DISCOVERIES IN MESOPOTAMIA.*

By Dr. FRIEDRICH DELITZSCH.

THE traveler starting overland from the port of Alexandretta, in northern Syria, beholds beyond the high pass of Beilan the widely extended plain of Antioch, a view surprising in novelty and charm. As far as the eye can reach the plain is strewn with mounds of varying height, often grass covered, their artificial origin easily discernible. These mysterious elevations, called by the Arabs "Tell," by the Turks "Tepe," accompany the traveler to Aleppo and even farther to the banks of the Euphrates and Tigris, and they constantly increase in height, extent, and number, from Mosul down the stream and through Babylonia, crossing into the Elamite plain and to Susa. They are the marks of the civilization of pre-Christian millenniums. The large and small cities of the oldest empires of western Asia, of the Hittite States of northern Syria, of the Assyrian, Babylonian, and Elamite empires, with their palaces and temples, walls and gates, terraces and towers, lie buried beneath them. From these mounds of ruins of the Euphrates and Tigris region, weather beaten, grave, and silent, rising from the lonely and lifeless desert, French, English, and American explorers have plucked unfading laurels. They have awakened to new life, after the sleep of thousands of years, the buried glory of millenniums gone, and from innumerable monuments of sculpture and writing living knowledge reaches us of Babylon, Nineveh, and of those earlier peoples whose civilization continues, in not a small measure, to be preserved in our own. The mounds of ruins in the fairyland of "The Thousand and One Nights" have become for France, England, and America mounds of treasure-trove, from whose darkness they bring to light treasures of human art and science that are the greatest ornament and pride and the never-resting ambition of the great national museums.

It was in the year 1820 that Claudius James Rich,

similar objects had been found in great number. Botta thereupon began, on the 20th of March, to dig in Khorsabad, and after but three days a room was opened, and a few days later another, the inner walls covered with alabaster slabs, on which were represented in bas-relief the campaigns and hunts, the gods and priests of a king. Full of joy, Botta, on the 2d of May, sent to Mohl a letter, with drawings of the inscriptions and sculptures. The drawings caused a lively sensation, and the French government immediately made an appropriation for further excavations. Botta had discovered, as we now know, the palace of Sargon, the conqueror of Samaria. In May, 1844, the inhabitants of the village were removed, with the permission of the Sublime Porte, and thereupon the excavations continued on a larger scale. New rooms were continually freed from the debris, new sculptures, still exhibiting traces of color, together with long-lined inscriptions, were continually brought to light, and the drawings of the French painter, Eugène Flandin, which were later published at the cost of the State, served to raise still higher the general interest in Assyrian art and civilization, which was believed irrevocably lost, and now, as if by magic, raised to new life. Botta's successor, Victor Place, found, in 1852, the walls and gates of the city of Sargon, with gigantic winged bulls, and completed the excavation of the palace, penetrating to the cellar, where the wine jars, with a reddish sediment in the bottom, were still standing in long rows. An Assyrian king, concerning whom until then only a simple brief notice in the Old Testament (Isaiah XX., 1) gave information, suddenly rose before our eyes as a live, tangible personage, and we now know as much about his wars and victories, his buildings and hunts, about the conditions of the civilization of the Assyrian Empire and the contemporaneous history of the neighboring states, as we know about any epoch of ancient Greece or Rome.

It may be readily imagined that the glorious achieve-

tended it. Both of these rulers built there magnificent palaces, surrounded by large parks, rivulets, and ponds, on whose isles water birds nested. And all this splendor and glory, covered by the mighty mound of ruins of Kuyunjik, were uncovered by the two English explorers. In the southwest corner of the mound Layard laid open the palace of Sennacherib, the largest Assyrian palace thus far known, with seventy-one rooms, galleries, and halls, the walls on every side covered with artistic bas-relief, depicting the edifices, the campaigns, and the domestic life of the king in a most vivid manner. There we see how the large terrace was filled up, how the gigantic bulls that guard the entrance to the hall were set in place by means of pulleys, rollers, and ropes, and a contingent of thousands of workmen, partly slaves in chains, whom the king superintended from his chariot, while pitiless taskmasters with raised sticks relentlessly urged on the work. In another room the sculptures show servants carrying bunches of ripe dates and flat wicker baskets with pomegranates, apples, and grapes, grasping at the same time small green twigs to keep off the flies. They are followed by others with hares, partridges, and dried locusts fastened on staves. Farther on come servants, two abreast, carrying on their shoulders low tables loaded with baskets of cakes and fruits, while in the rear follow a long line of servants with flower-decorated vases. All these representations are distinguished by vividness and truthfulness.

Splendid and admirable as were the finds in the so-called southwest palace of Sennacherib, they were to be greatly surpassed by the treasures which were brought to light from the so-called north palace of Sardanapalus, discovered by Rassam in 1854. There, too, one state chamber after another was freed from debris; the long Babylonian gallery, the smaller Arabic room, so named because their wall reliefs represent the great deeds of the king and his armies in Babylonia, Arabia, etc. After two and a half

ASSURBANIPAL, KING OF ASSYRIA 668-626 B. C., LION HUNTING.

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an officer of the English East India Company at Bagdad, undertook, for the recovery of his health, a trip into the Kurdish Mountains, and on his way back he spent a few days at Mosul, the well-known commercial town on the right bank of the Tigris. There the large mounds on the other side of the river attracted his attention. They resembled those which he had seen near Hilla on the Euphrates and which he correctly took for the remains of ancient Babylon. As the southern of the two largest mounds still has the official name of Nunia, and is crowned with a mosque dedicated to the prophet Jonah, the hypothesis suggested itself that there, opposite Mosul, lay the ruins of Nineveh, the ancient capital of Assyria. Rich examined the mounds. He also heard of a large stone slab, engraved with representations of human figures and animals, which had been found some time before, but had been broken by the Turks because of religious prejudice. He was not, however, in a position to continue his investigations.

Now it happened that in 1842 Emil Botta, son of the well-known Italian historian, was appointed French consul at Mosul, and was encouraged by the famous orientalist, Julius von Mohl—the second of the four brothers Mohl, who are a lasting honor to their native city, Stuttgart—to follow up the path entered upon by Rich and to begin excavations in the mounds near Mosul. But neither on the southern mound, Nebi Yunus, nor on the northern, Kuyunjik, were his endeavors rewarded with success. In March, 1842, a peasant of Khorsabad, a village situated four hours north of Mosul, told him that in the mound on which his village was built inscribed stones and

ments accomplished by French pluck, energy, and perseverance, which turned the eyes of the whole civilized world to the Assyrian collections in the Louvre, would not long leave the English idle spectators. Sir Austen Henry Layard, afterward minister of Great Britain in Madrid and ambassador to Constantinople, had already visited those regions in 1840, and had shown the most lively interest in the work of Botta. It was not long before the English ambassador at Constantinople, Sir Stratford Canning, succeeded in securing for Layard the firman permitting excavations and the necessary funds. Layard immediately began excavations on a grand scale, receiving the cordial aid of the native population, for not only was Layard an adept in winning the love and gratitude of the natives everywhere, but he had also in Hormuzd Rassam the most ideal companion, who, fully familiar with the Arabic character, could, as Layard acknowledged, secure the good will of the most savage with whom he came in contact.

On November 28, 1845, Layard commenced his labors in Nimrud, situated a few kilometers south of Nineveh, and the first four months of 1846 brought to light the entire northwest palace of Shalmaneser I. (1300 B. C.), the palace of Assurnazirpal, of the Biblical Tiglathpileser and Esarhaddon, and, especially with the palace of Assurnazirpal, a large number of sculptures and inscriptions of various kinds. Not less successful were the excavations at Nineveh, which Layard carried on after 1849 at the expense of the British Museum. Like the Babylonians, their masters, the Assyrian kings built their temples and palaces upon raised artificial terraces, from whose airy heights they not only enjoyed a purer and cooler atmosphere, but escaped the fever, the inundations, and the mosquito swarms of the river flats. King Sennacherib erected such an elevated terrace of bricks, and his grandson, Assurbanipal, the Greek Sardanapalus, ex-

thousand years of darkness the light of the sun again burst in the halls decorated with sculptures and in the courts artistically plastered with mosaics, exactly as when they were deserted in the year 607 B. C., when the Median hordes, intoxicated with the blood of foes and the triumph of victory, raged there, burning and plundering. Light fell anew into the royal harem, conjuring up before our eyes most vividly scenes with which an artist of the seventh pre-Christian century decorated its walls with realistic truthfulness. We behold in an arbor the king comfortably stretched upon a divan holding a full goblet in his hand, and near him, likewise with a goblet, the queen on a high chair, attired in rich vestments. Eunuchs fan the royal couple, while at a distance there is music. Not far from these apartments the beautiful lions' room was found, its sculptured walls perpetuating the king's adventures in the chase. Like most of the Assyrian kings Sardanapalus was a bold, passionate hunter, and the lions' chase was his favorite sport. The lions were confined in cages in a special park and on the day of the hunt were set free. Here we see the king, now on foot, now in the chariot, taking up the battle with the lion. Now the king calmly meets the attacking animal, and, with a sure hand, thrusts the deadly spear into his body. There the furious beasts fasten their teeth in the chariot spokes or writhe wounded upon the ground. Especially to be noted is a relief of a dying lioness, whose perfectly realistic character has made it famous in the history of art. On the floor of the lion apartment and of the adjoining rooms lay in thick layers fragments of the royal library, a collection of tablet books and documents once arranged in the upper rooms, but which at the collapse fell through, crushed into thousands of large and small pieces. Baked clay tablets of all sizes, inscribed on both sides with fine Assyrian cuneiform characters, which, after being freed from

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dirt and dust can be as distinctly read as if they were but yesterday impressed into the soft clay, constituted this unique royal library.

As if presaging the approaching collapse of the Assyrian Empire, Sardanapalus ordered that the most important books and documents from all the libraries in Babylonia should be collected, copied, some even in duplicate, and incorporated in his own library. Thus through the library of Sardanapalus there came to us a great part of the older, and indeed of the most ancient, works of Babylonian literature, and, as might be expected, only the most important works were considered worthy of admission into the royal library. It contained historical works with information as to the relations, now peaceful, more often warlike, of Assyria with its mother country, Babylonia; chronological lists accurately fixing the reigns of all those ancient kings, Shalmaneser, Tiglathpileser, Sardanapalus, and for a long period recording the most important event of each year; penitential psalms and hymns of praise, epics, and myths that reveal the religious thought as well as the poetical endowment of the Babylonian people; large grammatico-lexicographical works that for many decades to come will be an inexhaustible mine for Semitic philology; astronomical, astrological, and magical tablets, the original works from which the wise men of the East—the Babylonian Magi—drew their learning which they afterward spread over Greece and Rome; in addition a multitude of letters addressed to the great king of Assyria from the kings of Elam, from the generals abroad in hostile lands, from the court astronomers who report to the king the happenings in the starry heavens, eclipses of the sun and moon, from the Magi, who, on the basis of the flight of birds, or the entrails of sacrificial animals, advise the royal majesty what to do and what to leave undone; letters from the royal physicians, petitions and entreaties from captives; besides copies of the letters and proclamations of the king himself. Four royal-octavo volumes, with 1,952

full of exertions and trials, where, at the time, pest and cholera were raging—exhausted the strength of the indefatigable explorer. Accompanied by the English consul to Aleppo, he died there on August 19, 1876, covered with glory, fallen like a hero on the field of honor.

The traveler setting out from Bagdad in the direction of the little town of Hilla, traversing the plain which is spread out between the twin rivers Euphrates and Tigris where they are nearest one another, will, after passing many other mounds of ruins, arrive at a large one covering two English miles, named Abu Habba. Wall and castle are still clearly recognizable, but the highest point of this site of ruins is on the southwest side on the bank of a former arm of the Euphrates. When Rassam excavated here in 1881 he struck almost at once the walls of a building. The inclosure of a large quadrangular structure 1,500 feet long on the southwest side, was laid bare, and further trenches and shafts showed that the edifices were grouped around a central court, and consisted of a line of long narrow rooms with exceptionally thick brick walls. In the interior of this structure a pair of interesting rooms was discovered and freed from the debris. At the excavating of a shaft that ran along a wall in the middle of the mound a doorway was reached which led to a large gallery 100 feet long and about 35 feet wide. On it stood the remnants of a large sacrificial altar, made of bricks and measuring 30 feet square. Behind the altar, in the wall of this room, a door opened leading to a smaller room, and Rassam, as a result of experience gained in the Assyrian mound of Balawat, at once surmised that the temple archives had been here preserved. But though at Balawat the corner-stone documents of the builder of the temple were found in a stone chest nothing similar was here discovered. On the other hand the asphalt pavement attracted Rassam's attention and he therefore sunk a shaft in the floor when, behold, scarcely had he broken through

temple revenues in money and other commodities, the expenses in salaries, wages, etc., and the investment and employment of the temple property in loans, real estate, rents, etc. If to these be added the numerous so-called contract tablets from Babylonia, Tell Sifr, and other places, with their varied contents, purchase and sale of slaves, marriage documents, acts of lawsuits, testaments, and the letters of the time of Hammurabi or Amraphel (Genesis, XIV.) which were recently found, we derive a mass of the most important information on the commercial and judicial life as well as the economic conditions in the Babylonian State for a period of nearly two thousand years from the first Babylonian dynasty (2250 B. C.) until long after the time of the Achæmenian kings. The excavations at Sippar, Babylon, and elsewhere carried us back to the time of Hammurabi, that greatest king of the first Babylonian dynasty, who united the north and the south in one great Babylonian State, with Babylon as the capital. But the soil of Babylonia, inexhaustible in surprises, was soon to afford us an outlook into a much higher antiquity of the Babylonian people and to carry us to still more remote ages in the history of humanity. From the same archives to which the above-mentioned votive tablet belonged, which was deposited by King Nebobaladan (882 B. C.) in the sun temple at Sippar, came also, among other things, a remarkable clay cylinder of the last Chaldean king, Nabonaid. In it the king relates that he has decided to re-establish the sun temple upon its oldest foundation; for, in consequence of the repeated rebuildings in the course of many centuries, the temple was obviously detached from its original foundation site, from its oldest "temen;" and that he has succeeded, after continuous and laborious digging into the depths of the earth, in finding the "temen" of the first builder of the temple Naram-Sin, son of Sargon I., a "temen" which for thirty-two hundred years had not been seen by the eye of man. This established the year 3750 before

ASSURBANIPAL POURING A LIBATION OVER LIONS SLAIN IN THE CHASE.

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pages, are required for the catalogue of the thousands of clay tablets and prisms or fragments thus far transferred from Nineveh to the British Museum. And what a mass of knowledge and multitude of new points of view for religious and profane history, for linguistics and geography, for archæology in all its branches, has not the study of these ancient books revealed! Let us but recall that memorable autumn of 1872, when George Smith, one of the officers of the Egypto-Assyrian collection of the British Museum, while looking over the cuneiform fragments of the mythological series, read in one of them with growing surprise: "The ship stood still on the Mount Nizir. I took out a dove and sent it out; the dove flew hither and thither, but as it found no resting place it turned and came back. I took out a swallow and sent it out. The swallow flew hither and thither, but as there was no resting place it came back. I took out a raven and sent it out; the raven flew away and perceived the decrease of the water . . . and did not return to the ship." Smith had found the original of the Babylonian-Biblical account of the deluge. He reported his find at the meeting of the London Society for Biblical Archæology on December 3, 1872. The discovery created the profoundest sensation in England, and far beyond her borders. In press and pulpit it was celebrated and commented upon. Babel, it was said, confirms the Bible. "Where men are silent, the stones cry out." The proprietors of The Daily Telegraph, almost immediately after that lecture, hastened to give George Smith a thousand guineas for further explorations in Nineveh. On January 20, 1873, George Smith set out on his journey. In 1874 he was again sent—this time by the trustees of the British Museum—to Nineveh, constantly making discoveries, and in 1876 undertook a third expedition to the East, which was to be for him "a way without return." His last stay in Babylonia and Assyria—

the cement layer when a clay chest appeared containing a beautiful artistically inscribed alabaster tablet, in six columns, decorated at the top with a carefully executed bas-relief. In this holy of holies a god with a long-flowing beard, in his hand a ring and a short staff, was seated upon a throne decorated with cherubim. A king followed by two priests approaches the god in adoration, while two other men are raising the sun disk with ropes upon the roof of the holy of holies. Certainly a valuable and admirable find in itself but much more so because this document also revealed the name of the building and of the city which was thus rediscovered. "Image of the sun god, the great lord, who dwells in the temple Ebabbara in the city of Sippar." Thus reads the explanatory legend of the bas-relief. One of the oldest Babylonian cities has been found—Sippar, in which Noah-Xisuthros, by the command of the god Kronos, was ordered to bury the documents of antediluvian times; the sun temple which since its foundation in the fourth millennium until long after the time of the last Chaldean king, Nabonaid (538 B. C.), was the center of worship for Babylonia and the object of concern of all Babylonian kings was rediscovered. This sun temple in the course of thousands of years through revenues and donations came in possession of untold riches in money and land.

The forty to fifty thousand inscribed tablets that since 1881 have been flowing from Abu Habba as from an inexhaustible source into the occidental museums, above all into the British Museum, give an insight not only into the cult of the sun god and the deities worshiped beside him, into the divisions, obligations, and prerogatives of the several priest classes, but also into the system of the temple revenues and their application. From the temple archives of the sun god is derived a great mass of tablets, which, after the fashion of commercial bookkeeping, record the

our era as the date of the reign of Naram-Sin and about 3800 as that of Sargon I., and opened a vista into the past of the human race on Babylonian soil which lies fifteen hundred years beyond the time of Hammurabi-Amraphel, or, to speak with the Old Testament, beyond the time of Abraham, a vista never anticipated and at first hardly credible. And still, little as was the inclination to accept so remote a date, there was as little reason to doubt it, and, in fact, the progress of the excavations was soon to prove it more and more indubitable.

The French consul at Bassora, Ernest de Sarzec, who has been directing the French excavations on the south Babylonian site of the ruins of Tell Loh (Telloh) since 1875, had not long begun his work when he found those nine diorite statues, which represented partly in standing position, partly seated, the old priest kings (patesi) of the city of Lagash, named Ur-Bau and Gudea. These statues, although the heads of all are missing, are valuable examples of the old Babylonian art of sculpture, and this value is considerably increased by the inscriptions which, on the breast, back, etc., are incised with the most consummate artistic skill and neatness, exciting the admiration of our modern stonecutters. While the archaism of the writing leads us back to a time long before Hammurabi, the language in which they are composed shows that those ancient priest kings belonged neither to the Semitic nor to the Indo-Germanic stratum of the Babylonian population, but to the so-called Sumerian people, who spoke an agglutinative language, and who, though through the early centuries settled in Babylonia contemporaneously with the Semites, and in lively intercourse with them, must still be considered as the older native population from whom the Semites received the art of writing and other achievements of civilization. And since that first great discovery of De Sarzec, the finds of Telloh

have steadily carried Babylonian history to earlier periods as evinced by indisputable art, historical and paleographical criteria. They carried it back to the time when the two Semitic kings of Agade, Sargani-shar-ali and Naram-Sin—and these, as is recognized with ever-increasing certainty, are Nabonaid's Sargon and Naram-Sin (3800 and 3750 B. C., respectively)—exercised sovereignty over Lagash and the priest king of this city, Lagal-Ushumgal, was their vassal. Nay, even from an earlier time—the close of the fifth millennium—there rises before our eyes a whole line of hoary Sumerian patesis of Lagash—Ur-Nina, Akurgal, Eannadu, Enannatum, Entemena. And we know not only their names, but most of their heroism against domestic and foreign foes, and of their efforts for the general welfare of their city and its inhabitants.

As the origin of the cuneiform writing is more and more cleared up through the inscriptions of some of these most ancient rulers—above all, that of Eannadu—so one ray of light after another brightens the darkness spread over the earliest history of the great Babylonian cities—Agade, Babel, Kish, and Lagash, Erech, and the "city of bows." Nay, on some periods, especially the times of Sargon I. and his son, Naram-Sin, a flood of light is shed. For much as it may be deplored that the archives, consisting of some 30,000 tablets, cylinders, and large inscribed pebbles, found in 1894 in a cellar-shaped room at Telloh, were scat-

ter of Sargon I. lay in ruins; enemies, probably the Elamites, plundered and destroyed them. But if only the vases of the pre-Sargonic king of Erech, Lugal Zaggisi, son of a patesi of the "city of bows," which were pieced together from thousands of fragments, had been found they would be an ample reward on account of the historical and paleographical information that they furnish. The records of the Kassean kings were intact. They contained all the votive gifts that the kings of the so-called third Babylonian dynasty had presented to the god Bel.

Down to 1896 there were cleared from the ruins of Nuffar, successively, 2,000, 8,000, and 21,000 clay tablets and fragments, inscribed and stamped bricks, stone and clay vases. They were of the pre-Sargonic period, as well as of all the later periods of Babylonian history, from Sargon I. and Naram-Sin, and even from Ur-Gur and Dungi, the two ancient kings of the city of Ur, down to Darius II. and Artaxerxes Mnemon. They embraced syllabaries, chronological lists, letters, astronomical and religious texts, tax lists, plans of real estate, contracts, besides images of divinities and toys of terra cotta, weapons and implements of stone and metal, ornaments of gold, silver, copper, and bronze, carved precious stones and weights. It was estimated that the inscribed monuments found up to 1896 would fill twelve volumes of two to three parts each if published. What specially

logically important revelations, but sunk shafts in several places under Naram-Sin's platform and searched the entire earth stratum, which was about 9.25 meters deep, down to the underground water, for remains of human civilization. This great sacrifice of time, labor, and perseverance was to be rewarded in a way that could not have been anticipated. For, in one place, not far below Naram-Sin's platform, was found an altar of sun-dried bricks, the top of which was surrounded by a rim of asphalt and covered with a layer of white ashes 6.5 centimeters thick and the remains of burnt sacrificial animals; still farther below there was unearthed a large, beautifully decorated terra-cotta vase in perfect condition, an excellent example of old Babylonian ceramic art. And in another part of these underground excavations the oldest architectural arch of a drainage canal, and still farther down in the deepest layers, or, what amounts to the same, back in many centuries beyond the fifth millennium, everywhere interesting and valuable remains of human civilization came to light, fragments of vessels of copper, bronze, and clay, a mass of earthenware, so beautifully lacquered in red and black that one might consider them of Greek origin, or at least influenced by Greek art, had they not been found 8 meters deep under Naram-Sin's pavement.

We could go on a long time in this way were we to enumerate all the achievements which foreign explorers, supported by the energetic interest of their governments and aided by the liberality of their countrymen, have accomplished and are still accomplishing on the ruined sites of Assyria, Babylonia, and Elam. We could speak of Hormuzd Rassam's finding of Nebuchadnezzar's palace in the middle mound of Babylon, called Kasr; of two beautiful wells which reached down to the water level of the Euphrates, and of other traces of water balances in the extreme northern mound Babil, probably the site of the hanging gardens of Semiramis. We could describe the successful expeditions of Jules Oppert, William Bennett Loftus, Sir Henry Rawlinson, and, above all, tell of the great work of the Dieulafoys on the ruins of Susa. But we must forego this here, and will mention in passing that only recently the French government succeeded in acquiring for 5,000 francs the right from the Shah of Persia to excavate for all time in Susa and the surrounding province and to transfer half of the finds to France, while for the other half it secured the first option. The French have been active in Susa since November, 1897, under the direction of De Morgan. De Sarzec and Haynes continue their labors with undiminished and untiring zeal. Philadelphia, it is rumored, is equipping a new expedition, and Germany—is she to continue for another half century to be an idle and admiring onlooker of the glorious deeds of foreign nations? Shall she longer be content to play the part of the poet, until it is proclaimed: Too late; the world is already divided?

Germany may justly be proud that one of her sons, the Hanoverian Georg Friedrich Grotefend (born in 1775 at Münden), as a young teacher at the gymnasium of Göttingen in 1802, had the genius to decipher the cuneiform writing, and thus placed the key in the hand of science which was to unlock not only the old Persian monuments but also the great Babylonian-Assyrian cuneiform literature, and in addition to that make possible the reading of the Armenian and Elamite cuneiform script. Germany may also glory in the fact that a scholar of German blood, Julius von Mohl, gave the first impulse to the excavations in Nineveh; she can also note with satisfaction that the enthusiastic interest which is being brought to the Assyriological studies especially in America, and from which grew the Philadelphia expeditions, was awakened in the German universities. If, then, Germany would at last arouse herself and secure a share of the priceless art and written monuments of the old—nay oldest—human civilization for German museums and German science, this great national and scientific undertaking may count with certainty upon the sympathy and self-sacrificing support of all men and women who are zealous for the glory of the German name and German science. No one can deny that the excavations in the mounds of Mesopotamia have opened and are continually opening new and rich sources of highest importance for an entire series of sciences—Old Testament research, ancient history and geography, the history of art and archaeology, the history of religion and comparative mythology, Semitic and general philology, comparative history of jurisprudence, the history of astronomy and mathematics, and many other sciences. We must refrain from entering into details and can only briefly refer to a few facts.

For the history of art, particularly the history of sculpture and architecture, and in a measure also of painting and some of the industries, such as stone-cutting and pottery, a peculiar and highly important link was recovered through the resurrection of Assyro-Babylonian antiquity, the more important as the history of the development of the Babylonian art can be followed up to the fifth pre-Christian millennium. The image of Naram-Sin found at Diarbekr, the famous vulture stele of Eannadu, the sculpture with the representation of Ur-Nina and his sons, will forever remain milestones in the history of the art of western Asia, and of human artistic skill in general. And as it is an established fact that "the forms of the column, and some other ornaments of Greek art which are much in use are first met in Assyrian sculptures," light from the East may also be hoped for to illumine the darkness in which the origin of the oldest Greek art is in many respects still enveloped.

The light which sprang from oriental ruined mounds has with one stroke illuminated the sphere of the ancient peoples and states of western Asia, so distant in time and space, and restored it to ancient history. The nebulous forms of Ninus, Semiramis, and the effeminate Sardanapalus have been replaced by clear-cut individualities. The old great culture States—the old Babylonian, Assyrian, and Chaldean empires, their external political history and internal development in commerce and industry, law and religion, manners and customs—enter into our horizon with steadily increasing completeness and vividness. At the same time they furnish us the most valuable information on the history of the neighboring kingdoms, from Elam to Canaan, on the ethnic movements which during

ASSYRIAN ACCOUNT OF SENNACHERIB'S CAMPAIGN AGAINST JERUSALEM AND KING HEZEKIAH OF JUDAH (701 B. C.)

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tered everywhere by the thievish Arabs, the documents themselves are not lost to science, whether they came to the museums of Constantinople, Paris, Berlin, Philadelphia, or elsewhere; and they reveal to us in a surprising and at the same time in detailed manner the commercial, agricultural, and economic conditions, as well as the civic and religious life of the times of Sargon I. and Naram-Sin. Even pierced lumps of clay were found with the names of Sargon or Naram-Sin stamped upon them, inscribed with the names of the addressee, the place of destination, and evidently attached to bales of merchandise, to be forwarded from Agade to Lagash.

One of the oldest sanctuaries upon earth is the temple of the lord of the universe, Bel, in the middle Babylonian city of Nippur. The ruins of this city, now called Nuffar, and especially the gigantic remains of this temple, were the goal of the three expeditions from Philadelphia, which, from 1886 up to the present time, under the direction of John P. Peters, Hermann V. Hilprecht, and J. H. Haynes, have excavated and constantly made discoveries of the greatest import to science on that vast site of ruins. Two temple archives rewarded the labors of the American explorers within a few years. True, those

distinguishes the excavations of the Americans is the systematic clearing up of the single layers of the mighty temple edifice and of its superstructure.

The colossal ruin of the tower of the temple of Bel, now called Bint-el-Amir, rises 29 meters above the plain and 15 meters above the mass of debris which surrounds it. The immense platform, about 2.40 meters thick, constructed of sun-dried bricks, together with the three-story temple tower erected upon it, probably a work of King Ur-Gur, was laid bare and the ascent to the single stages in the southeast of the ruin was found. Close under this platform another pavement was discovered, consisting of two layers of baked bricks of about 50 centimeters square and 8 centimeters thick. Most of them were stamped, some with the name of Sargani-shar-ali, the others with that of Naram-Sin. Both kinds were intermingled in both brick layers, so that the identity of Sargani-shar-ali with the Sargon of Nabonaid (3800 B. C.) was made sure. Ur-Gur had, it appears, razed the buildings of his predecessors and elevated the platform of his temple tower over the pavement of Naram-Sin. J. H. Haynes, however, who since 1894 has been alone at the ruins of the temple of Bel, superintending the excavations, was not content with these chrono-

four millennia took place in the large quadrangle of lands between the Black and Caspian seas and the borders of Egypt-Arabia. And how many chronological and geographical riddles have not been solved or at least brought nearer to solution!

Assyriological research which sprung from the ruins of Babylon and Nineveh has above all shown itself fruitful for the science of the Old Testament, and for it promises to bear still more fruit. For not only is the Assyrian language most akin to Hebrew, affording new information on questions of grammar, lexicography, and phraseology but there is scarcely a book of the Old Testament the interpretation of whose subject-matter has not been aided to some extent by the cuneiform monuments. The narratives and conceptions of the Book of Genesis of the creation of the world—the serpent as the arch enemy of the Deity and embodiment of all sin and malice, the ten patriarchs, and the catastrophe of the Deluge which destroyed primitive humanity, so well known and familiar to us from childhood—appear in a new light through the surprising parallels which the Babylonian-Assyrian clay books furnish. The Old Testament history, especially that of Israel from Chedorlaomer to Belshazzar and the Achæmenian kings interlinked with the history of Babel and Asshur, continually receives new light from the latter. The chronology of the kings of Judah and Israel is through the chronology of the Assyrian empire placed on a more secure basis than was possible before; and since in the annals of the Assyrian kings mention is made of the kings Ahab and Jehu, Pekah and Hosea, Ahaz and Hezekiah, the possibility is afforded of comparing more than one narrative of the historical and prophetic books, as, for instance, that of Sennacherib's campaign against Jerusalem, with the records of the opposing side. Hebrew antiquity is connected by hundreds of threads with that of western Asia, particularly of Babylonia and Assyria. The deeper insight which we now have into the belief and cult of the gods, especially into the nature of the sacrifices of the Babylonians, their conception of the winged angelic beings after the manner of the cherubim and seraphim, their views of life after death, their bestowing of names, the peculiarities of their psalm poetry in form and matter, their manners and customs, their system of measures and weights, etc., directly serve the advancement of Old Testament theology and archæology.

The resplendence of the starry sky over the endless expanse of the Euphrates' land is something wonderful; the stars sparkle with the greatest brilliancy, and the movements of the planets, the changes of the moon, the various meteors, enchant the attention at night. The Babylonians learned to calculate the course of the stars; their observations constituted the foundations of the astronomical studies of the learned Alexandrians. And when we even to-day divide the circle into 360 degrees, the day into twelve hours of sixty minutes; when we count seven days of the week and name them after the planets; when we divide the apparent path of the sun according to the signs of the zodiac, we therein directly follow those old Chaldeans, whose great scientific accuracy, while it has left traces in some other things, has borne imperishable fruit in the science of astronomy, which originated with them. And just as the first chapters of the history of astronomy can only be written with the aid of cuneiform works or notices, we must see in the same sources the history of mathematics, geometry, metrology. Nay, in many respects our present civilization is still under the influence of the hoary Babylonian; the week and its seven days and the names of so many constellations as well as our old square measure, the cubit, and our old weight, the pound, have their homes in Babylonia. Jurisprudence has good reason for the assumption that the often striking agreements between Roman and Babylonian law will clear up the origins of Roman law, which, at least partly, are still obscure. In the exceedingly rich Babylonian-Assyrian "contract literature" an abundant as well as a valuable source was disclosed for the comparative history of jurisprudence; many other functions of state institutions receive new and instructive data of a comparative and historical nature from the results of the excavations. We have in mind, for instance, the economic development of those ancient culture states, or of the history of war in its manifold branches. Do not the bas-reliefs on the alabaster slabs and bronzes of the Assyrian palaces furnish instructive information as to the progress in the clothing and arming of the Assyrian army, the developing of the cavalry, the technique of fortification, the defense and attack by means of machines of assault and mines, on scouting and pontoon building?

A new world is opened to human knowledge and inquiry through the Babylonian-Assyrian excavations. But while we zealously collect books and documents in our libraries and archives as the obvious condition of scientific progress, we stand idly by when the oldest documents and books and art monuments of humanity, the invaluable original material for a large number of scientific departments, go abroad, so that German Assyriologists, Old Testament scholars, historians, all who occupy themselves with the archæology of western Asia, with the history of art, etc., are almost entirely dependent upon foreign publications and foreign museums.

But still another consideration peremptorily demands that a change of conditions should as soon as possible take place. We German scholars continue to praise the ever-extended welcome which we receive from the directors and assistants of the British Museum, the Louvre, the National Library at Paris. We have to acknowledge the generosity with which the foreign collections are opened to us, the museum publications presented to us as a gift. But the more often we enjoy English and French hospitality the more urgent becomes the reminder, noblesse oblige. For more than fifty years German science has been availing itself of the fruits of foreign labor and sacrifice, and has been making use of achievements possible not only through enormous expenditures of money, but also by continuous sacrifices of time and comfort, health and life, on the part of the foreign explorers. It is not a small thing to do excavating yonder in Babylonia, in a climate whose temperature reaches

in the shade 39 deg. Réaumur (119 deg. F.), among wild, ignorant, and treacherous Arabs, in the vicinity of widely stretching swamps, full of deadly fever germs, attacked by day and by night by ubiquitous insects. If the explorers of other nations are constantly ready to endure such sacrifices of health, nay, even life (the cemeteries of Bagdad and Aleppo bear witness to it), to science, it is certainly high time that Germany, too, imbued with a similar lofty national and scientific enthusiasm and readiness of self-sacrifice, put her hand to the raising of those treasures which are most valued by herself. There is certainly no lack of men who are ready for any sacrifice in the service of the fatherland and of science. As for the money, all Germany will certainly be able to do what a few generous citizens of a single American city, Philadelphia, have accomplished, they having defrayed the expenses of three expeditions from 1888 to 1896, amounting to 280,000 marks (\$70,000). The self-sacrifice of generous Germans, which from 1888 to 1891 rendered possible the successful excavations of the German Orient Committee at the mound of ruins in Sendjirli, in northern Syria, will certainly not be wanting for researches on the Babylonian-Assyrian ruined sites, which, in all human probability, will be much more successful, and will put the newly organized German Orient Society in a position to energetically carry out from now on uninterruptedly and in a constantly widening compass its efforts for the study of western Asiatic as well as Egyptian antiquity for the prosperity of German museums and German science and for the glory and honor of the German fatherland.

THE ANATOMY OF PLANTS.

The anatomy of plants is not studied like that of animals; that is to say, by dissecting them, since their tissues are too intimately connected with each other to permit of this. It is therefore necessary to make exceedingly thin sections of them and examine these under the microscope. And even then we do not see many details of structure, since each cell is easily confused with its neighbors. In order to obtain good preparations, it is necessary to clean the sections, that is to say, to remove the internal protoplasm from each cell and allow only the membrane of cellulose to remain. To this effect, they are treated with a solution of hypochlorite of lime, in which they

possible to construct an apparatus with six or eight lever arms instead of four. The levers not in use may be raised vertically so as not to put too much useless strain upon the clockwork movement.

The operation of the apparatus is perfect. With it, it is easy to color forty sections in one morning, while, with the ordinary method, it is impossible to color more than five or six. This is a very sensible difference, and will certainly be regarded favorably by botanists, to whom, as well as to the common run of people, "time is money."

Let us add that after the sections have been colored as described above, it is necessary to mount them in Canada balsam in order to preserve them; but this operation can be performed only by hand. They are first dehydrated by means of absolute alcohol, which is afterward expelled by immersing the sections in xylol or oil of cloves. Finally, they are placed upon a glass slide in a drop of Canada balsam and covered with thin glass.—For the above particulars and the engraving we are indebted to La Nature.

EXPLANATION OF THE INCLINATION OF THE PLANETARY AXES.

By WILLIAM H. PICKERING.

SUPPOSE a uniform spheroid to be revolving in its orbit about the sun and to present always the same face to a star. If this spheroid is covered with liquid an annual tide will be produced which in the process of time will cause the spheroid to rotate upon its axis so as to present always the same face to the sun, says the *Astronomical Journal*.

Suppose now that this spheroid possesses an original rotation about its minor axis, and that this axis lies in the plane of its orbit, as is for instance approximately the case with the planet Uranus. We shall thus have two independent rotations about two axes placed at right angles to one another. When these motions are combined, however, as may be clearly illustrated by means of the gyroscope, the effect produced is to shift the minor axis of the planet out of its original plane, so that the plane of the planet's equator shall approach the plane of its orbit, and in such a manner that the rotation and revolution shall take place in the same direction.

This shifting of the axis is not to be confused with

APPARATUS FOR COLORING PLANT-SECTIONS.

A, lever arm in an operative position; B, lever arm in an inoperative position and raised vertically; C, springs to keep the levers vertical, and the axis that revolves the horizontal levers; D, housing for the clockwork movement; E, basket of wire cloth.

are allowed to remain for from five to ten minutes, and are then washed with water containing a little acetic acid. This is not all; the form of the cellular elements does not always afford information as to their true nature. In order to distinguish them perfectly, it is necessary to use coloring reagents, and so they are passed successively through a solution of iodine green, water and carmine and alum. In this way, all the membranes of cellulose are colored red, while all the ligneous portions, that is to say, the vessels and fibers, are colored green.

It will be seen from this that the coloring of a single section involves considerable labor. In fact, the section must be passed successively through at least ten reagents and be handled for this purpose with a flat needle. Such manipulation of the sections is so much the more difficult in proportion as they are smaller. It is necessary also to keep constant watch of the time that the sections are to remain in the reagent, and this is very fatiguing to the mind.

Such considerations have led M. Henri Coupin to devise an apparatus that permits of the operations being performed automatically. This consists essentially of a clockwork movement that causes a vertical axis to revolve in one hour. Upon this axis are fulcrumed four light levers that rest near the center upon a ring carrying alternately thirty teeth and notches. To the extremity of each lever is attached a small basket of very fine brass wire cloth, into which the sections to be colored are thrown. The reagents are arranged in a circle around the apparatus in thirty watch crystals. The following is the list: 7 (hypochlorite), 6 (dilute acetic acid), 1 (iodine green), 3 (water), 7 (carmine), 4 (water), 2 (alcohol).

The lever in revolving causes the basket that it supports to pass from one reagent to the other. The latter enters through the meshes of the wire cloth at the bottom and acts upon the section. The time of action of the reagents is proportional to the number of watch crystals that contain them. From the moment at which the sections are placed in the baskets we have therefore no longer anything to occupy ourselves with but the removal and final mounting of them. Let us remark also that it is possible to place within the circle of crystals a second circle of smaller ones and thus to color double the number of sections. Finally, it is

that producing precession, which is due to a different cause and is periodic. The present shifting is continuous in its action and its direction lies at right angles to that causing precession.

According to Laplace's nebular hypothesis, as is well known, when the rings break up into planets, these should rotate in a retrograde direction. Owing to the tidal action above described, however, the plane of their rotation will gradually shift so that, from being at first nearly parallel to the plane of their orbits, it becomes later perpendicular to them, and finally again parallel, but this time with the rotation direct. Successive satellites formed by the contracting mass would thus originally revolve in different planes, but would all finally approach the plane of rotation of their primary through the attraction of its equatorial regions.

Such a progressive change of plane is found in the orbits of the satellites of the four major planets. Thus, for Neptune the approximate angle is 145 deg., for Uranus 98 deg., for Saturn (inner satellites) 27 deg., and for Jupiter 2 deg. It is also found in the case of the four inner planets, as far as is known, as determined by the inclination of their equators to the plane of their orbits. Thus, for Mars the angle is 25 deg., for the Earth 23 deg., for Venus the angle is unknown, and for Mercury, while undetermined, it is certainly very small, as is indicated by the drawings of surface detail made at Milan, Arequipa and Flagstaff. While the force producing this change must at the present time be almost infinitesimal, yet such would not have been the case in the past, when the planets were perhaps one hundred or more times their present dimensions.

If we take the great nebula in Andromeda as a type of our earlier existence, the planets being merely condensed masses revolving within and with the solar atmosphere, this atmosphere itself would excite a frictional force which would tend always to keep the same side of the planet toward its primary, while gravitation acting on the mass before it had separated itself from the spiral would tend to cause it to revolve in a retrograde direction. Thus in the earlier times it is very certain that these forces would be much more active than we find them to be at the present day.

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ASSURNAZIRPAL, KING OF ASSYRIA 884-860 B. C.

ASSYRIAN ASSAULT OF A CITY (CAMPAIGN OF SENNACHERIB, KING OF ASSYRIA 705-681 B. C.)

ASSYRIAN CHERUBIC FIGURE—WINGED HUMAN-HEADED LION.

CAPTIVE LIONS RELEASED FROM CAGE FOR THE ROYAL SPORT.

DISCOVERIES IN MESOPOTAMIA.