

HIEROGLYPHS OF THE HEAVENS.
BY ESTHER SINGLETON.

The amateur astronomer, who takes delight in contemplating the starry skies, is as familiar with the constellations as he is with the continents and islands of the terrestrial globe. He rarely thinks of them, however, with regard to the images they are supposed to represent; but finds them by means of the quadrangles, triangles, circles, etc., by which they are distinguished, and by means of their relative positions. Rarely does he realize how long it took for the stars to become systematically classified and the constellations mapped out as they are to-day. The skies as we know them owe their arrangement to the Greeks and the Arabians.

The first reliable information regarding the Greek sky is obtained from Eudoxus of Cnidus, an astro-

the kneeling Bull with the Hyades and the Pleiades; the Eagle; Dolphin; Wolf; Centaur; the Water Serpent winding across the sky with his head under the Crab and his wreathed body under the Lion, and bearing on his body a cup out of which a crow seems to drink; and Orion with his dog Sirius, here not a star but representing the whole constellation of Canes Major. "His body is dark," says Aratus, "but a star on his jaw sparkles with more life than any other star."

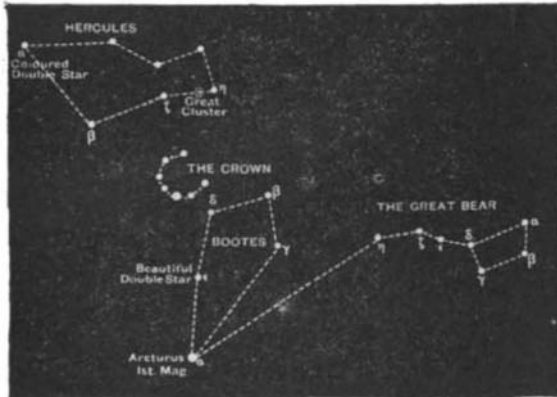
Beneath Orion is the Hare, which he is hunting, and behind the Dog the Ship "Argo" sails. The Tortoise, found by Mercury and converted by him into a lyre, here appears with the Lyre on his head; and the Swan is described as "spreading its pinions in gentle flight and sinking down perpendicularly into the western horizon, with its right wing turned toward Cep-

particulars; the Centaur he calls Chiron; gives the Wild Goat and Altar other names; introduces Berenice's Hair; and speaks of Aquarius's stream of water and the Thyrsus wand of the Centaur.

Equuleus, the Little Foal, of the southern hemisphere seems to have been introduced by Hipparchus (160-125 B. C.), who compiled a catalogue of a thousand stars with their latitudes and longitudes.

Ptolemy (130-150 A. D.), who extended many of the theories of Hipparchus in his great work, to which the Arabs gave the name of "Almagest," gave forty-eight constellations. The figures were the same as the old constellations of Aratus with a few additions. The stars, however, were marked in their proper places and defined as to latitude, longitude, and magnitude.

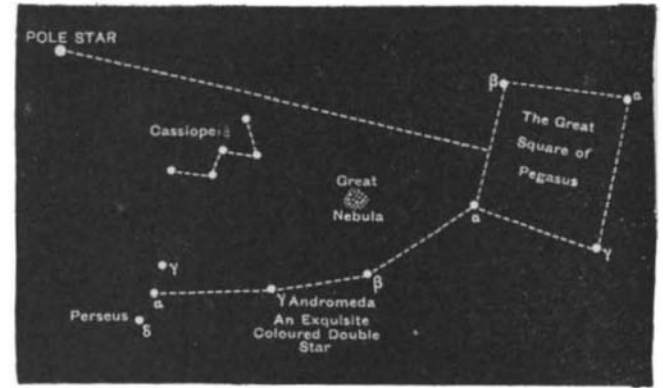
After Ptolemy a long period ensued during which the astronomical charts were unchanged. It is to the



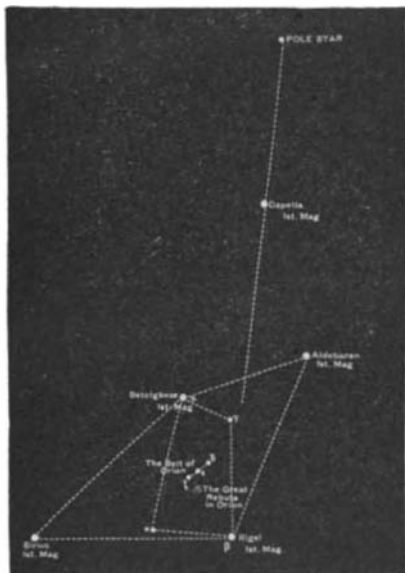
Boötes and the Crown.



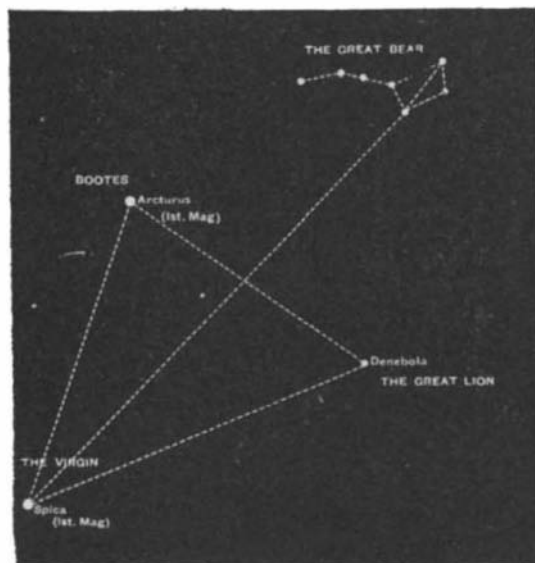
The Great Bear and Cassiopeia.



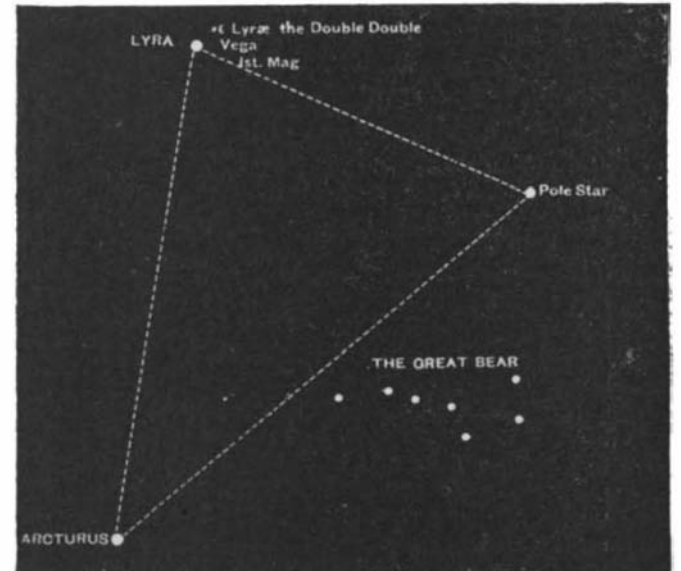
The Great Square of Pegasus.



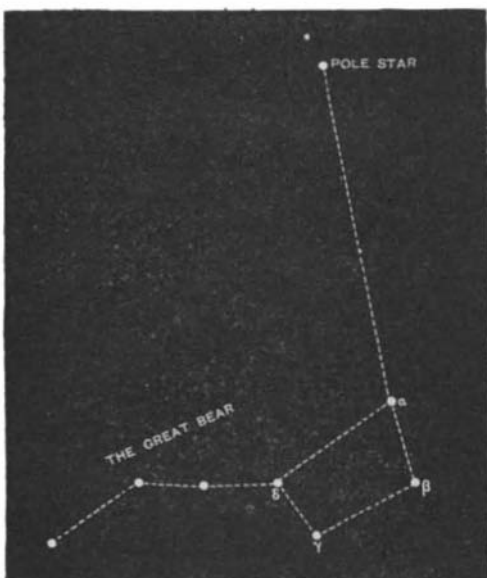
Orion, Sirius, and neighboring stars.



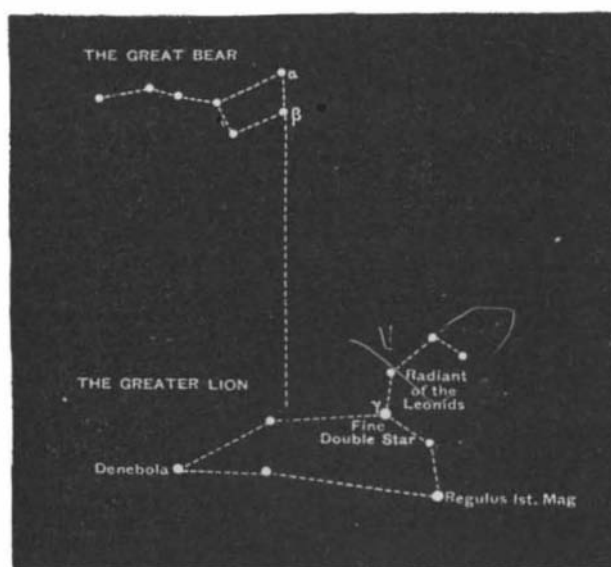
Virgo and the neighboring constellations.



The constellation of Lyra.



The Great Bear and Pole Star.



The Great Bear and the Lion.



Perseus and its neighboring stars.

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mer who lived about 370 B. C. His work furnished Aratus, who lived a hundred years later, with material for his great astronomical poem. The Romans read this in many translations, one of which was by Cicero. Instead of Hercules, Aratus gives the figure of a kneeling man with outstretched arms, called the Kneeling One. Above him stand Ophiuchus holding the Serpent, under whose coils Boötes, the Ox-Drover, is seen with the brilliant Arcturus under his girdle. The other constellations of Aratus are Auriga, the Wagoner, carrying on his left shoulder the goat that nourished Jupiter, and on his wrist a kid; half the body of Pegasus with his wings; the chained Andromeda menaced by the sea monster Cetus (now the Whale); the King Cepheus; Cassiopeia in her chair;

eus's right hand and its left to the Horse's foot."

The Manger and the Asses are also mentioned, and all the signs of the Zodiac.

"In great numbers," says Aratus, "and in various courses the stars incessantly move around the motionless skies. The axle stands immovable. In the midst the earth is suspended in equilibrium, while the heavens swing around it. The poles bound the axle on both sides. These are encircled by the Bears, that revolve around back to back separated by the Dragon's manifold coils."

Eratosthenes (about 70 B. C.) enumerates these constellations and not only tells the mythological stories but indicates the positions and numbers of stars in every figure. He differs from Aratus only in a few

Arabs in the eighth century that the next advance is due. The Caliphs of this period, among whom was Haroun al Raschid of "Arabian Nights" fame, were friends to science, and gathered around them men of learning, such as the famous astronomers Ulug Bekh, Fergani, El-Batan, and Abdelrahman Sufi. To a great extent they were satisfied with Ptolemy's work, to which they gave the name "Almagest"; and, although they retained a great many of the Greek star names, they added a number derived by tradition from the ancient Arab names. Abdelrahman Sufi wrote a detailed and exhaustive account of the Greek constellations, carefully following Ptolemy, and at the same time he treated of the ancient Arabian heavens.

This great mass of uncharted Arabian folk lore is

extremely picturesque. The stars in the vicinity of the North Pole are supposed to represent a shepherd, who with his dog is pasturing a herd of sheep. To this group belong also two calves, three goats, four camels, and a foal. These animals are all in the neighborhood of Cepheus. A single camel (one star in Draco) has strayed away to pasture alone. Two jackals and several hyenas are prowling around the herd with wicked intentions. The small stars in the region occupied by Hercules indicate another meadow, where another shepherd pastures his flock; and the long row of stars (in Hercules and Serpens) are fences protecting the sheep from the hyenas and jackals. The other side of the meadow is protected by the shepherd's two dogs. Many other shepherds with flocks of sheep and camels are scattered through the heavens; and amid these meadows runs a River (the Milky Way), which affords refreshment to various camels, sheep, and ostriches, some of which are in the act of drinking, or going to, or returning from the River, each represented by stars more or less close to the broad luminous band. The oval ring which we know as the Southern Crown is the Ostrich Nest, near which two pairs of Ostriches are supposed to stand. Another Ostrich Nest is situated in Eridanus, near which a number of small stars indicate male and female ostriches, young birds, eggs, and broken egg shells. Five yelping dogs are marked by five stars in Virgo; a pair of birds by two stars in Sagittarius; two frogs by a star in Pisces Australis and one in Cetus; four monkeys by four stars in Ursa Major; and two ravens by two stars in Columba. Near Ursa Major and Ursa Minor are a gazelle and its young. Three pairs of stars (below the feet of the Great Bear) are the footprints of several gazelles, which, according to the story, sprang from that spot when the Lion, also in the vicinity, lashed the sky with his tail, and which is now pursuing these gazelles, some of which have jumped for safety into the great Pond (a group of stars in Ursa Major).

We also find in the Arabian Heavens a Tent (three stars near Auriga); a Traveling Tent (near the Southern Crown); a Pot (a ring of stars in Cepheus and Cygnus); a Beggar's Dish with nicked rim (the broken circle which forms the Northern Crown); a Boat (in the Phoenix); a Manger (in Crater); a Dyed Hand (in Cassiopeia); a Mutilated Hand (in the head of Cetus); and Pearl Necklaces, Brooches, and Crosses are scattered in various parts of the sky. The quadrangle of the Great Bear forms the Bier, followed by three mourning women poetically called the "Daughters of the Bier." These three stars are what we call the tail of the Bear.

In many instances, as will have been noticed, the imaginary figures are not composed of a group of stars, but of a single star. Some individual stars, too, are of great importance; the three bright ones that form Orion's belt are the Three Kings; one in Andromeda is the Red Speckled Magpie; one in the Great Bear, the Black Horse, belonging, perhaps, to the neighboring Emir, and around the North Pole circle the Dancers. Besides these, the Arabs have a great many stars with such vague names as the Forgotten, the Touchstone, the Isolated, the Dim-eyed, etc.

So strong was their objection to the personal element, that when the Greek Zodiac was incorporated by the Arabian astronomers they indicated the names of the objects carried by the characters instead of the characters themselves. Thus Virgo was called the Ears, on account of the wheat she held in her hand; Sagittarius was not the Archer, but the Bow; and Aquarius, not the Water-Bearer, but the Well Bucket.

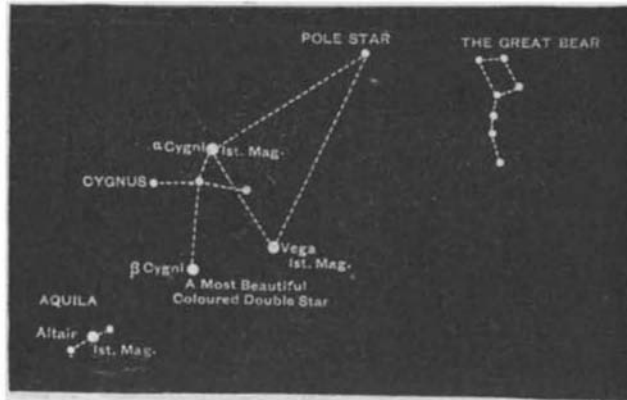
When the great mixture of Arabian folk lore was combined with the Greek sky, many of the star names were retained; but occasionally the Greek names were changed, for instance, the beautiful red Antares in Scorpio was appropriately called the Scorpion's Heart.

In 1433 Ulug Bekh made at his observatory in Samarkand the most correct catalogue of stars up to that period. The famous astronomical tables compiled under Alphonso X. of Castile date from 1252, and next in importance was the great catalogue of Tycho Brahe (1546-1601). In this occur two new constellations, Berenice's Hair and Antinous, which Ptolemy mentioned in speaking of the "informæ" of the Lion and the Eagle. Berenice's Hair was erased by Bayer, who depicted in his "Uranometrie" (1603), an authority for many years, a Sheaf in its place. Subsequently Berenice's Hair was replaced.

Two new figures occur in Jakob Bartsch's "Planispherum" (1624), the Tigris and the Jordan, which were repeated for many years on the French maps and globes, and are mentioned in a book by A. Royer

(1679) in which a constellation in honor of Louis XIV. was introduced. This was the Scepter and the Hand of Justice, and was placed immediately over Sagittarius in the Milky Way. After the death of the grand monarch, it suddenly disappeared from the globes, its place being taken by the Lizard which originated with Helvetius. In Royer's book the Lily from the old French coat-of-arms occurs in the spot occupied by the Fly. A similar liberty was taken by Thomas, in his "Firmamentum Firmianum" (Augsburg, 1731), where he changed the Northern Crown to "Corona Firmiana," a device ornamented with two stag-antlers from the German coat-of-arms.

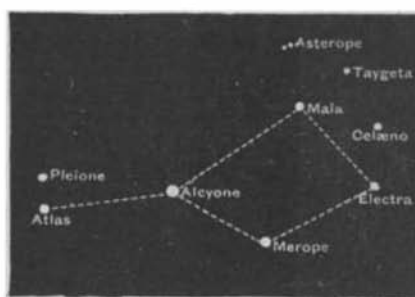
The southern hemisphere, which was uncharted by the ancients, is of far less interest than the northern, partly because the changes have been frequent and unimportant, and partly because the only constellation



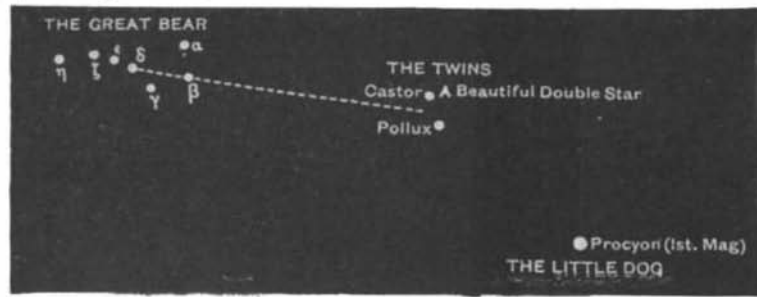
Vega, the Swan, and the Eagle.

visible to us is the Dove, introduced early in the sixteenth century. In the old books it is called Columba Noë because it is near the ship, represented sometimes at that period as Noah's Ark. The regions around the Ship and the North Pole have been subject to the most frequent changes since the seventeenth century. For a time the Cock was formed at the expense of the Ship, which, however, was soon restored. Halley introduced in his "Catalogus" (London, 1678) the figure of an Oak between the Ship and the Centaur, to represent the tree in which the King of England was hidden for twenty-four hours after Cromwell won the battle of Worcester (September 3rd, 1651). Helvetius and Flamsteed accepted this new constellation; but La Caille complained that Charles's Oak was formed out of some of the finest stars in the Ship and ruined this constellation. Therefore he left it out of his charts. Bode, however, used it. Halley also introduced another figure—the Heart of Charles the Second—which was finally adopted on all the modern charts and globes. It consists of a single star of the third magnitude on the collar of the Southern Hunting Dog.

Camelopardus is a young constellation, and was placed in the space between the Pole Star and Auriga about 1624. This is the only figure that remains of the many that were here, among which were the Reindeer introduced by Le Monnier when he returned from Lapland, between the Pole Star and Cassiopeia; a Harvest Keeper, between Cepheus, Cassiopeia, and Camelopardus, formed by Lalande when the comet of 1774 passed through that unclassified region and named



The Pleiades.



Castor and Pollux.

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by him for the astronomer Le Messier, who put it on his globe of 1780; and a third figure, formed by Bode as a memorial to King Frederick II., called Friedrichs-Ehre, consisting of seventy-six stars between Cassiopeia, Cepheus, Andromeda, and Cygnus. The figure includes sword, pen, and olive branch laurel-wreathed.

In 1624 the Fly was made out of the "informæ" of the Ram; and the Unicorn was placed between the Great and Little Dogs.

Helvetius is responsible for the Hunting Dogs (Canes Venatice) which run before Boötes; Monnat Mænalus, below Boötes; Cerberus in the left outstretched hand of Hercules; the Fox and Goose in the Milky Way, near Sagittarius; the Lizard, near Andromeda; the Sobieski coat of arms, above Sagittarius; the Lynx, between the Great Bear and Hercules; the Little Lion near the Great Lion; and a small Triangle and Sextant. These were published in 1690 after his death and were accepted.

Early in the seventeenth century an attempt was made to substitute Biblical names and characters for those of classic myth and legend. Julius Schiller, for example, published in 1627 a star map in which saints, popes, martyrs, and persons from the Old and New Testaments were figured in rich colors and gilded in the style of the illuminated manuscripts of the Middle Ages. Christ was represented as the sun and the planets revolving around him were called Adam instead of Saturn; Moses, Jupiter; Joshua, Mars; John the Baptist, Venus; Elijah, Mercury; and the Virgin Mary was substituted for the moon. David with Goliath's head was placed on the map instead of Perseus with the head of Medusa; Samson holding the jawbone of an ass, instead of Hercules; the ass on which Christ rode to Jerusalem instead of Pegasus; Noah's Ark for the Ship Argo; the Cross for the Swan; the dog of Tobias instead of the Great Dog, etc. The signs of the Zodiac were named for the twelve Apostles; the Ram became St. Peter; the Bull, St. Andrew; the Twins, St. John; the Crab, St. John the Evangelist; the Lion, St. Thomas; the Virgin, St. James the Less; the Scales, St. Philip; the Scorpion, St. Bartholomew; the Archer, St. Matthew; the Goat, St. Simon; Aquarius, St. Thaddeus; and the Fishes, St. Mathias.

In the latter part of the same century a second attempt was made by Weigel, who substituted the coats of arms of various families of Europe and other devices in his "Cælum Haraldicum" (Jena, 1688), where we find the Brandenburg Eagle in place of the Eagle; the Elephant of Denmark in place of the Great Bear; a Cardinal's Hat instead of the Scorpion; the double-headed Roman Eagle for Orion, etc. Flamsteed's "Sky Atlas," corrected by Bode (Berlin, 1782), gives two new constellations: the Brandenburg Scepter near Eridanus and the Poniatowski Bull, named in honor of the King of Poland, near the Eagle including the Hyades. The youngest of all the constellations is the Cat, introduced by Lalande between the Cup and the Ship in the eighteenth century. After Napoleon's death some enthusiasts tried to place him in the heavens in place of Orion; but his figure appears in no map of the starry skies.

The accompanying illustrations are reproduced from Sir Robert Ball's "Story of the Heavens."

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1757, deals with the railway-car ferries between Germany and Sweden, and describes in particular the vessel called the "Drottning Victoria." Mr. A. Roze's excellent article on imitation arms and armor is concluded. In 1911 Rome is to be the center of a celebration of the fiftieth anniversary of the proclamation of the Italian kingdom. For that reason an article on Old and New Rome seems peculiarly appropriate. The paper read by Prof. Harold A. Wilson before the Royal Institution on the Electrical Properties of Flames is summarized. Mr. Percy Collins contributes an article on Ants and Bees as Pets. Mr. Snowden B. Redfield prophesies that in a few years a person who desires to call another over the telephone will not only make all the electrical connections for talking, but will deposit his money in an automatic meter, talk as long as he likes, and then have his change automatically handed back to him. This prophecy he bases upon the wonderful performances of an automatic telephone central, which is described at length. Mr. Arthur Watson contributes an entertaining article on Some Old Conjurers' Formulæ and Utterances. One of the most brilliant papers read before the British Association for the Advancement of Science at its Winnipeg meeting was that of Sir J. J. Thomson.

In the current SUPPLEMENT will be found an abstract of that paper, entitled "Studies of Electricity and Matter."

Swarms of bees are sometimes compelled to take refuge in very remarkable shelters. A peculiar and instructive instance was observed by the writer in the spring of 1908. The swarm flew over a large vineyard which contained few buildings. One of these buildings was constructed of hollow concrete blocks. The swarm flew directly toward a small hole in one of the blocks and disappeared in the interior. No doubt the swarm had rested on a tree or shrub on the preceding day and had sent out scouts to seek a home. The scouts found the little hole leading into the great cavity of the concrete block, and reported their discovery to their comrades. This case furnishes indisputable proof that swarming bees really send out scouts, as they are believed to do, for the little hole could not have been discovered in the rapid and lofty flight of the swarm.