MORNING AND EVENING STARS IN 1906.

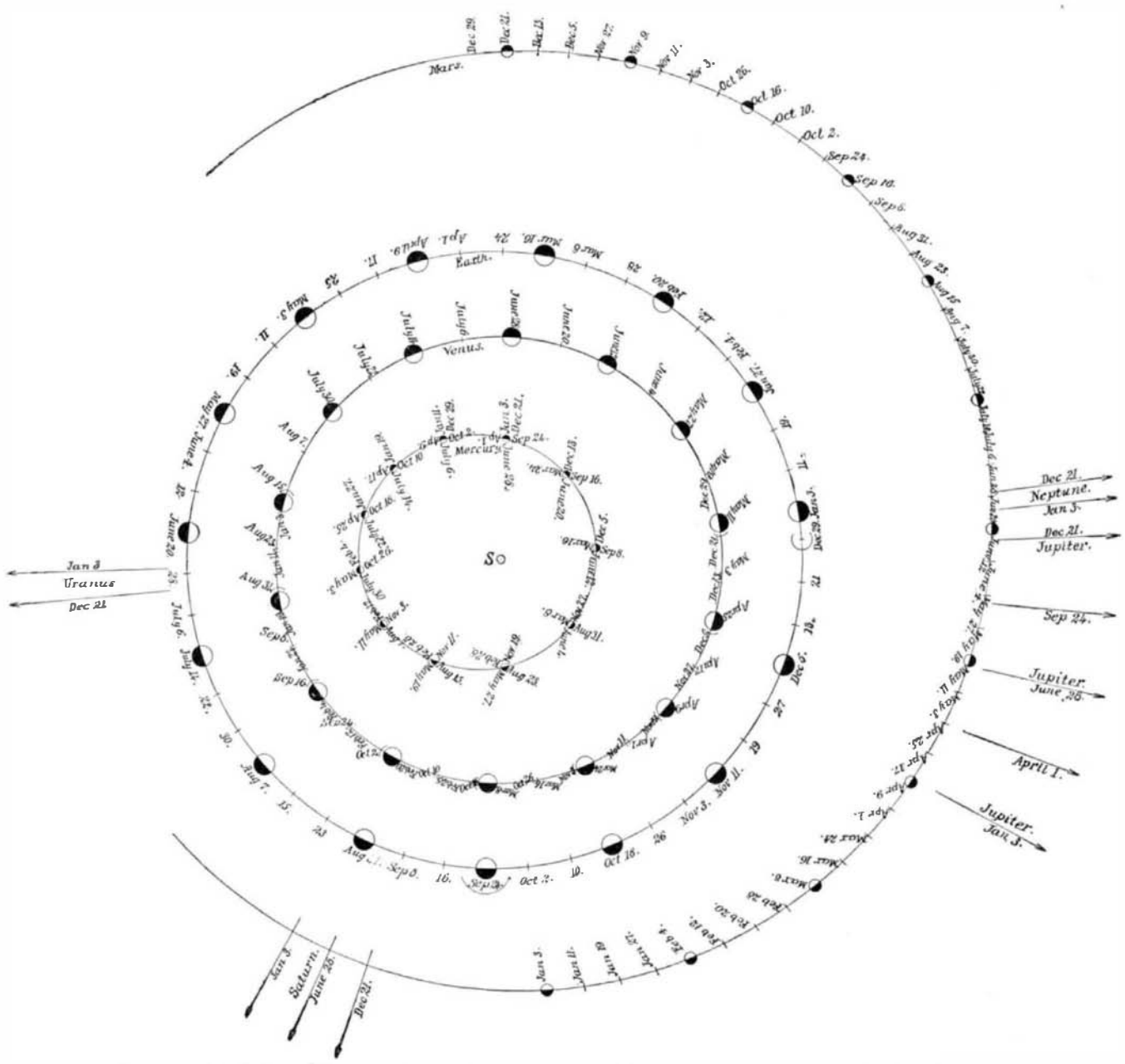
BY F. R. HONEY.

The representation of a portion of the solar system illustrating this article is designed to assist the non-professional reader to identify the planets which rise before and set after the sun for any day of the present year.

The orbits of Mercury, Venus, the earth, and Mars are here plotted, and the position of each planet is indicated, in each case, at intervals of eight days. The orbits of Jupiter, Saturn, Uranus, and Neptune fall beyond the limits of the page; but since the motions of the last three are limited to very small angular measurements, and that of Jupiter is not more than about one-twelfth of a revolution, the reader will be able, with the assistance of the drawing, to determine approximately the position in the heavens of each of these planets at any assigned date.

Mercury performs his journey round the sun in very nearly eighty-eight days (more exactly 87 days and 23¼ hours). His position is shown for January 3, and thereafter at intervals of eight days. After one revolution Mercury reaches on April 1 the same position he occupied January 3. The dates are then given for the second revolution, which is completed June 28. The dates for the third and fourth revolutions then follow in order. The third revolution is completed September 24; and the fourth on December 21

Since Mercury performs his revolutions in a very small fraction of a day less than eighty-eight days, it is evident that, after this exact interval of time, he will have passed a little beyond his position of January 3; and similarly for each of the successive revolutions. After an interval of three hundred and fifty-two days, i. e., after four revolutions and a small fraction, the planet will reach a position which is about ½ deg. in advance of that occupied January 3. For the present purpose the positions are made identical. The drawing is sufficiently accurate, and confusion is avoided. The planet is represented in the position it occupies at four different dates; and similarly for the intermediate dates.



A MAP WHICH SHOWS THE POSITIONS OF THE MORNING AND EVENING STARS FOR THE YEAR 1906.

Venus performs her revolution in two hundred and twenty-four days and sixteen and three-quarter hours. Omitting the hours, 224 days brings her almost to the termination of her first revolution. Two hundred and twenty-four is exactly divisible by eight. Her first position is shown for January 3; and at intervals of eight days thereafter. This number of days is selected in order that the reader may readily compare her position with that of Mercury, the earth, or Mars for the same date. Since Venus makes about one and five-eighths of a revolution during the year, it is easy to show her different positions without confusion. She begins her second revolution on August 15, and is represented by the open circle which falls a little behind that of January 3. Thereafter she is represented in a similar manner with the new date attached. The earth and Mars are also shown for January 3; and for every eighth day.

For the intermediate dates the reader will have no difficulty in determining the position of each of the planets in its orbit. Jupiter's position on January 3 is on the line drawn from *S*, which represents the sun, and at a distance from it over five times the distance from the sun to the earth. He will reach the positions indicated on April 1, June 28, September 24, and December 21.

The position of Saturn is shown for January 3, June 28, and December 21. Saturn is at a distance from *S* equal to nine and a half times that of the earth.

The directions of Uranus and Neptune are indicated for January 3 and December 21. The former is over nineteen times, and the latter thirty times, the distance from the sun to the earth. Since these planets move very slowly, it is unnecessary, for the present purpose, to interpolate intermediate dates.

In order to determine the planets which rise before the sun, the reader must bear in mind that the earth revolves on its axis in the direction represented by the arrow (shown at the date September 24). At sunrise the observer emerges from the shadow area. If the drawing be held in such a position that the earth is between the reader and the sun, and he can read the date without turning his head, he will have a correct exhibit of the relative positions of the sun and planets at that date. In this position, if a planet is on the right of the sun, it evidently rises before him. Should the planet be exactly in line with the earth and sun, as e. g. in the case of Mercury or Venus, if the planet is on the near side, it is in inferior conjunction; if it is on the far side, it is in superior conjunction. If it is at or near conjunction, it will be lost in the sun's rays. At sunset the observer is entering the shadow area. When the drawing is held for a given date in the position above described, if the planet is on the left of the sun, it will set after him. In order to familiarize himself with the use of the plot, the reader is recommended to confine his attention to one planet at a time, and trace its movements relative to the earth and sun throughout the year. For example, if he will revolve the drawing until the earth is between him and the sun for the date January 3, he will read the same date attached to Mercury. Being on the right of the sun, he rises before him. If the drawing be revolved until the date February 20 is reached, Mercury will then be on the far side of the sun, i. e., in superior conjunction. For some time prior to and after this date, the planet will be lost in the sun's rays. After this he will be on the left side of the sun, and will therefore set after him. He will be in conjunction—alternately superior and inferior—six times during the year on the following days: February 20, April 5, June 8, August 12, September 24, and November 30. If the earth were stationary, there would be twice as many conjunctions as revolutions, i. e., eight; but this number is reduced by two on account of the revolutions of the earth around the sun.

Mercury will be seen to good advantage after May 3 before sunrise when near aphelion. He will also be seen advantageously in the early evening after June 28 when approaching aphelion. The last position indicated is December 29, when Mercury will rise before the sun.

Venus rises a short time before the sun on January 3 and thereafter. She will very slowly approach superior conjunction, which she will reach on February 14 She will be seen satisfactorily in the evening about the middle of June. Venus will then approach nearer the earth until November 30, when she will be in inferior conjunction. Her dark side will be presented to the earth, and she will be lost in the sun's rays. She will then rise before the sun until the end of the year.

Mars will be visible in the evening before July 15, when he will reach conjunction; and will then rise before the sun for the remainder of the year.

Some Wholesome Advice to Lawyers.

New Jersey's lawyers recently paid a deserved tribute to their most distinguished associate, the one who has been longest in practice in the State and who, throughout its boundaries, is recognized as the dean of the profession—Cortlandt Parker, of Newark. In the course of an excellent address Mr. Parker said: "To my young friends, a word of advice: Stick to the profession—seek to elevate it. Do not seek by it to make money. Doing that makes it a trade—not a profession. Be fair in charges. Help the poor, with advice and with professional aid. If it occurs to you, as it should, to look out for old age, believing that Webster was right when he said that the fate of a lawyer was to work hard, live well, and die poor, use economy, and as you acquire something to lay up, buy in some growing town or city a building, a business one, if you can, even if it involves a mortgage for part; rent will keep down interest and pay taxes and the property one day will enrich you. You will have hard work to get well off by simply saving, and the community will expect you to live comfortably. Do not speculate. Be known in Christian work, and in charity, public and private, according to your means. Study law and history in all spare time, and manifest it by your action in the courts. Do not be a politician. But always vote and do the duty of a citizen. Be member of a party, but independent—a slave to no one. Deserve honors and office. If they come, as if you deserve them they should, do honor to them. If they do not, never mind. There is One who seeth not as man seeth, whose 'well done, good and faithful' is worth all the dignities of all the world."

THE NEW ARMORED CRUISER "TENNESSEE."

The successful completion of the official trials of the new armored cruiser "Tennessee," which took place on the government course on February 12, marks the addition to the United States navy of one more of a class of ships of which the United States navy is very justly proud. The average speed over the whole 80-mile course was 22.15 knots an hour.

The armored cruiser which, in the earlier days of its development, was intended to hold something of a middle position between the battleship and the protected cruiser, has grown so steadily in size and power that the modern type, as represented by the "Tennessee," approximates in fighting efficiency to the battleship. This is evident at once when we bear in mind that the "Tennessee" carries as her main armament

four 40-caliber, 10-inch rifles, whose ability to punish the enemy, even at the more distant ranges, is greater than that of the 12-inch guns mounted on the battleship "Iowa"; for at 5,000 yards the 12-inch projectiles of the Iowa can theoretically penetrate, if they are capped, 9¾ inches of Krupp armor, whereas the 10-inch projectiles of the "Tennessee" can under similar conditions penetrate 11¾ inches. Moreover, these guns are protected by 9 inches of inclined Krupp armor, which is superior to the 14 inches of vertical turret armor carried by the "Iowa." In a comparison of the secondary batteries, the "Tennessee" shows a superiority in total energy; since she carries sixteen 50-caliber 6-inch guns, each with a muzzle energy of 5,838 foot-tons and protected by 5 inches of Krupp armor, as against eight 8-inch guns of 7,500 foot-tons, and six 4-inch guns of about 1,000 foot-tons energy, having about the same protection. The total muzzle energy of a single discharge of all the guns of the "Tennessee" amounts to 202,224 foot-tons, whereas the total muzzle energy of a single discharge of all the "Iowa's" guns amounts to only 169,940 foot-tons. Furthermore, the great superiority of speed possessed by the cruiser (22½ knots as against 17 knots) and the higher velocity and flatter trajectory of her projectiles, would enable her to choose a fighting range and bearing with relation to the battleship, which would put the low velocity guns of the "Iowa" at a disadvantage and yet enable the "Tennessee" to deliver her fire with telling effect.

Our armored cruiser fleet consists of twelve vessels, two of which, the "New York" and "Brooklyn," are now somewhat obsolete, although they are undergoing, we believe, a re-armament and overhauling which will greatly increase their efficiency, at least in respect of the power of the battery. The other ten ships are divided into two classes, in the earlier of which, known as the "California" class, are six ships, namely, the "California," "Colorado," "Maryland," "Pennsylvania," "South Dakota," and "West Virginia." These fine vessels are 502 feet long, 69 feet 6½ inches in beam, and on a 24-foot 1-inch draft they displace 13,680 tons. Each carries four 45-caliber, 8-inch guns in two turrets, protected by 8 inches of Krupp steel, and fourteen 6-inch guns protected by 5 inches of Krupp steel. They have a continuous water-line belt 6 inches in thickness, and their speed is in every case from 22 to 22½ knots an hour.

The "Tennessee" class are larger vessels by about 1,000 tons, the increased displacement being secured by carrying the beam out to 72 feet 10 inches and increasing the draft to 25 feet. The water-line and side armor have been re-arranged and somewhat extended as compared with the "California" class, and the speed is about the same. The most marked improvement, of course, is in the main battery and its protection, the four 8-inch guns protected by 8 inches of armor giving place to four 10-inch guns behind 9 inches of armor, while two more 6-inch guns have been added to the secondary battery.

The 10-inch guns are mounted in two electrically-controlled, balanced, elliptical turrets, each with an arc of fire of 270 deg. Four of the 6-inch guns are mounted in independent casemates on the main deck; one at each corner of the central superstructure. The other twelve 6-inch guns are mounted on the gun deck in broadside, and each gun is isolated by splinter bulkheads of nickel-steel from 1 to 2 inches thick. The whole of the 6-inch battery is protected by five inches of armor. Four of the 6-inch guns can fire dead ahead and four dead astern. Of the twenty-two 3-inch guns, six are carried in sponsons on the gun deck (one of these will be noticed in our engraving forward of the foremost 6-inch gun) six are mounted in broadside on the gun deck, three on each beam in the center of the 6-inch battery, while on the main deck immediately above these and mounted in broadside between the 6-inch gun casemates, are ten 3-inch guns, five on each broadside.

Each ship also carries four of the new 21-inch turbine-driven Whitehead torpedoes, of the type which was fully described and illustrated in the SCIENTIFIC AMERICAN of January 6, 1906.

The hull is protected by a water-line belt of 5 inches of armor, which is worked in vertical strakes amidships, the strakes extending 17 feet 3 inches in height from the protective deck to the gun deck. Throughout the machinery and magazine space this armor is 5 inches in thickness, while forward and abaft it diminishes to 3 inches. This 5-inch armor extends also in the wake of the casemated 6-inch gun entirely up to the main or upper deck. Two-inch nickel steel has been worked in the wake of the 3-inch battery. The barbettes of the 10-inch guns, which are from 4 to 7 inches in thickness, extend from the protective deck to 5 feet above the main deck. The turrets for these guns have a sloping front or port plate 9 inches in thickness, which may be taken as the equivalent of a 12 or 13 inch vertical plate.

Steam is supplied by Babcock & Wilcox boilers to twin vertical triple-expansion engines of 23,000 contract horse-power. The "Tennessee" was constructed by William Cramp & Sons, who also built the armored cruisers "Colorado" and "Pennsylvania," above mentioned, and also our first armored cruisers, the "New York" and "Brooklyn."

RECENTLY DISCOVERED RUINS IN RHODESIA.

BY RANDOLPH I. GEARE.

Spreading over an area between 18 deg. and 22 deg. south latitude and about 27 deg. to 33 deg. east longitude some puzzling ruins have lately been discovered, concerning which very little has so far been published. More than one hundred and twenty separate localities show evidences of the same character of remains, while minor ruins of forts and what were probably guard-houses are scattered for a considerable distance beyond the limits above indicated. Most of the ruins are in or near a region liberally supplied with granite, whose huge bowlders form parts of the walls, which it would seem were erected for defensive purposes. Most of the blocks of granite measure from seven to eleven inches in length, and from 2½ to 5 inches thick, roughly worked into a rectangular shape, while larger ones were often used in building the lower courses. The blocks were carefully laid in the walls, many faced on both sides, the interior being filled up with loose rubble. No cement or mortar was used, but the excellent and solid character of the masonry is proved by the fact that some of the walls, 30 feet high and 16 feet thick at the base, stand as firmly to-day as when they were built—probably as far back as 1,000 to 2,000 years before the Christian era.

The extent of some of the ruins, such as Zimbabwe, Mundie, M'Popoti, Chum, Dhlo-Dhlo, and Khami, would indicate that they were important centers, the first being by far the greatest. The so-called "temple" at Zimbabwe (houses of stone) is perhaps the best example of the architecture employed. It is an elliptical figure of three hundred feet by two hundred and thirty feet. Several ingenious theories have been propounded as to the significance of the curves, of orientation, of the special object of the ornamental work in its walls, and as regards the standard of measurement used, but it is a question how far they can be relied upon. Thus, one explorer states that his measurements of the celebrated cone in the temple differ materially from others that have been made, and on which latter was founded the theory that the unit of measurement was the cubit of 1.717 feet.

It is regarded as strange that none of the buildings is square or rectangular in form. The older ruins are characterized by round ends to the walls and entrances, elaborately ornamented, while those of apparently recent date have square corners and straight walls. Several of the entrances were found to be covered in. At Zimbabwe passages or openings through the walls can be seen, the roof or top being supported by beams or slabs of stone. In the entrances of some of the ruins stout hardwood posts still remain, lying partly in recesses which were left in the wall at the time of their construction, the blocks being laid carefully against the timbers. The theory has been advanced that the entrances to these ruins face the rising or the setting sun, which might indicate some form of sun-worship, but others affirm that these openings point to all parts of the compass, and were evidently placed where best suited to the special locality.

In the older type of ruins the walls generally run in one face from the foundations to the top, while in later ruins the walls are built in two, three, or even four tiers, stepped back, and forming terraces two to ten feet in width, and originally covered with a concrete or cement pavement made of crushed burnt granite.

The most characteristic feature of the buildings is the way in which they were ornamented. Spaces were left in the courses by introducing sloping tiles or thin slabs of stone of different colors, or by laying some courses of a different colored rock. Explorers report that they have discovered several distinct types of ornamental work, which they have named and classified as (1) dentelle, (2) chevron, (3) herring-bone, or double line of sloping blocks, (4) sloping block, (5) check or chess-board pattern, and (6) courses of different colored rocks. The first of these styles of ornamentation—the least common of them all—is formed by placing blocks with an angle facing outward, as is often seen in modern brickwork. The second is a kind of inverted V (the apex uppermost). In the third the V lies sidewise, one following another. In some instances the slabs or tiles of each "herring-bone" are of granite or ironstone, or occasionally a section of granite tiles is followed by one of ironstone. In others the herring-bone figure extends for a long distance, while in others each pattern is separated by one or more full-sized blocks of granite. The "sloping block" is similarly varied. In the check or chess-board style the pattern is formed by leaving out alternate blocks, the dark cavity which remains forming a marked contrast with the gray face of the wall.

At Zimbabwe is seen a special style of ornamental work, consisting of large beams or posts of granite and soapstone fixed into the top of the walls, generally in an inclined position. The objects found in these ruins embrace a large variety, including iron and brass cannon, silver utensils, crockery, beads, glass, etc. These would indicate the presence of the Portuguese at some time. Articles of iron and copper are supposed to represent comparatively recent Kaffir occupation; while worked gold in plates, bangles, beads, tacks, ferrules, etc., are considered to be typical of the ancient builders who, in search of the precious metal, penetrated into what was to them the uttermost part of the world. Such articles as the beads, gold work, roughly carved stone emblems, etc., are claimed by some to establish the antiquity of the ruins beyond doubt on account of the similarity between them and other like objects found in Egypt and Arabia, although it is of course possible that these articles may have been brought from Northern Africa by Arab traders or by migrating tribes in comparatively recent times. This is a problem which further investigation alone can solve.

Mr. Randall McIver, who largely through the assistance of the Rhodes trustees has made extensive explorations in this region, divides these ruin-sites into two groups, the first including the Rhodes estate, the Niekerk ruins, and Umtali; the second embracing Dhlo Dhlo, Nanateli, Khami, and the celebrated Zimbabwe. Dhlo Dhlo is easily accessible from Bulawayo, being only sixteen miles from the railway station of Insiza. Round the citadel there runs a girdle-walk, built of rough, unworked stones, carelessly piled on one another. Viewed as a whole, with the citadel on high ground in the middle, and this rough wall surrounding it, Dhlo Dhlo strongly resembles the eastern fort at Inyanga, whose antiquities have been described as "hill forts," "slave pits," and "water furrows." Some explorers believe that these pit dwellings not unfrequently contained a subterranean passage, but others affirm that they were built up, and not excavated. The builders commenced by raising a massive platform, whose exterior platform was composed of large, unhewn rocks, carefully selected and fitted, while the inside was filled with earth and rubble. On continuing the work down hill, the builders did not content themselves with maintaining the same height of platform all the way, but added extra courses in proportion to the increase of the gradient, so as always to maintain a horizontal surface over the top. On the upper side of the incline the artificial structure might only be a meter high, but on the lower side it was often two or three meters high. So it was possible, by leaving a space within the platform itself on the lower side, to make a pit without excavating at all, and this the ancient builders appear to have continually done. Thus the floor of the circular or elliptical pit is always found on the actual level of the ground outside, though its sides may be as much as eight feet in height.

The cement walls of Dhlo Dhlo are still partially intact, and the circular ones were foundations and floors of huts, but where the circumference of one circle abutted on another, a horseshoe or wedge shaped piece was often inserted to fill the space which otherwise would have been left vacant. Excavations showed these hut-foundations to have been constructed as follows: On the bed-rock was first put a layer of large, rough stones mixed with earth, and a flooring of cement some 40 centimeters thick was laid upon this. Then the cement walls of the round hut were erected upon this floor, and divisional walls of the same material were inserted to divide it into compartments. The walls of the huts bear the clear impress of wooden stakes, against which the cement had been plastered, and stakes were also used to hold together and strengthen the cement of the platform while it was drying. In all these platforms wooden stakes are found within the cement of the floor, generally running clear down to the foundation. There is therefore nothing surprising in the presence of wooden posts standing up above the ground to support the sides of the stone walls at the main entrance.

Some idea of the vast extent of these ruins may be had from the fact that the Niekerk ruins alone cover an area of not less than fifty square miles, and it is said that within their limits it is hardly possible to walk ten yards wthout stumbling over walls or buildings of rough, undressed stone. The general principle of these ruins is described as embracing nine or ten hills, each of which constitutes a separate unit, complete with its own buildings and divided at the bottom from its neighbor by a boundary wall. Such a boundary is the first in a series of concentric lines which rise one behind the other, at first low and wide apart, then higher and closer together, until the crown of the hill is reached. On one of the lower hills there were counted fifty distinct concentric lines from the valley to the top.

For what purpose could these walls have been built? Mr. McIver disposes of the idea that they were built for purposes of cultivation or irrigation, and concludes that they were intrenchment lines, which leads to the supposition that the inhabitants were subject to sudden attacks from hostile tribes.