. The crosses will be cut from granite, marble, or whatever stone characterizes each region, and will bear an inscription.

#### Correspondence.

##### Foreign Trade Marks.

To the Editor of the SCIENTIFIC AMERICAN:

Your notice addressed to American merchants in the SCIENTIFIC AMERICAN reminding them that some merchants do not understand that in foreign countries the first registrant of a trade mark becomes the legal owner thereof is most timely.

We are continually receiving evidences of the truth of your remarks. Great hardships frequently arise to foreign merchants simply because local traders have applied for and have been granted trade marks which are identical or somewhat similar to those of foreign manufacturers. These latter at a subsequent date have applied for and then found to their cost that they were out of court.

An instance occurred just recently where it cost an English manufacturer several hundred dollars to have the register rectified by the removal of the mark of which he was the first and true inventor. Had he only applied, without unnecessary delay for the mark, he could have done it practically speaking for a few dollars. His loss, therefore, was great. And fortunate was he that it was not greater.

Trusting that the merchants of America will be quick to realize the dangers that are incurred in not applying within reasonable time for their trade marks we would remain yours faithfully,

EDWIN PHILLIPS,

Melbourne, Australia, January 30, 1900.

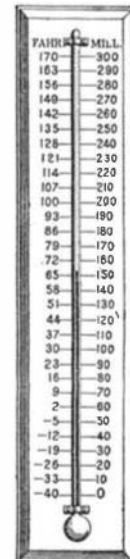
##### A MILLIGRADE THERMOMETER.

To the Editor of the SCIENTIFIC AMERICAN:

I have devised the new milligrade thermometer, the only perfect thermometer in all the world. True to name, it has in its scale 1,000 degrees. As mercury is the substance in general use, the 1,000 degrees shows the full tenacity of mercury, for a thermometer should be graded according to its tenacity. In milligrade mercury freezes at zero and boils at 1,000. This scale is to Fahrenheit as 10 to 7. The French centigrade is really a three hundred and eighty-niner, while Fahrenheit is a seven hundreder (660 + 40). In a true centigrade thermometer, not enough would be implied in a degree, so we minify the degrees ten times and use milligrade—the only perfect scale that will ever be devised. It will register in all minutiae. Decimals will not be needed. No below zero temperatures as long as mercury has power. Everybody knows positive and negative characters are a nuisance in computation, and milligrade ought to be international. It is worth striving for. Water boils at 360 degrees—the number of degrees in a circle. The point of aqueous congelation is just above a hundred (102°). The first hundred is the winter hundred of our northern latitudes. The second hundred is our summer hundred, and the hundred figure is easy writing and easy adding. 200 milligrade = 100 Fahr. It seems to me the simplicity of this scale should be its chief recommendation.

ARTHUR BETTS.

U. S. Vol. Observer, Ridgeway, Iowa.



##### A Dynamometer Car.

A new dynamometer car is being built in the shops of the Illinois Central Railroad, and will be operated by the railway company and the Department of Railway Engineering of the University of Illinois. It will be equipped with apparatus and instruments for road tests of locomotives, air-brake tests, and line inspection. The dynamometer recording apparatus will have three tandem cylinders, 3, 6 and 9 inches in diameter. By combinations of these, the apparatus can be tested with any weight of train. The apparatus for track inspection will automatically record deviations from gage and level of rails, the superelevations of rails, curves, the time, distance, etc. The motions are transmitted from an independent pair of wheels under the car to small cylinders in the car, transmission being effected by means of oils.

The pistons in these cylinders transmit the motions of the wheels below and their piston rods carry the pens by which the records are marked on a moving sheet of paper.

##### A Pipe Line for Sugar Juice.

At Springfield, Utah, there is a plant for slicing sugar beets and extracting the sugar laden juice by diffusion, and this, with its impurities is then pumped through a pipe line to a beet sugar factory at Lehi, where it is treated and refined by the usual processes. It is learned, says Cassier's Magazine, that the same system of piping sugar juices are also in use in France and Germany, and in the latter country also pipe lines have been used in potteries to carry much thinned clay paste from one department to another.