Ruined Spanish church beside the road from Dzitas to Chichen Itzá.

Portion of the ruins of the Nunnery or "Monjas" at Chichen Itzá.

A Chapter of Ancient American History*

THE wreck of human handiwork touches the heart, and none of us can fail to invest a ruined city with the purple haze of romance. At least, it is safe to say that no traveler in Yucatan and Central America can fail to be deeply stirred by the vestiges of ancient empire that lie scattered through the jungle. The ruins of Chichen Itzá, long famous on account of their size, accessibility and healthful situation, have been explained by fanciful tales or wrapped in impenetrable mystery according to the mood or stock of information of the person describing them. It does not detract from the wonder of this city or the grandeur of its buildings to say that the light of recorded history, somewhat faintly to be sure, shines upon its foundation, its periods of brilliancy and decadence and its final abandonment. But first let us view the monuments that time has spared.

To visit Chichen Itzá, which is situated in northern Yucatan not far from Valladolid, we leave the narrow gage railroad at the station of Dzitas, and then jolt for a never-to-be-forgotten fifteen miles over the solid limestone plain in a vehicle called a *volan*. This word *volan* means in Spanish "they fly," but judging by unhappy experience, "they leave the earth frequently and return

* Reproduced from the *American Museum Journal*.
† Photographs by the author.

By Herbert J. Spinden¹

End view of the North Temple of the Ball Court.

The entire side surface of the North Temple, including the sloping walls of the vault and the round columns in front, is sculptured in low relief.

with emphasis" would be a better etymology to follow. The *volan* is a high, two-wheeled cart which travels at top speed behind several mules. It has no seat for the passenger, but instead a sort of box, hung from a stiff frame, in which he reclines. As this primitive transport

The North Temple of the Ball Court.

View showing the two cylindrical columns. The figures on the sculptured walls have never been drawn or carefully studied. In general the carvings show processions of warriors and priests similar to those of the lower chamber of the Temple of the Jaguars.

Capitol of a rectangular column—lower chamber of the Temple of the Jaguars.

The design shows a grotesque face surrounded by three human figures. The man at the top bears a head-dress of leaves and flowers and holds flowering branches in his hand.

The Story Told By Monument and Temple

lurches along the road, glimpses over the edge of the box may be caught of the tangled jungle on either hand, with here and there a trail making off to some *milpa* or corn-field. Finally, when misused flesh and bone can hardly stand another bounce, we arrive at the village of Pisté with its little cluster of palm-thatched huts. A few moments later, on rounding a curve, we flash into sight of a stone temple crowning a lofty pyramid—and about us lie the ruins of Chichen Itzá, a capital city of the ancient Maya empire.

Northern Yucatan is a limestone plain without streams on the surface, but here and there the roof of a subterranean river has fallen in, making huge natural wells called "cenotes." At Chichen Itzá, there are two cenotes: one, commonly called the Sacred Cenote, was anciently used as a place of sacrifice where human victims were thrown into the pool below; the other, called the Grand Cenote, furnished water for the inhabitants of the city. The name Chichen Itzá means "the mouth of the wells of the Itzá." The Itzá were a tribe, clan or political division of the Maya nation, who have been named the Greeks of the New World.

At Chichen Itzá seven or eight structures are still in a fair state of preservation, but the bush for miles about is filled with heaps of cut stone that mark the sites of other buildings now in utter ruin. The most impressive structure is doubtless the Castillo or Castle—the temple

Castillo of Chichen Itzá.

The Castillo is the loftiest temple mound at Chichen Itzá. The original cut stone facing of the terraces can be seen in places. A wide stairway ascended the pyramid on each side. Base of pyramid, 195 feet wide. Height, over 100 feet.

The Sacred Cenote into which human victims were thrown.

This great natural well is about eighty feet from the rim to the surface of the water. It was made by the falling of the roof of an underground river.

Great sink-hole in the limestone plain similar to the cenote.

Except that the caving in has not reached water level. Such a sink-hole forms a fairy grotto with its cool depths hung with vines and long thread-like roots.

on the pyramid seen as we entered the ruins. The pyramid rises steeply in nine terraces faced with cut stone and decorated with sunken panels, and on each side is a wide stairway with balustrades. The base of the pyramid measures 195 feet and its height 78 feet. The temple on the summit rises an additional 24 feet, so the structure as a whole is more than one hundred feet in height. This temple has on one side an ample doorway with two serpent columns, that lead into a vaulted portico. Directly behind this is the sanctuary. On the other three sides of the temple are doorways giving access to a narrow vaulted passage that leads neither into portico nor the sanctuary. The decoration of the temple consists of sculptured door jambs and lintels, all in bad repair; a mask panel or highly conventionalized serpent head in front view, on the outer walls above each door; two columns, already mentioned, that represent feathered serpents with the heads at the base and the tails serving as the capitol, and an open-work roof ornament reproducing the Greek meander.

From the shaded porch of Mr. Thompson's residence, we look across a lawn where the fountain plays and the orange trees hang their golden fruit, to a splendid relic of ancient glory—the great building known as the Monjas or Nunnery. This rambling structure, richly decorated with grotesque faces and geometric designs, is of especial interest to the archæologist because it shows different periods of growth. In the first place, the substructure of the principal range of buildings has been enlarged several times, as is made clear by excavations leading into the solid mass. The ground level wing on the east was added after the substructure had received its final enlargement. The small chamber at the top of the Monjas, which may be called the third story, was not contemporaneous with the range of rooms beneath it, first because some of these rooms had to be filled in with earth to support the weight above, and secondly because the walls of this upper chamber are plainly made of re-used material. There is good evidence that the sculptured details of certain other parts of the Monjas were taken from the wreckage of earlier buildings. In close connection with the Monjas are two small temples without substructures, the more interesting one being the single-roomed building called the Iglesia or Church. This little temple is decorated with mask panels, and has the front wall elevated one story above the roof, an architectural device known as the flying façade. This flying façade bears three mask panels which differ from each other and which are obviously made up of reused material.

West of the Monjas is the Akat'eib, the House of the Dark Writing, so called on account of some hieroglyphic inscriptions. North of the Monjas is the Caracol or Snail, a curious circular tower with a winding stairway.

Still farther to the north is the Casa Colorada or Red House, an admirably preserved building with a long outer chamber and three inner ones. The flying façade of this building is very pleasing with its mask panels flanked by

frets. Over the center of the roof rises another wall pierced by windows. This architectural detail, commonly called the roof comb or roof crest, is found in this single instance at Chichen Itzá, although often seen in other Maya cities.

Continuing in the same northerly direction, we encounter a temple upon a pyramid very similar to the Castillo, but smaller, which has been named the Temple of the High Priest's Grave. This rather fanciful title comes from a deep shaft on the floor leading down to a small burial chamber. In conjunction with this temple are some small platforms which are believed to have been used as stages for dramas or religious ceremonies. Several of these platforms, having stairways on the four sides, and sometimes sculptured panels, are found at Chichen Itzá.

Northwest of the Castillo lies the Ball Court Group with the famous Temple of the Jaguars. The South Temple of this group is a plain building of little interest, but the North Temple is very interesting because its entire inner surface, including the sloping surfaces of the vault and the round columns in front, is a mass of sculptured detail in low relief. The carvings deal with processions of priests and warriors similar to those on the wall of the Lower Chamber of the Temple of the Jaguars. The Temple of the Jaguars is situated at the southern end of the parallel stone walls of the court. The inner chamber of this temple has excellent frescoes in low relief, while the lower chamber at the base of the wall has painted sculptures. The last group of buildings which we have time to consider is the group of the Columns in the western part of the city. In this extensive ruin there are great rows of columns on platforms as well as several interesting temples. It has been suggested that this part of the city was a market, but nothing that really confirms such a belief has come to light. The temples are mostly of the same general type as the Castillo, with sculptured door jambs and serpent columns. Several of these temples have been only partly excavated. One of the most interesting is the Temple of the Tables, which takes its name from a table-like altar supported on the uplifted arms of small Atlantean figures. So much for the buildings of Chichen Itzá: let us now examine the question of history.

When Grijalva and Cortes sailed their caravels to the low-lying, palm-fringed coast of Yucatan in 1517 and 1518, they found the Maya Indians in a state of advancement that excited wonder and admiration. Yet we know from many documents that not a single one of the great stone-built cities was really occupied at this time. Great

Atlantean figure carved from a single block.

At Chichen Itzá occur table altars, consisting of a flat stone carried upon the heads and hands of figures of this sort.

Photo by F. M. Chapman.

Temple of the Tables.

Showing sculptured door jambs and stone figure used as altar support. These table altars have given the temple its name.

Carved stones from temple walls.

Serpent heads, death beads, and other sculptured figures lie scattered about in the brush, awaiting the careful study of the archæologist and student of primitive art.

The lower chamber of the Temple of the Jaguars.

A mass of interesting sculptures which were primarily painted and which show processions of warriors who bear tributes to various gods.

Detail of the sculptured lower chamber of the Temple of the Jaguars.

The stones seem to have been carved after they were put in place in the wall. Traces of color are still discernible.

trees were growing from the roofs of the buildings at Uxmal, and while Chichen Itzá was a place of pilgrimage and sacrifice, it is pretty clear that the temples we have just seen were all abandoned and in partial ruin. To restore the history of Chichen Itzá, we must review our knowledge of the other great Maya cities situated not only in northern Yucatan but also far to the south and west in Guatemala and Honduras.

The restoration of Maya history depends upon three lines of study which must be carefully brought into relation, each with the others—namely, traditions, inscriptions and natural developments in art. The first of these is, at first sight, most intelligible. Brief chronicles, called Books of Chilán Balam, were preserved at several towns in northern Yucatan. These chronicles were written in Spanish letters but in Maya words by educated Maya Indians during the sixteenth and seventeenth centuries, and were doubtless based upon earlier native documents which contained hieroglyphs and pictures. The events of history recorded in these chronicles are fixed with reference to the katuns or twenty-year periods of Maya chronology. These katuns are distinguished from each other by the numbers one to thirteen, which fall in a peculiar order. Any date in the chronicles is definite for a cycle of thirteen times twenty, or 260 years. But by putting down all the katuns which passed, whether or not there were historical entries opposite them, the Maya historian prevented confusion in the 260-year cycles and actually carried the historical count over a stretch of seventy katuns, or 1,400 hundred years, before the coming of the Spaniards.

Now let us glance at the second line of research—the inscriptions. These are found on monolithic monuments, lintels, tablets and other objects. The inscriptions of the greatest value to the student of ancient American history are those expressing dates in the so-called archaic Maya

Mask panel, front view of modified serpent head, on frieze of Nunnery foundation.

The nose formerly projected a foot or more from the wall. A small human face is seen above the serpent nose.

calendar. This archaic calendar is essentially the same as the one used in the Books of Chilán Balam so far as the length of the katun is concerned, but by another system of naming the katuns, the danger of confusing the 260-year cycles is overcome. Dates in the archaic calendar are exact over vast stretches of time. The most valuable data are found in what is called Initial Series, and of these over fifty have been deciphered. The Initial Series is really a number which records the days which intervene between a beginning day, in all cases the same, and the day given in the inscription. We count the years

A human-like head in the distended mouth of a plumed monster.

The claws of the monster are seen at the bottom and between them hangs the great forked tongue.

us to express this time sequence in terms of years. Space does not permit a full explanation of this complicated subject which, however, the writer has elsewhere given in detail. Suffice it to say that by carefully co-ordinating the three lines of study just explained, an outline of the course of Maya history is made possible. The following

Design on door jamb, showing classical idea of Atlantean support of weight above.

Winding plant motive with intrusive serpentine details, from Chichen Itzá.

from the birth of Christ, the Maya count the days from a beginning day, that according to our system falls about 3,600 B. C. Nearly all the Initial Series dates known occur at the southern cities of the Maya area, but one very important date of this sort occurs at Chichen Itzá. Indeed it is this date which has made possible a correlation of the archaic Maya calendar with the calendar used in the Books of Chilán Balam.

But dates that are simply dates mean very little; to be of value they must be associated with events. Now while we can read the dates in Maya inscriptions, we can do very little with the remaining hieroglyphs that probably tell the significance of these dates. A third line of research enables us, however, to prove what dates are, in all probability, contemporaneous with the monument on which they are found, and what dates refer to the past or future. Progressive changes in style of sculpture and progressive adaptation of superior mechanical devices in architecture enable us to arrange many works of art in their proper time sequence, but do not, of course, enable

names and limits have been suggested for the various periods:

Protohistoric Period.....	235 B. C. to 160 A. D.
Archaic Period.....	160 A. D. to 455 A. D.
Great Period.....	455 A. D. to 600 A. D.
Transition Period.....	600 A. D. to 960 A. D.
League Period.....	960 A. D. to 1195 A. D.
Nahua Period.....	1195 A. D. to 1442 A. D.
Modern Period.....	1442 A. D. to ?

Now let us see what place Chichen Itzá occupies in this historical vista. Several of the chronicles relate that

Sculptured column, Temple of the Tables.

The use of square and round columns at Chichen Itzá transforming the outer room of the temple into an open portico, is a great advance over the simple doorways of the earlier Maya buildings.

The plumed serpent in the sculptured lower chamber of the Temple of the Jaguars.

This may be identified with Kukulcan, the Maya equivalent of Quetzalcoatl. (Drawn from carving shown in first illustration on this page.)

Sculptured column made of drum-shaped sections.

From the South Temple of the Ball Court. The designs represent warriors, reclining figures and a wealth of highly conventionalized serpent heads interwoven in a phantastic pattern.

Panorama of the ruins of Chichen Itzá.

In the foreground at the left are the Nunnery buildings, the smallest, the single-roomed temple figured on front page; in the background and to the right is the Castillo, with its lofty stepped pyramid, while immediately to its left is the Ball Court Group of ruins, including the famous Temple of the Jaguars. Two cenotes are shown, the Grand Cenote at the right of the center, and a second in the extreme central background. The tops of the ruins of Chichen Itzá rise above the tree-tops of a forest which everywhere gives rich color to the plain. The function of the various buildings is thought to have been mainly religious. The names given to the ruins serve only for convenience in description; they may not be appropriate.

Chichen Itzá was discovered during a residence of the Itzá at Bacalar on the east coast of Yucatan. By the term "discovered" is probably meant that the cenotes which made habitation possible were discovered. The settlement was made about 450 A. D. at a time when the southern cities, such as Copán and Tikal, were entering upon their most brilliant epoch. It seems certain, however, that Chichen Itzá was only a mediocre provincial town at this time. Only one dated stone has been found, and this is poorly carved. The date upon it corresponds to 603 A. D. Shortly after this date, Chichen Itzá was abandoned, and the Itzá went to the land of Chanputun, near Campeche, where they stayed according to the chronicles, for 260 years. Somewhere near the middle of the tenth century, they made their way back to the north and re-established Chichen Itzá. At about the same time, Uxmal and Mayapan were likewise founded, and a league between the three was instituted. This League of Maya-

pan, as it is commonly called, endured for over 200 years and controlled the destinies of northern Yucatan. Trouble between the allies broke out with the Plot of Hunac Ceel, the chief of Mayapan, and as a result the hereditary ruler of Chichen Itzá, whose name was Chac Xib Chac, was driven out in 1176. A disastrous war, lasting 34 years, took place, and the ruler of Mayapan seems to have enlisted seven warriors from the highlands of Mexico under his standard. These men have Nahua names. In all probability, the conquered city was given over to them as the spoils of war at the end of the long contest. After this, however, there seems to have been little in the way of peace. Civil wars rent the land, and while we cannot put an exact date on the final fall and abandonment of Chichen Itzá and Uxmal, it is probable that these events occurred somewhere in the fourteenth century. Mayapan, the last city to survive, fell in 1442, almost a hundred years before the Spaniards

made their first really permanent settlement at Mérida.

When we try to arrange the buildings of Chichen Itzá in their proper order of erection, it is remarkable that so many of the finest structures clearly belong to this last short period when the city was in the hands of foreign rulers from the distant Mexican highlands. It is unlikely that a single structure of the first occupation of Chichen Itzá will be found in a good state of preservation. The stone with the early date that has already received comment is a lintel that was probably taken from an old building and is reused in a later one. There are, however, a number of structures that probably date from the second occupation when Chichen Itzá was a purely Maya center. The Akat'cib and the Casa Colorada are Maya structures without a trace of foreign influence. Most of the Monjas Group is also Maya without modification. The Castillo, the Temple of the High Priest's Grave, the entire Group of the Ball Court and the Group of the Columns date in all probability from the foreign régime, and consequently cannot have been erected before the last quarter of the twelfth century. The architecture of these buildings as well as the sculptures show strong resemblances to work in Tula, Teotihuacán and other sites in the valley of Mexico. The native religion seems to have suffered from the foreign infusion also. New forms appear in the religious art, and it is not unlikely that the human sacrifice at the Sacred Cenote was inaugurated by the intruders. The game played in the Ball Court seems not to have been known by the Maya in earlier times, and indeed the only examples of ball courts in Yucatan are seen at Chichen Itzá and Uxmal.

This, in brief, is the story of Chichen Itzá. Founded when the Huns, under Attila, were battling with the failing armies of Rome, it was abandoned for the first time when Mohammed was laying the heaven of Arab conquest. Re-established in the era of the Saxon kings, it flourished during the Crusades, and lost its freedom to a foreign power when our fathers were struggling for the Magna Charta, and sank into oblivion while the English and French fought out the Hundred Years' War. Surely a city with such a history can hardly be dismissed as void of interest and inspiration.

Strength of Shafting Required to Transmit a Given Horse-power at Different Speeds

Table Computed and Prepared by C. H. Clark

d = Diam. of Shaft

R = R. P. M.

Substitute 100 for 50 if shafting is not well supported

$$H.P. = \frac{d^3 R}{50}$$

$$d = \sqrt[3]{\frac{50 \times H.P.}{R}}$$

$$R = \frac{H.P. \times 50}{d^3}$$

Copyright 1914 by C. H. Clark

Plasmodium Tenue, a New Malarial Parasite of Man

SIR RONALD ROSS has just communicated to the Royal Society of London the discovery, by Dr. J. W. W. Stephens, professor of tropical medicine at the University of Liverpool, of what he believes to be a hitherto undescribed malarial parasite of man. It was first noticed in a blood-slide from a native child in the Central Provinces of India. A striking peculiarity of the Indian parasite is its decided irregularity of form as compared with the regular, almost monotonous contour of the "rings" of the malignant tertian parasite (*Plasmodium falciparum*). The new species, to which the name *Plasmodium tenue* has been given, is extremely ameboid, judging from the stained specimens. Thin processes often extend across the cell or occur as long tails to more or less ring-shaped bodies. There may be several of these processes, and they may give the parasite most fantastic, irregular, web-like shapes. The cytoplasm is very scanty. The nuclear chromatin is out of proportion to the volume of the parasite, and the abundance of the chromatin masses, as well as the marked irregularity in their distribution, seems to be characteristic of the parasite.—*Journal of the American Medical Association*.

Some Statistics on German Universities

SOME interesting statistics about German universities are given in a recent issue of the *Chemiker-Zeitung*. During the academic year, August, 1911, to August, 1912, 4,455 doctors' degrees were given, 83 more than in the previous year; these were divided among the various faculties as follows: Theology, 55; law and political science, 1,265; medicine, 1,343; philosophy and natural science, 1,792. The percentage of students who receive degrees in the different universities and faculties varies from 87.6 per cent in law at Erlangen to 0.2 per cent in law at Berlin.

The salary of rector varies in an astonishing way at different universities. This position is, of course, quite different from that of president in an American university, for the rector is elected from the faculty by his colleagues for a short term. In Berlin the rector's salary is about \$9,250, in Kiel \$800, while in the Academy at Braunsberg it is slightly more than \$20. The average is about \$1,500. The salary of the deans of the various faculties varies even more, ranging from \$5,500, the salary of the dean of the faculty of philosophy at Berlin, to \$5, the compensation of the head of the theological faculty at Halle.—*Journal of Industrial and Engineering Chemistry*.