

lows: the first, fifth, ninth, thirteenth and seventeenth were painted red and represented the east; the second, sixth, tenth, fourteenth and eighteenth were painted yellow and represented the north; the third, seventh, eleventh, fifteenth and nineteenth were painted blue and represented the west; the fourth, eighth, twelfth, sixteenth and twentieth were painted green and represented the south. The fifth, tenth, fifteenth and twentieth were market days. The year consisted of 365 days. The five intercalary days, were considered very unlucky, were called "nemontemi" or "useless" and were spent in sacrifices, prayer, penitence and fasting.

Around the days of the months is a border of quadrates, each one with five dots and a small border of glyphs. From amongst the borders issue eight rays of light, representing the eight "hours" as we may call them, of the Aztec night. Thus the diurnal period was divided into sixteen "hours," each "hour" being just ninety minutes in our reckoning of time. The hours were announced from the roofs of temples by means of conch shells blown by priests. The dots and glyphs surrounding the days and hours are 335 in number and evidently refer to the days of the year.

The terminal pentagons between the vanes and rays are fifty-two in number, referring doubtless to the fifty-two years in the cycle.

Beyond the borders last described we see twelve curious raguled figures. They are thought to be the sign, Cipactli or Dawn, expressing the daybreak or approach of the Sun from behind the Volcanoes.

There is finally an outer band of quadrates with the sign Acatl or "Reed" in each, surrounded with dots. Examining it closely the discovery is made that this band is divided into two parts, and that each part forms the body of a bimanous serpent. The heads of these serpents are face to face at the bottom of the stone and their triangular tails point to the date "Thirteen Reed" or 1479 A. D. at the top of the calendar. The four ligatures near the tip of each tail symbolize the four periods of thirteen years each, or the cycle of fifty-two years. There are thirteen vertebrae in each serpent, consequently each snake represents thirteen years or the fourth of a cycle.

In the vertebrae of the serpents are seen some peculiar figures that appear to be rays in groups. Counting them, we find there are fifty-two groups in each serpent, and we at once know their meaning to be the cycle.

At the bottom of the rock the two faces that issue from the open mouths of the serpents are crowned with plumes of stars. The face on the left with protruding tongue is Tonatiuh, the Sun, and he on the right is Quetzalcoatl, the planet Venus. On the apparent movements of these two planets were based the chronological combinations of the Mexicans. The two serpents, themselves, may be called Coatl and Quét-

zalcoatl. The plumes of stars have been thought to represent the Milky Way.

The entire face of the rock was painted red to indicate that it was dedicated to the Sun—and there are even yet traces of the color remaining after a lapse of four hundred and twenty-seven years.

One of the most interesting evidences of the astronomical knowledge of the Aztecs is their intercalation of five days in the calendar at the close of each year. As the year is composed of nearly six hours more than the 365 days, there still remained an excess, which they adjusted by interposing twenty-five days in every 104 years. This shows a nicer adjustment of civil to solar time than is presented by even the Gregorian Calendar, since more than 5,000 years would have to elapse before the loss of an entire day. But the first intercalation in the Mexican Calendar took place sixteen centuries previous to the arrival of the Spaniards.

The Aztecs began to use their calendar 483 years before the ultimate adoption of the Julian Calendar at Rome. A very good example of the original Roman Calendar, established either by Romulus or Numa, has been brought to light by the excavations in recent years amongst the ruins of Pompeii. It had ten months, and the names of the last four of its months are still retained by us: September, October, November and December.

Julius Cæsar reformed this Calendar in the year 46 B. C. and introduced the arrangement to have three years of 365 days each followed by one of 366 and dividing the year into months nearly as at present. The months of the Julian Calendar at first alternated from thirty-one to thirty days, with the exception of February; that is to say; January had thirty-one; February, twenty-eight and twenty-nine; March, thirty-one; April, thirty; May, thirty-one; June, thirty; July, thirty-one; August, thirty; September, thirty-one; October, thirty; November, thirty-one; December, thirty. But, a few years later, in order to gratify the vanity of the Emperor Augustus, his month of August was given as many days as Julius Cæsar's month of July. So that instead of six long and six short months in the year we have seven long and five short ones. The additional day in leap year was given to February by calling the fifth day before the calends of March "a second sixth," whence leap year is still called in the almanacs bissextile year, from "bis," twice, and "sextus," sixth. When the Spaniards, who used the Julian Calendar, landed at Veracruz, in 1520, they were ten days behind the correct time—or, in other words, ten days behind the reckoning of the barbarous Aztecs. This most remarkable fact lies in the error of the Julian Calendar which gave the year a length of 365 days and six hours. This is about eleven minutes too much—an error which has now amounted to over thirteen days. The Julian Calendar—now known

as Old Style—is used still in the Russian Empire. For example: a letter written in Russia and addressed to some party in Mexico will be dated, say, “Jan. 1st.—Jan. 14.”

Thus, the Julian Calendar goes along with a constantly increasing error of three days in every 400 years, so that in 4,000 years the difference will amount exactly to one month. To rectify this and to so arrange matters that the festivals and saints-days of the Catholic Church would recur as nearly as possible at the same seasons in each year, Pope Gregory XIII, after much thought, long study, and many consultations on the subject, decreed that the 5th day of October, 1582, should be called the 15th. To prevent the intrusion of the same errors in the measurement of time in the future ages, he further ordered that every year whose number is not divisible by four should consist of 365 days, (e. g. 1906, 1907); every year which is so divisible but not divisible by 100 should consist of 366 days, (e. g. 1908); every year which is divisible by 100 but not by 400, of 365 days, (e. g. 1700, 1800, 1900); and every year divisible by 400, of 366 days, (e. g. 1600, 2000.)

The true astronomical or solar year has been calculated to consist of 365 days, 5 hours, 48 minutes and 46 seconds. The Gregorian rule—by which all civilized countries, excepting Russia, are now governed—omitting three leap years in every 400 years, gives to a civil year an average duration of 365 days, 5 hours, 49 minutes and 12 seconds. This exceeds the true solar year by 26 seconds and amounts to the difference of one day in every 3323 years. But in the Aztec Calendar more than 5000 years would have to elapse before the loss of an entire day! It will thus be seen that our Gregorian Calendar is not as near perfection as the Aztec. And see how marvelously simple was the latter! So well adapted to the wants of the people that it could be readily understood and applied without great learning! It merely consisted in inserting twenty-five days into every 104 years. As the Mexican cycle comprised fifty-two years, these twenty-five days had to be fitted into two cycles in some manner; so they cut the Gordian knot by adding thirteen days to the first cycle, twelve days to the second cycle, thirteen to the third, twelve to the fourth, and so on, giving an even number of days to an even-numbered cycle and an odd number of days to the odd cycle.

But, farther: this Mexican cycle was divided into four quarters of thirteen years each. The system of numbers was based upon multiples of four, and not upon a decimal notation, as with nearly all other nations in the world. The names of the years were Tochtli, Rabbit; Acatl, Reed; Tecpatl, Flint; and Calli, House. These repeated constantly would cause the second series of thirteen years to begin with Reed, the third with Flint, the fourth with House—an ingenious arrangement by which any year in the cycle could be clearly designated.

Leon y Gama, whose book on the Calendar and Sacrificial stones was published in 1792, called attention to the fact that eight holes for the insertion of gnomons of dials could be found just outside the outer rim on the face of the stone. He further says that this stone clearly shows the following dates: Vernal equinox, March 22nd; Summer solstice, June 22nd; transits of the sun by the zenith, May 22nd and July 26th; and the Autumnal equinox, 22nd of September—the first two occurring in the year Thirteen Reed (1479) and the last three in the year One Rabbit (1454.)

While archaeologists do not all agree with Leon y Gama nevertheless it seems evident that when the rock was placed in its proper horizontal position, with its meridian arrow pointing to the south, styles fitted perpendicularly into the four outermost holes could be made to give the following results: The tip of the nose in the central face being assumed as the central point in the stone and to correspond with the latitude of Mexico—an east-and-west line between the two northern styles represented the tropic of Cancer. An east-and-west line between the two southern styles—being farther from the center—represented the Tropic of Capricorn. In the summer solstice the shadow of the north-eastern style at sunrise fell on the central point, and at sunset of the same day the shadow of the northwestern style also fell on the central point. The same thing also occurred with the other two styles during their winter solstices. Threads stretched between the northern styles in summer and between the southern styles in winter, would on the solsticial days throw a shadow falling exactly in the centre of the stone from east to west. During the equinoxes the shadows of one style would strike its companion style at sunrise and sunset and lie exactly beneath the thread. Thus the dates of the solstices and equinoxes could be accurately ascertained. To fix the passage of the sun—to express it thus—through the zenith of the City of Mexico, it sufficed to stretch threads from the northeast to the southwest style, and from the northwest to the southeast style, since the shadow of the point of intersection of the two threads would fall at midday in the centre of the stone, and the four styles would give forth no shadows.

The resemblance between the Aztec Calendar and those used by the Oriental nations is striking. The Chinese had sixty years in their cycle, in five divisions of twelve years each, and the names of the years were: 1, Mouse; 2, Ox; 3, Leopard; 4, Rabbit; 5, Crocodile; 6, Serpent; 7, House; 8, Sheep; 9, Monkey; 10, Hen; 11, Dog; 12, Hog. The Tartars, Japanese and Thibetans have nearly the same, but substituting: 3, Tiger; 5, Dragon; 8, Goat. In the Mexican signs for the days we meet with Rabbit, Serpent, Monkey, Dog. Instead of Leopard, Crocodile and Hen they had Ocelotl, Lizard and Eagle. Both the Asiatics and Aztecs indicated the year by its sign, as the “year of the Rabbit,” etc. In the

lunar calendar of the Hindoos seven of the terms agree with the Aztecs, viz: Serpent, Reed, Monkey, Flint Knife, Path of the Sun, Dog and House.

The Java Islanders also regulated their markets by a week of five days—having, besides, one week of seven. The Persians had a cycle of 120 years of 365 days each—at the end of which they intercalated thirty days. The ancient Etruscans arranged their calendar in cycles of 110 solar years, and reckoned the year at 365 days, 5 hours, 40 minutes.

It is a curious fact that the number of sacred months of thirteen days each, contained in a Mexican cycle of fifty-two years with the intercalation, should correspond precisely with the number of years in the great Sothic or dog-star period of the Egyptians, namely 1461, a period in which the seasons and festivals came round to the same place in the year again. The coincidence may be accidental—but Prescott well says that a people employing periodical series and astrological calculations have generally some meaning in the numbers they select and the combinations to which they lead.

The feast most notable amongst the Aztecs was that made on the first day of the cycle. From superstitious motives they feared, (at the terminus of each one of these periods,) the end of the world; and the last night they passed in a state of expectation and the greatest consternation. They destroyed all their household utensils and furniture, supposing them to be useless. All fires were extinguished, both in the temples and in the houses. Three hours before midnight an immense procession, headed by the priests, marched to the Hill of the Star, near the village of Ixtapalapan, 5 or 6 miles south of the present City of Mexico. There, on its summit, when the Constellation of the Pleiades had reached its zenith, upon the breast of a prisoner of war selected for this sacrifice, they kindled with two sticks of wood the new fire. Then the victim and the blazing fagots were cast into a pile of combustibles, and, as the flames leaped up, they were received by the assembled multitude with shouts of gladness. The signal fire on the mountain top was seen all over the valley, and the people hailed the emblem of light, life and fruition as a blessed omen of the restored favor of their gods and the preservation of the race for another cycle. The priests, at sunrise, carried the new fire to the temple of Huitzilopochtli, and in every temple and dwelling it was rekindled from the sacred source. The fortunate event was celebrated through several days in succession—all the inhabitants delivering themselves to rejoicing and forgetting at once their past fears.

Their last celebration was in the year 1507 A. D., They felt themselves secure for another age, but as a nation, they were already doomed. All unknown to them, three years previously, westward bound, there had landed in the West Indies, from Spain, a youth nineteen years of age, Hernan Cortés, their future Conqueror.

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