

A NOTICE OF YUCATAN WITH SOME REMARKS ON ITS WATER SUPPLY.

BY DAVID CASARES.

As I do not pretend to offer these remarks as the result of serious scientific research of my own, but rather as more or less well compiled information gathered from such sources as I have had within my reach, to which I will try to add something of my own observation, I deem it necessary to precede them by a short notice of the country they refer to.

The peninsula of Yucatan is the most southern country of North America, projecting northward from its extreme point and forming the eastern side of the Mexican Gulf, which is barred on all sides but this one, where two outlets are found, the northern one between Florida and Cuba, and the southern between this island and Yucatan, the extreme point of which at the northeast is Cape Catoche, only a hundred and fifty-three miles from Cape San Antonio on the opposite coast of Cuba. This narrow passage, Humboldt presumes was made by the eruption of the sea into the Gulf. It is situated between 18° and $21^{\circ} 32'$ North latitude and $6^{\circ} 37'$ and $12^{\circ} 5'$ longitude east of Mexico. The situation of Yucatan gives it great advantages to communicate with other countries, its extensive coasts being bathed on the north and west by the Mexican Gulf, and on the east by the Carribean Sea, while on the south it is bounded by Guatemala. These advantages are greatly diminished, however, by our want of good ports. Campeche on the bay of the same name has a very shallow bottom, and so is the case with Celestun and Puerto de la Asension. Sisal, our port for foreign commerce until 1871, and Pro-

greso, our present port, besides being but a little better off in that respect, are without protection from storms.

The area of the peninsula according to the most accepted computations is 8,363 $\frac{1}{2}$ square leagues, equal to 146,825 square kilometers=56,739 miles. This land to which historians have ascribed different names as those of Ulumilkutz and Ulumilceh, the land of wild turkies and deer, and Yucalpeten (the neck of the peninsula), was most probably called Mayab, land of the Mayas. The Spaniards on their first arrival in 1517 called it Yucatan, and from that date, through the conquest, and through the colonial government, and for thirty-seven years after our independence, that name was applied to the whole peninsula as one community; but in 1858, the district of Campeche towards the southwest, became a state under that name, and very lately in 1903 the general government declared the eastern section which had just been wrested from the Indian rebels who possessed it for over fifty years, a federal territory under the name of Quintana Roo, one of the most illustrious founders of the Mexican Independence, born in this state. The English colony of Belice fills the southwestern corner of the peninsula.

This is now politically divided thus: the state of Yucatan covers an area of about 18,018 square miles and has a population of about 315,000 inhabitants, that dwell in seven cities, 14 villas, which may be called towns, 157 villages, and 2493 rural establishments spread over 16 partidos, which may be called districts; Merida, Progreso, Tixcocab, Motul, Hunucma, and Acanceh, first group; Yzamal, Temax and Sotuta, the centre group; Maxcanu, Ticul, Tekax and Peto, the southwestern group; and Espita, Valladolid and Tizimin, the eastern.

The state of Campeche comprises the five partidos of Campeche, Carmen, Hecelbakan, Champoton and Chenes, that contain two cities, 8 villas, 25 villages and 350 haciendas, ranchos and small plantations, spread over 19 $\frac{2}{3}$ sq. miles.

The Quintana Roo territory was formed by sections of the partidos of Valladolid, Tizimin, Sotuta, Tekax and Peto, and it has about 8,000 inhabitants, the capital of which is Chan Santa Cruz, the old headquarters of the rebels for half a century, at the distance of 220 miles from Merida, with a few small seaports.

The colony of British Honduras, the boundary lines of which were definitely settled by the Spenser-Mariscal treaty, has about 5,000 inhabitants dwelling in the capital Belize and in a few towns and rural establishments.

The aspect of the country is that of a long extended plain that goes on rising gradually from the water's edge to the foot of a ridge called the Sierra, which begins seven miles from the town of Maxcunu, in the western part of the state, and follows a winding course to the east and the southeast for the distance of ninety miles, and after leaving on its northern slope the picturesque towns of Muna, Ticul, Oxkutzcab and Tecax disappears near Kambul in the district of Peto. This Sierra is called Puc in Maya; its maximum height is 500 feet above the sea level, and is a rocky and barren structure from its beginning to about six miles before Tecax, where a stratum of rich vegetable soil begins to appear.

There is another branch of hills forming a broken chain that starts at a short distance from the coast, below the small town of Seybaplaya in the bay of Campeche, some of the peaks of which attain a considerable height. This runs parallel to the sea-side for a short distance, then it turns round forming a sort of amphitheatre where the city of Campeche is beautifully situated, after which, following a northern direction by the sea-side for two miles beyond, it turns to the northeast, goes on crossing the district of Hecelchakan and after following its course to the east and southeast, it approaches the lake of Chichankannab, near the end of the first ridge. From this point this range takes a southern course in a broken line, and goes to join the great chain

which under the different names of Rocky mountains, Sierra Madre, and Andes are the backbone of the American continent. This system is not a continuous chain like the first ridge. It is formed by a series of high hills or peaks called Uitzes, which are separated by narrow valleys the surface of which is at least as high as that of the first Sierra, and they are covered by a thick bed of vegetable soil, proper for the cultivation of corn, sugar-cane, tobacco and most tropical plants.

The plain that we mentioned as stretching from the north coast to the foot of the first Sierra, and as being of calcareous formation comprises several zones or belts. The first one extends over a great part of the peninsula from the village of Buctzotz in the district of Temax, about fifty-four miles to the northeast of Merida, to the district of Hecelchakan in the state of Campeche. This belt rests on a bed of limestone covered by a thin layer of vegetable soil and comprises the district of Merida, Acamceh, Yzamal, Maxcanu and part of Hecelchakan. Here corn, beans, and other articles of food, cattle and horses were raised to some extent, but now hemp, for which the soil is very well adapted, is raised on a great scale, and that has not only saved this state from poverty, but it has made of it one of the most prosperous of the Mexican confederacy. From Buctzotz eastward to Yalahau and from Hecelchakan to Campeche, the ground though still stony is good for the cultivation of sugar-cane, rice, etc., and improves as we advance, the soil becomes more moist and the woods are thicker and higher.

On all sides of these tracks, that is, from Yalahau on the northeastern coast to Bacalar on the southeast, and from Campeche to Champoton in the west and to the Sierras in the south, the soil attains all the luxuriance and richness of the tropics, and while all the produce of those regions can be got there, magnificent forests of a great variety of trees cover also those extensive grounds.

The lands around Ticul are of an intermediate quality, between these and those of the north, and they are still better from Tekax and Peto to Chichankanab and Saban.

If we draw a cross section or profile from the port of Progreso through Merida, Ticul, and Tzibalchen to the southern boundaries of the peninsula and Guatemala, we find first a very narrow strip of sand along the shore, then a belt of moving monticules of sand from three to eight hundred yards wide covered by a thin coating of thorny weeds and small palm trees, bordered by long patches of salt beds. Next comes the Cienega, a marshy kind of stream with a bottom of white mud, full of water weeds, two or three miles wide, dry in the dry season, with a narrow thread of water in the centre, and overflowed in the rainy season, where some islets called Petenes are found here and there, and also interrupted now and then by a peculiar kind of stream called Ojo-de-agua (water-holes). Next comes the Savana or prairie from a mile to a mile and one-half wide, which gradually disappears, giving place to a very stony formation called Tzekel, poorly covered by thorny shrubs, some lonely palm trees and wild hemp plants. This rough stony bed extends for about eight miles changing then to a better soil upon which Merida stands over 28 feet above the sea level and 28 miles from Progreso. The ground goes on rising with a smooth grading for eighteen miles more, at the end of which the surface becomes more and more rugged, so that in the railroad lines, cuts fifteen feet high are formed. For six miles before getting to Ticul, the approach to the Sierra is known, the layer of earth growing thicker and the color of it changing to a darkish red.

Two miles from the city of Ticul, the foot of the Puc is reached, the ascent to the summit of which is a mile long, its height being four hundred feet above the level of the plain. The descent on the opposite side is at most one-fourth the ascent, coming down then to a high table land

that stretches from the west of Santa Helena to the borders of Chichankanab Lake over an area twenty-five miles wide from north to south. Here the most magnificent ruins of the country are found: Uxmal, Santana Tabi, San Francisco, etc., which afford a wide field of study to the scientific man and interest to the mere tourist. Bordering this section on the south the broken chain of hills called Uitzes within the limits of the inhabited sections of the peninsula, the line of which may be traced through the villages of Tzibalchen, Yturbide Xul Becanchen.

Beyond this line an extent of land supposed to be of no less than eight thousand square miles, stretches to the province of Peten in Guatemala, covered by a thick and uninhabited forest only crossed by three paths that start from Campeche and Bacalar to the Lake of Peten, through stations placed far from each other.

Now if we examine a map of Yucatan, we see that from the Champoton River that empties into the Campeche Bay, on the south end of the western coast to the Manatin river that empties into the Ascension Bay, about the middle of the opposite coast, there is no river or stream whatever worth the name, they are only small inlets of the sea or cuts made by the heavy showers of the rainy season. The Champoton River has a course seventy-five miles long, from Lake Jobonochac and is navigable by small craft of from 10 to 15 tons for the distance of 15 miles inland. The water courses of the eastern coast are of little importance, even those of San Jose and Hondo that water the extreme southern portion. As for the Nohbecan (the great stream in Maya) the Pocayxun, the Palizada and some brooks, they are only profitable to a small section of the southwestern corner of the peninsula.

Yucatan is very poor in lakes, those only that deserve that name are the Laguna de Chechankanab (small sea) about 20 miles in length by less than three wide; that called Ocon from which the Manatin River takes its course

seventy-two miles from Ascension Bay, and that of Jobonochac.

We will finish this notice of the physical conditions of Yucatan with some remarks on its climate.

From the observations taken in the observatory of the State Literary Institute, I find that in 1903, the lowest temperature taken was $7^{\circ}.2$ Centigrade= $44^{\circ}.96$ F. on several days in December, and the highest 39° C. = $102^{\circ}.2$ F. on the 19 of April, though on the very first of that month the minimum registered was $13^{\circ}.3$ C.= $55^{\circ}.5$ F. The highest monthly average was $29^{\circ}.1$ C.= $80^{\circ}.38$ F. in June; and the lowest, $21^{\circ}.6$ C.= $70^{\circ}.08$ F. in December. The average of the minimum noted in the whole year was $17^{\circ}.60$ C.= $62^{\circ}.69$ F. and the average of the maximum $32^{\circ}.9$ C. = $91^{\circ}.22$ F.

In 1904, the lowest temperature was that of $7^{\circ}.2$ C. on the 15th and 16th of January and February= $44^{\circ}.96$ F. and the highest on the sixth day of May, $38^{\circ}.4$ C.= $101^{\circ}.12$ F., though the thermometer went down several times that month to $23^{\circ}.0$ C.= $75^{\circ}.8$ F. The highest average was 28° , C.= $82^{\circ}.4$ F., both in May and June; and the lowest in February $22^{\circ}.9$ C.= $73^{\circ}.22$ F. The average of minimum temperature registered the whole year was $17^{\circ}.8$ C.= $68^{\circ}.1$ F.; and the average maximum $97^{\circ}.34$ F. These differences between the highest and the lowest temperatures are explained by the fact that the heat always diminishes in the night and the early morn.

An idea of the mortality of the country can be had by these numbers: on an average of 315,000 inhabitants, 3,768 deaths were registered in one quarter of a year from the first of July to the 30th of December, 1903; 2,975 from the first of October to the 31st of September; 2,470 for the first quarter of 1904, and 2,960 in the second, up to the 30th of June. The lowest number of deaths registered was that of 808 in March, and the highest 1,348 in July and August.

The cases of yellow fever we have are generally from importation, and they are fatal mostly to Mexicans of the high

table lands of the interior and to Europeans. From the first of January to the 31st of March, 1904, we had 24 cases, of which 14 were cured and 10 fatal. In the second quarter of the year those numbers were 38, 17, and 21 respectively; and in the third they were 17, 9, and 8. As a consequence of the strong sanitary measures taken by our present administrations both local and federal, that scourge has almost wholly disappeared, and to such an extent that during the worst months of this year from May to August we did not have a single case in a period of a hundred days.

We only have two seasons: the rainy season begins about the end of May and lasts till the end of November. Showers are very frequent and heavy during the first three months and go on slacking in number and intensity toward the end. The dry season lasts the rest of the year, March and April being commonly the driest months, during which all vegetation is laid waste and the air is suffocating, not only on account of the natural heat of the season but also because during those months they burn the cornfields that are to be sown at the beginning of the rainy season. The scene then changes rapidly, the leaves renew their verdant hue, and the wild flowers balm the air.

We have no earthquakes as our ground is not volcanic; but we felt something like it two years ago in Merida and Progreso.

From the general description and notice of the physical conditions of Yucatan and such as I have been able to give in a condensed form, it is easily understood that the water supply, not only for the common needs of life but for those of agriculture and all kinds of industries, is a question of paramount importance in the country. I will now try to show how this *sine qua non* desideratum of life and work has been provided by a merciful nature. But before going further into the bottom of the subject, I must state that I agree with Stephens and other explorers who think that at least the northeastern portion of the peninsula was, in a

former period, covered by the sea. That conclusion they draw from the lowness of the coast, from the fact that marine shells are found in the calcareous rocks, whenever they are bored to dig a well; and that these shells are also found at the bottom of caverns far from the sea incrustated in the solid rock, and from the fact that the sea is constantly and perceptibly receding from the coast. In the first zone, potable water of more or less good quality is found within 15 miles inland, a little brackish and hard by the seaside, but improving as you go on, and good for domestic purposes. In Merida, the wells are 27 feet deep and there the water is pure enough and no other was used until cisterns began to be built on a great scale. Following the rule that the farther you go inland the deeper the wells and the purer the water, and that the wells are $28\frac{1}{2}$ inches deeper per mile, we find that within that distance of 40 to 60 miles from the seacoast their depth ranges from 40 to 60 feet. At the first Sierra in Muna, Ticul, and Tekax they are 90 feet deep. Beyond the first Sierra in the region of fine rich lands, once the seat of flourishing cities, the ruins of which are silent witnesses of the high degree of civilization acquired by departed races, and where thriving haciendas and ranchos have them within their borders, the wells are from 200 to 240 feet deep. In all the area comprised between the Pucs on the north and a line that may be drawn from Muna to Calkini in the west, and from there to the southeast through Santa Helena, Uxmal, Santana and San Francisco to the Sierra of the Pucs back again. To the south of this line going into the region of the Uitzes, the few wells that are found there are very deep. Among the most remarkable ones we may mention, is that of Sabaché nine miles to the south of Tabi, dug in the neighborhood of the ruins of that name in the centre of a region where water was not to be found miles around. A hat or a very light object thrown into the well at certain hours of the day will be thrown out again.

The little town of Xul, which means the end, *ultima thule*, a curate whom Stephens knew, dug a well 200 feet deep, in the thirties of the last century at the cost of \$1,500, an enormous sum in those days. Fifteen miles to the southwest of Sabacché is the hacienda Yaxché, half-way between Santa Helena and Bolonchen, 27 miles apart, the noria (well) of which is 240 feet deep, was the only source of water supply of this kind for over two thousand souls that lived in the place and its neighborhood before the Indian war of 1848, when that part of the country was laid waste by the rebel Indians. On the way from Hecelchakan to Bolonchen you find Montebello, a rancho that has a well 270 feet deep, and farther to the southeast Chicmuc with one 312 feet deep, Yalmon with one 468 and Uechil with another about the same.

Then comes the town of Bolonchen in the neighborhood of which is the famous cave called Xtacumbilxunan. In that same neighborhood there is an old noria or well, the digging of which had probably been given up many years ago. The government of Campeche ordered the continuation of the work, and water was found four hundred thirty-two feet underground, but it affords a very meagre supply. The wells of Yalnom and Uechil, in the very heart of the Uitzes country, were bored by drilling carried on by a scientific method and the water is hauled out by powerful pumps. The deepest well now in use is that of the rancho Polyuc, about fifteen miles south of San Antonio, a station on the Merida and Peto railroad, ninety-three miles from Merida. This was also drilled by modern scientific methods, and water was found at the depth of 552 feet, through various layers and strata of earth, common rock, clay, flint and granite. The work went on steadily for four months and its cost amounted to fourteen thousand dollars, Mexican money. Still we read in Stephens's most interesting work, of wells that had to be given up at the depth of 600 feet in those high regions. To finish this part of my

subject, I will mention a row of ancient wells that are found along the road from Teabo to Chacksinkin, about seventy miles to the southeast of Merida, that are said to have been dug without boring through the rock, but simply by digging the earth that filled the crevices to the depth of ninety feet. It is also worthy of remark that in the town of Chapab in the region called Sierra-Baja, because the ground rises some fifty feet above the level of the plain on which Merida and the centre districts stand, the wells are only eighteen feet deep; and those of Sotuta in the centre of the state are twenty-seven feet deep. Both places are built on low patches of ground.

If we were to depend on the wells only for the supply of water, the greater part of our peninsula could not be inhabited, but fortunately there are other sources provided by nature, such as the Sartenejas, the Aguadas, the Ojo-de-agua and the Cenotes.

The Sartenejas are natural hollows or cavities found in our rocky grounds. They get full of water in the rainy season, and their supply holds out for some time into the dry season, as there are many of them and their dimensions sometimes are five and six yards long, two to three wide, and two to three deep. They afford considerable help to places where water is scarce, and some small ranches have no other source. Near Xul there is a sarteneja 90 feet in circumference and 10 deep.

The Aguadas are much more important than the sartenejas, and they are very numerous, and often of considerable size. They can be classified in two groups, natural and artificial. The first group follows the broken line that can be traced from the district of Tizimin in the northeast, and goes through those of Espita, Yxamal, Sotuta, Acanceh, Ticul, Maxanu and Hecelchakan towards Campeche. They are mostly mere pools of unwholesome water deposited over a muddy bed, with organic substances in suspension and of a dark bluish color. They are full during the rainy season;

in the dry season their level generally goes down, some become dry altogether, but many of them hold out all through it. The decomposition of organic matter they contain, has a very unhealthy influence on the air of their surroundings where paludism is very common, and the aguadas are generally only good for cattle to drink. They are seldom over one hundred feet wide, though some are much larger and there is one named Yalahua in the district of Acanceh, near Homun, that is seven hundred yards across, which never gets dry.

The artificial aguadas are found in the high hilly ground of the interior at the bottom of the basins formed by the hills, where the rain water comes naturally to be deposited. Some have a bottom made out of stones and some have not such stones, and they are of all sizes—true works of art they are—that show the ingenuity and attainments of their builders. The bottom is made with large blocks of stone with a plain surface several layers deep, and so set alternately as to cover the joints, which are in most cases filled with clay, though this material is not always found in their vicinity. In the centre of the best built aguadas, ancient wells are found from four to five feet in diameter with their sides made of smooth stones put together without mortar, and around their margin there are several hundreds of pits called Casimbas. The water filters into the wells and pits and when the supply that fills the aguada is exhausted, these casimbas come to the rescue. These bodies of water are so considerable that in years of protracted drought, not only the population of the ranchos nearby, but also that for miles around get their supply from them. The following description of one of these curious water works differing somewhat from the common type, made by the acute observer mentioned before (Stephens), gives a good idea of them:

“Near the rancho Jalal, between Becanchen and Tekax, near Macoba, there is a picturesque aguada of a differ-

ent construction from the others, which was discovered while digging holes in search of water. It had a square platform at the top and beneath was a round well, faced with smooth stones, from 20 to 25 feet deep. Below this was another square platform, and under the latter another well of less diameter, and about the same depth. The discovery of this well induced further excavations until upwards of forty wells were found, differing in character and construction. Those were all cleared and the whole aguada repaired, since which it furnishes a supply during the greater part of the dry season, and when this fails the wells appear and continue the supply until the rain comes on again."

The Ojos-de-agua, or water holes, are found on the northern coast, though that section is the most barren, being as we said before, a wide extended plain of limestone formation, in spite of which the supply of water is more abundant here. The character of these remarkable phenomena is thus described by Humboldt, though he did not see them and obtained his information from other sources: "On the northern coast, at the mouth of the Lagartos River, at four hundred miles from the shore, some springs of sweet water ooze out through the salt water. They are called Bocas (mouths) of Conil. It is probable that hydrostatic pressure forces the sweet water to rise above the salt water after breaking the banks of calcareous rocks, through the fissures of which they have run thither." These Ojos-de-Agua, water springs, are not rare along the coast. In the neighborhood of Chuburna they are very numerous and so they are in other places. I lately saw two very remarkable ones, one of them by the little port of Yalahau, 194 miles east of Progreso, and another one near Chiquila Beach, some eight miles farther on. This is now of great use, its waters being carried by means of powerful machinery, pumps and pipes, three miles inland to feed the great deposits of a sugar plantation, where water is scarce and of bad quality.

The Cenotes are not only the most curious and remarkable phenomena that make the study of this country interesting, but they are the best gift that nature could bestow upon it as a compensation for the want of lakes and rivers, partaking as they do of the character of caves and springs, or as most people think, of subterraneous rivers. They were called cenotes by the Spaniards from their Indian name, Tzonot, and may be classified into two groups. The first is found in the western section, and the second one in the eastern section of the country. The former are great caverns with imposing, yawning mouths that open into great chambers with high fantastic looking vaults, from which hang enormous stalactites formed by the filtration of water. From these chambers, halls, or vestibules winding passages branch off in every direction. These are generally dark, but they are sometimes lighted by some body of light that comes from above, and they lead generally down to the deposits in the deep recesses of the cave. In these cenotes, the stalactites and stalagmites are more numerous and varied, and a soft noise is produced by the constant falling of a drop of water, that like a crystal thread comes down quietly and steadily right into the great cistern or basin formed by the calcareous sediment, where these drops keep an everlasting cool and clear delicious liquid.

Among a great number of these caves, we may mention that of Talchaquillo, not far from the ancient capital city of Mayapan. Here the water rises in level during the rainy season, and goes down in the dry season; but they never disappear altogether. Beautiful specimens of these natural and useful curiosities are those of Loltun (the flower cave), near Oxkutzcab and Sajcabha (white earth water), near Tekax, both of which are said to be about a mile long, but they have never been thoroughly explored. In the district of Chenes (the wells), there are several of them. In a place called San Jose, six miles from Noh-Yaxché, there is a regular grotto at the bottom of which very good

sweet water is found. And fifteen miles from Tzitzbalchen, there is a small borough called Cumpich, inhabited wholly by Indians, that get their water from a grotto with an oblique entrance, at the bottom of which going down a ladder, there is what seems to be a natural spring known for ages. But the most remarkable of these caves are those of Xcoh and Chack, and more than all of them is that of Xtocumbil-Xunam, which is a perfect wonder. That of Xcoh, three miles from Santa Helena, formerly called Nohcacab, is in all ways remarkable. A popular tradition made it marvellous with the Indians, who asserted that there were to be found in its winding passages and chambers, sculptured figures, a great square adorned with columns that upheld a vaulted roof, a great polished table and more interesting than all these, a covered way to Mani, twenty-seven miles away. As it is, as you go through crooked passages, so low at times that you have to crawl to get on, as you cross large chambers and go over a feeble set of poles, put up for a bridge over a yawning chasm, and up steep rickety ladders until you get to the water basin, you meet many objects that an excited imagination easily takes for sculptured figures and the like.

There are two things that call your attention in this descent several hundred feet long. For about a third part of the distance a strong current of wind takes away your breath. And next there is all along a track some three inches deep, that Stephens rightly conjectures could not be easily cut by the foot-step of a straggling population, but by the constant treading of the inhabitants of the city, whose ruins are found in the neighborhood without any visible means of supply of water. As to the passage that leads to Mani, that is stopped by the natural closing of the rock. The cave of Chack, a little farther from Nohcacab, is on the western slope of the first sierra. This has also precipitous descent through perpendicular holes, caverns, chasms and dark passages, to which you go down by nine

different ladders to the bottom, where a deposit of cold water is at last found, at a distance of two hundred feet from the ground in a vertical line, and about five hundred from the mouth of the cave. This descent is so fatiguing and dangerous that as an exception to what is seen everywhere else, only men and never women go down to take and carry out the water. The so-called wells of Bolonchen and Becanchen, constitute a singular phenomena. The town of Bolonchen belongs to the Chenes district and is ninety-four miles from Merida and forty-five from Campeche. That name means "nine wells," which are found within the public square, and they seem to be but holes in the rock or circular deposits with an interior connection with one another, getting their supply by the filtering of rain water from some unknown source, from which it goes slowly to these deposits that are found only a few feet from the ground, and where water holds out seven or eight months in the year. Becanchen is a town thirty-one miles from Merida. Its name means "well with a current," and it is situated at the bottom of one of the table-lands of the second cluster of hills. Several wells are found in the plaza or public square, the surface of which is a ledge of stone and as the bottom and sides are of solid rock, the waters that filter through the fissures of the ground are kept there for a long time. In the declivity of the hill below the square, the stream that gives the name to the town gushes from the rocks filling the basin beneath with clear water. These wells are true oases in these dry and high grounds.. I said that the cave or Cenote of Xtacumbil-Xunan, near Bolonchen is a perfect wonder, and so it is. That name means "the hidden lady," referring to a popular legend.

Entering a rude, lofty and abrupt opening under a bold ledge of overhanging rock, you go into a wild cavern, which on advancing becomes darker, but after going down two rough ladders, you get to the brink of a great perpen-

dicular descent, where there is a third ladder ninety feet long that leads to the bottom and where a great body of light comes from the surface of the ground 210 feet above. Still going down this immense chamber where gigantic stalactites and great blocks of stone assume all kinds of shapes, through crooked and dark passages, sometimes so steep that you have to go up four rude ladders more, branching off in different directions, you get to seven deposits of water, called each by the name that pretends to show its peculiar quality, at the oblique distance of about fourteen hundred feet from the mouth of the cave, and at a perpendicular depth of four hundred and fifty. These basins are called Putzulha (water that runs away), Chachac-ha (red water), Sallab-ha (spring water), Akab-ha (dark water), Choco-ha (warm water), and Chimes-ha from the name of an insect that is found there. When the supply of water in the wells of the town failed, the whole population had no other source but that, and they inaugurated the season of this painful task by a great feast held during one day each year in the spacious hall at the foot of the great ladder.

The second group of cenotes are found scattered over the eastern part of the peninsula, starting beyond Acanceh and stretching to the district of Sotuta, Ticul and all the eastern districts. They are much more numerous in the three first that were mentioned. They are immense circular holes from sixty to two hundred feet in diameter, with a perpendicular depth of from fifty to one hundred feet with rocky sides that go to the bottom, where great deposits of water with a current are found. The bottom is not always reached and their level does not change. Not infrequently a small kind of fish called bagre is found there also. They all have a name, according to the habit of the Indian of giving one to natural objects of all descriptions, and as a general rule, it is a compound word that ends with the syllable ha (water) more or less well expressed, and

that of some quality that they ascribe to it, as for instance, Chochola (brackish water) Yaxcaba (water on green soil) and that name is the same one as that of the place where they are found, chiefly in rural localities. Mr. Molina, in his remarkable history of the discovery of Yucatan gives the names of thirty-four cenotes that were best known before the conquest; but there are a great many more of them: viz. Yaxcaba, Tabi, Cuzama, etc. Among the most noted I will mention two in Valladolid, over one of which the old convent was built; that of Yaxcabah right in the middle of the plaza, sixty feet from the surface of the ground, and with a body of water fifty feet deep, and that of Tabi, of which our historian, Cogolludo, speaks of the appearance of a fine palm tree when the rays of the sun struck full into the surface of the water. This is also in the plaza of that little village once famous for a beautiful church now going to ruin. Finally I will mention the far renowned cenotes of Chichen-Ytza, visited by Bishop Landa in 1560, only eighteen years after the foundation of Merida, by Gogolludo and by all the archæologists and travellers who have come since then to study our stately and magnificent ruins. The first cenote, and the one nearest the cluster of the ruined buildings is like all of this group, a great hole with rocky perpendicular sides on which a steep winding path leads to the water's edge, a path that seems to be artificial. Somewhat different from others of the same character, this cenote is oblong, about three hundred fifty feet in length and one hundred fifty wide and its sides rise sixty odd feet from the surface of the water.

The sacred cenote which to this day is held in admiration and awe, not only by the Indians but by most people that visit it, is about four hundred fifty feet north of the Castillo, the superb structure which standing over a lofty terrace in the shape of a pyramid, overtowers the plain and catches your eye as you approach the field of ruins. A paved way several inches high leads to it, through a

thick forest. According to Mr. Thompson's* measurements this famous piece of water is some hundred and fifty feet in diameter, the surface of the water is seventy feet below the ground, while its depth is forty feet and the thickness of the layer of mud that is found there is thirty feet. The water is of a greenish hue, due probably to its great depth and to the shadow reflected on its surface by the trees that grow on the brink of the cenote, giving it a savage, mournful appearance enhanced by the associations recalled by a small temple that stands on the very brink, and which was probably connected with the superstitious and barbarous practices for which this mysterious well was used. Indeed it was a place of pilgrimage for the ancient Mayas, a holy place which with the sanctuary of Kabul in Yzamal, and that of Cozumel, connected by well built causeways that traversed the country, some vestiges of which still exist, was held in great veneration; and to these they repaired when a public calamity threatened the land, as the loss of the harvests, a long drought or impending war. The pilgrims came not only from other places of the peninsula but also from the neighboring provinces of Tabasco, Chiapas and Guatemala. The pilgrimage was carried on with great solemnity, and all along the way they went on visiting the old temples they found and carried their offerings, consisting not only of the richest objects they could get, but also of animals and human beings, preferring for the sacrifices the most healthy, vigorous and handsome, which were probably whirled down from the little temple already mentioned. Some fragments from Landa's work will illustrate our subject: "After the Spaniards went away, as the supply of water failed in the land, and because they had spent all their coin during the invasions, a great starvation ensued, and the Xius, Lords of the Mani, decided to offer solemn sacrifices to their idols, taking male and female

*Mr. Edward H. Thompson, United States Consul at Meriden, author of "A Page of History" in this number of the Proceedings.

slaves to throw into the well of Chichen-Ytza; and as they had to go through the town of the Cocomes, their capital enemies, whom they thought would renew their old grievances in such a crisis, they sent a message begging them to go through their land, and the Cocomes betrayed them, complying with their request." Paragraph XIV, 80th page. On page 158 he says, "They held Cozumel and the well of Chichen-Ytza in the same veneration as do pilgrims now Jerusalem and Rome, and so they used to visit them, carrying their offerings chiefly to Cozumel, as holy places, and when they could not go they sent them." Again I copy this from page 344. "They had the habit then of throwing into this well living men as sacrifices to their gods in time of drought, and they thought that these would not die though they never saw them again. They used also to throw precious stones and the things they most prized. Just on the brink of the well there is a small building where I found all kinds of idols in honor of all the gods of the land like the Parthenon in Rome." What Landa, Cogolludo and all other writers had narrated from mere heresay, one of the distinguished members of this Society, Mr. E. H. Thompson, has had the satisfaction to realize, bringing to light the truth of those statements, by diligent and intelligent work, the results of which I will not mention as that grateful and honorable task belongs exclusively to him.

The general belief is that these cenotes, at least those that belong to the second group, are subterraneous rivers, as it appears by the current of their waters, their level, their great supply, which does not seem to diminish, and which is probably fed by sources and streams of an origin as little known as the currents themselves. There is, nevertheless, a phenomenon noted in this country that may perhaps explain their origin, and that is the great sewers called Xuches in Maya, found chiefly in the second region of the high hills. These Xuches, the surface of which keeps closed during the dry season by a layer of thick chalky earth, in a thick

compact mass, which in the rainy season is softened by the great quantity of water that overflows the low plains, the fissures are opened and the waters rush into them, carrying all that comes in their way. These bottomless sewers are found in great numbers in the districts of the eastern portion of the peninsula and in those of Sotuta and Bacalar; and it is to be deduced that these subterraneous rivers are fed by them, that they keep on their course to our low coasts, and that they are the sources of those springs of sweet water like the ones of Conil and of many other places. The words quoted are a resumé of the explanation given by Messrs. Regil and Peon in a good statistical work published in 1853. Some think that these cenotes have their source among the mountains of Chiapas and Guatemala. May it not be also that those that have no current are the outlets of great subterraneous lakes, some of which are connected with one another? The satisfactory solution of this puzzling question will not probably be found till the geological study of the country is carried to a greater extent. So far we have only the data got by boring in search of an artesian well in the city of Merida in 1864, and carried on afterward to the depth of eight hundred feet, and the data acquired by Mr. Agnew, manager of the gas company of Yucatan in another quarter of the same city, where he drilled to the depth of 2,240 feet, which operation gave him very curious and unexpected results.

The question of the supply of water of most of the ancient cities is still a matter of study. The Chaltunes or cisterns found in their neighborhood, do not seem to be of sufficient capacity, being as they are subterraneous dome-shaped structures, those found at Uxmal with mouths but eighteen inches in diameter, which increase to 7 feet, 6 inches below in the body of the cistern, and 10 feet 6 inches perpendicular from the mouth.

Of the great cisterns that are to be found in many quarters where water is scarce, the most remarkable are those

built by the curate of Rodriguez in Xul, and are of a more modern construction. Mr. E. Ancona and other historians conjecture that the frequent migrations of the Mayas and most of the wars the different tribes waged against each other were caused by the want of that element.

The process by which water has been hauled from the bowels of the earth like that of all new countries in their evolutions towards progress, is the same one with some slight difference. In the first place we ought perhaps, to mention the primitive well, older than Jacob, as we learn among other sources from the beautiful story of the woman of Samaria, in which the traditional bucket and rope are used. When the wants are greater and the depth of the well is considerable, they have a horse to haul out the buckets; and when the requirements are greater still, as those of an hacienda, the noria, a Moorish apparatus, is needed. This noria is a rudimentary, rough, wooden machine, set over the mouth of the well, the horizontal section of which is about eight feet by three, made up of two wheels, the vertical one has a cage for a felley formed by arms that engage with those of the horizontal wheel, and drive it, while a string of buckets of different kind of material, such as leather, the bark of trees, or tin, hung over the felley of the horizontal wheel, follows the rotation of both of them, imparted by a lever attached to the top of the hub of the vertical wheel, and pulled by a horse, makes them go round the well and carries the water out. This noria gives good service where there are no pumps and it only wants a horse to pull the lever.

Haciendas that have a population of one hundred souls and some two hundred head of cattle and horses only need one. Uyalceh, where they have about a thousand animals to water and a population of over one thousand, more than half of whom go to get their supply there, have two norias constantly at work, and that is all they want. For the last forty years, steam pumps are found in almost all

haciendas of any importance, and for the last ten or fifteen years, wind mills of which there was only one in the country in 1882, number now over twelve hundred in Merida alone, and their use extends rapidly.

I beg your pardon, gentlemen, for bringing these remarks to an end by saying a few words in favor of my country, impelled by the love that all men feel for their native land. In spite of the obstacles and difficulties I have mentioned, and perhaps owing to these very causes, the state of Yucatan, with a population of 315,000 inhabitants, thinly spread over an extensive territory, has accomplished a fair share of work in the way of progress. Yellow fever has been almost completely expelled from its borders. Education has been promoted as much as its financial conditions allow. With a budget of \$2,653,996, Mexican money, there are 343 public schools, both day and evening, paid by the State treasury at an expense of \$291,052. There are also a large number of boys' and girls' private schools, besides those paid for by the municipalities. The public schools of Merida number thirty-five. With the increased budget now in preparation for the next year, those numbers are to be increased. A model school house for those of that city was inaugurated last September at a cost of \$100,000 M. c., and appropriate buildings for the same purpose are to be erected in other localities. Benevolent institutions have strongly enlisted public attention, and next January the President of the Republic is to inaugurate among other works, an Insane Asylum and a great Hospital that has twenty-eight separate pavilions, built and furnished in accordance with the latest requisites of medical science. A portion of the streets of Merida have been paved with bricks, but generally with asphalt, not only the central ones, but also some in the suburbs. Electric lights began to be used in 1884. Our means of communication have been improved, and there are now six different railroad lines with an aggregate length of over 550 miles; and tram-

ways for public and private use are very numerous and of a very considerable aggregate length. The first telegraph line was laid in 1865. Now they run from Merida to Campeche and to all the chief towns, to the frontiers of the State and to Mexico by the intermission of cable. The telephone is very widely used. Besides the two lines owned by two companies, there are many private lines. The railroads of course have their own telegraph and telephone service. A line of meteorological observatories has been established over the whole state with a full equipment of the most modern instruments. The central station is in Merida, and there is one in the chief towns of the other districts. 986,655,683 kilogrammes of merchandise were imported in the year 1903 from foreign ports to the amount of \$7,011,553, and 67,377,714 kilogrammes worth \$18,729,644 were imported from domestic ports. During that year the exports amounted to 100,883,683 kilogrammes worth \$37,497,169, in which numbers hemp counts for 93,058,666 kilogrammes worth \$33,331,157 Mexican money. In 1904 we exported 606,008 bales of hemp, weighing 97,205,649 kilogrammes on board 167 steamers, which hemp was estimated at the value of \$32,022,563. Of those 606,008 bales, 509,634 weighing 81,093,418 kilogrammes were exported to the United States. Finally a concession for the water supply of the city of Merida has been granted to an American company that has already begun work.

Copyright of Proceedings of the American Antiquarian Society is the property of American Antiquarian Society and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.