natural history was swept away, as chessmen from the board at the end of a game. So for as our science is concerned, there is a complete break at this period. The modern school of zoology dates from the appointment of Prof. E. S. Morse, of Salem, Mass., U.S.A., to the chair of Zoology at the University of Tokyo, in 1877. His indefatigable zeal and genial manners won many friends for the new science among all classes of society, while his lectures, popular or otherwise, drew attention for the first time to the immense strides which our science, under the stimulus of Darwinism, was making in the West. He, with a few students under him, also soon had in working order a tolerably good museum—the nucleus of the present zoological and anthropological collections of the Science College. It was also during his stay and through his care that the Tokyo Biological Society, from which the Tokyo Zoological Society is directly descended, was first organised. It is truly wonderful how much he accomplished in the brief time he was in Japan. On the return of Prof. Morse to America, he was succeeded by Prof. C. O. Whitman, now of the University of Chicago. It was the latter who first introduced modern technical methods. These two Americans, Morse and Whitman, thus stood sponsors to the modern school of zoology in Japan.

Since 1881, the development of zoology in Japan has been entirely in the hands of Japanese.[1] The spirit of earnest study which signalised the natural history school of the pre-Restoration days is happily revived, but with higher and wider purposes, and with greater facilities for successful attainment. Though only twenty years have passed since the "new departure," a vigorous school of zoology has already sprung up.

There can be no doubt that the establishment of the marine station at Misaki, by the Imperial University, in 1887, gave a great impetus to the study of zoology in Japan. Situated at the point of the peninsula jutting out between the Bay of Sagami and the Bay of Tokyo, it has access to localities long since famous as the home of some remarkable forms of animal life. Along the coast, all sorts of bottoms are found, yielding a rich variety of animal forms, while the hundred-fathom line is within two or three miles of the shore, and depths of five hundred fathoms are not very difficult of approach. The existence of a remarkable deep-sea fauna in these profounder parts has been ascertained within the last few years, and zoological treasures are now being constantly hauled up. The great "Black Current" (*Kuro Shiwo*) sweeps by, not many miles out, and a branch of it often comes right into the harbour of Misaki, gladdening the heart of the Plankton collector. Face to face with this inexhaustible treasury of animal forms, the zoologist will have to possess unusual powers of self-restraint, indeed, not to grow enthusiastic over his science.

The prospects of zoological science in Japan have never been brighter than they are at this time. All of its main branches, including applications of it to practical purposes, such as fisheries, sericulture, entomology, &c., are now fairly represented. Each year will see gradual additions to the specialists of different groups, as the number of graduates from the Imperial University increases. The marine station at Misaki, which has become too small for our growing body, will be removed within the present year to a new site, about two miles north of its present location, and its accommodations will be considerably enlarged. While perhaps not essential to the pursuit of science, the extreme beauty of the situation, which commands a matchless view of Fujiyama and the Sagami Bay, will certainly not lessen its attractions; and an additional charm to those who are interested in the heroic achievements of the past may be found in the historical associations with which the spot abounds. A proposed railway, passing near the new site, will bring the station within two or three hours of Tokyo. A number of teachers, scattered over different parts of the country, are acting somewhat as sentinels at the outposts of zoology, and doing good service in collecting animals from different localities. The field of activity has also lately been suddenly widened by the addition of Formosa to the territory of Japan, and the work of a collector now on that island will, it is hoped, be but the forerunner of many similar undertakings.

[1] Some who read this statement may consider that I have not given due credit to those zoologists from other countries who have lived in, or visited, Japan from time to time. It is certainly as far as possible from my intention to slight the labours of Hilgendorf, Döderlein, Pryer and others, but the fact remains that the recent development of the zoological school in Japan has been almost entirely independent of these men. It is a pleasure to me to add that Mr. Owston, of Yokohama, has been very active in unearthing the treasures of the deeper parts in the Sagami Sea.—K. MITSUKURI

## THE WORSHIP OF METEORITES.[1]

HERE is a small fragment of iron that has a curious history. It is a portion of a mass of meteoric iron found upon a brick altar in one of the Ohio mounds. Along with it were various objects—a serpent cut out of mica—several terra-cotta figurines—two remarkable dishes carved from stone into the form of animals; pearls, shells, copper ornaments, and nearly three hundred ankle bones of deer and elk. There were but one or two fragments of other bones, and one animal furnished but two of these ankle bones; hence they must have been selected for some special, important reason. The figurines had been apparently broken for some purpose, and the whole collection had suffered in the fire not a little. In a like altar of another mound of the same group were found nearly two bushels of like objects.

It must have been in some ceremony of a religious, possibly one of a funereal, character that the mound builders collected here on the altar their ornaments and other valuables, and after burning them buried the charred débris in the huge earthen mound that was built over them and the altar.

What would we not give if this fragment could be endowed with the power of repeating to us its experience—chapters in the history of that people? But nearly all that we can say is that it was found among objects held by them in peculiar esteem, and used by them in some serious, probably religious ceremony.

There was formerly, and so far as I know there is still, in the collection of meteorites in Munich, a stone that weighs about a pound. It fell in 1853 in the region north of Zanzibar, on the East African coast, and was seen and picked up by some shepherd boys. The German missionaries tried to buy it, but the neighbouring Wanikas, because it fell from heaven, took it to be a god. They secured possession of it, anointed it with oil, clothed it with apparel, ornamented it with pearls, and built for it a kind of temple to give it proper divine honours. The agents of the missionaries were not allowed even to see the stone, far less could they purchase the Wanika's tutelar deity. Neither entreaties, nor arguments, nor offers of the missionaries, nor of the officials were of any avail. But when three years later the wild nomad tribes of the Masai came down upon the Wanikas, burned their village, and killed large numbers of them, the Wanikas thought very differently of the stone's protecting power. In fact they lost all respect for it. A famine having meanwhile arisen, the elders of the tribe were quite ready to exchange their palladium for the silver dollars of the missionaries.

Among the Buddha legends is one of two merchants who offered food to the Buddha, which was accepted, and in consequence of their request for some memorial of him the Buddha gave them a hair and fragments of his nails, and told them that hereafter a stone should fall from heaven near the place where they lived, and that they should erect a pagoda and worship these relics as though they were Buddha himself.

The nations of India have always been specially superstitious about stones fallen from the skies. In 1620 an aerolite fell near Jullunder, and the king sent for a man well known for the excellent sword blades that he made, and ordered him to work the lump into a sword, a dagger and a knife. The mass, however, would not stand the hammer, but crumbled in pieces. By mixture with iron of the earth the required weapons were made.

In 1867 a shower of stones fell, some forty in number, at Saonlod. The terrified inhabitants of the village, seeing in them the instruments of vengeance of an offended deity, set about gathering all they could find, and having pounded them into pieces they scattered them to the winds.

In 1870 a meteorite fell at Nidigullam, and the Hindoos at once carried it to their temple and worshipped it. The same has been repeated in India on the occasion of several other stonefalls in the present century. One native ruler refused to allow a stone to be carried across his territory for fear of the injury that might come to his people or his lands.

Two Japanese meteorites, formerly the property of a daimio family, were long kept and handed down as heirlooms, being in the care of the priests in one of the family temples. They were among the family offerings made to Skokujo on her festival days. They were connected with her worship by the

[1] A lecture delivered in New Haven, Conn., by the late Prof. Hubert A. Newton. (Reprinted from the *American Journal of Science*.)

belief that they had fallen from the shores of the Silver River, Heavenly River, or Milky Way, after they had been used by her as weights with which to steady her loom. One of these stones was presented by its late owner to the British Museum, and it is in its collection of meteorites.

There is a curious institution among the Chinese that has existed, according to Biot, from a time more than one thousand years before Christ. The Chinese attributed to different groups of stars a direct influence upon different parts of the empire. Some of these groups correspond, for example, to the imperial palaces, to the rivers, the roads, and the mountains of China. By reason of this belief, regular observations are made by the imperial astronomers of all that passes in the heavens, especially of the groups of stars in which comets and meteors originate, or across which they travel. The interpretation of what is seen in the sky forms part of the duties of these very important officials. These observations have been carefully written out, and are preserved in the archives of the empire. Upon the ending of a dynasty, by change of name or otherwise, these comet and meteor records have been published as a special chapter of the chronicles of the dynasty. The existing dynasty began in 1647, since which date the records are, therefore, unpublished.

In 1492 a stone of 300 pounds weight fell at Ensisheim, in Alsace. The Emperor Maximilian, then at Basel, had the stone brought to the neighbouring castle, and a Council of State was held to consider what message from heaven the stonefall brought to them. As a result, the stone was hung up in the church with an appropriate legend, and with strictest command that it should ever remain there intact. It was held to be an omen of import in the contest then in progress with France and in the contest impending with the Turks. Nineteen years later a shower of stones fell near Crema, east of Milan. The Pope was at war with the French, and the stones fell into the French territory. Before the year had passed the French, after a long possession of Lombardy and serious threatening of the States of the Church, were forced to retire from Italy. At this time Raphael was painting for an altar-piece his magnificent Madonna di Foligno, now in the Vatican. Beneath the rainbow in the picture, indicating divine reconciliation, Raphael painted also this Crema fireball, apparently to set forth divine aid and deliverance.

I have thus rapidly gone over some selected facts, showing how the mound builders, the wild Africans, the Hindoos, the Japanese, the Chinese, the modern Europeans have been ready to revere these mysterious bodies that come from the skies. But it is in the Greek and Latin literature that we have reason to expect the more numerous and full accounts, both legendary and historic, of this reverence and worship.

It is now, I believe, admitted by the best scholars that both in Greece and in Italy, there was a period earlier than the age of images, when the objects worshipped were not wrought by hand. Men worshipped trees and caves, groves and mountains, and also unwrought stones. Even after men began to make their objects of worship, these were in many cases mere hewn stones, not images. The earlier Greek term ἄγαλμα, an object of worship, stands apart from the later term εἰκών, image.

What would be more natural in that age to the affrighted witnesses of the most magnificent of spectacles, the fall of a meteorite, than for them to regard the object which had come out of a clear sky, with terrific noise and fire and smoke, as something sent to them by the gods to be revered and worshipped? It was nobler to worship a stone fallen from the sky than one of earthly origin.

The worship of an unwrought stone once established has wonderful vitality. For example, the Greek writers speak of such a worship in their day among the Arabian tribes. When Mohammed, with his intense iconoclasm, came down upon Mecca and took the sacred city, he either for reasons of policy, or from feeling, spared the ancient worship of this black stone. Entering into the sacred enclosure, he approached and saluted it with his staff (where it was built into the corner of the Kaaba), made the sevenfold circuit of the temple court, returned and kissed the stone, and then entered the building and destroyed the 360 idols within it. To-day that stone is the most sacred jewel of Islam. Towards it each devout Moslem is bidden to look five times a day as he prays. It is called the Right Hand of God on Earth. It is reputed to have been a stone of Paradise, to have dropped from heaven together with Adam. Or, again, it was given by Gabriel to Abraham to attest his divinity. Or, again, when Abraham was reconstructing the Kaaba that had been destroyed by the deluge, he sent his son Ishmael for a stone to put in its corner, and Gabriel met Ishmael and gave him this stone. It was originally transparent hyacinth, but became black by reason of being kissed by a sinner. In the day of judgment it will witness in favour of all those who have touched it with sincere hearts, and will be endowed with sight and speech. The colour of this stone, according to Burckhardt, is deep reddish brown, approaching to black; it is like basalt, and is supposed by some to be a meteorite.

It is not important for my purpose to separate the history from the myth. Eusebius quotes from an old Phœnician writer, Sanchouniathon, that the goddess Astarte found a stone that fell from the air, that she took it to Tyre, and that they worshipped it there in the sacred shrine. We have reason to question whether that Phœnician writer ever lived. What matters it? The existence of the story in Eusebius' time has to us a significance not greatly unlike that of the existence of the worship itself in the earlier years.

Virgil describes a detonating meteor in such terms that I feel reasonably sure that either he had seen and heard, or else he had had direct conversations with others who had seen and heard, a splendid example of these meteors. The passage is in the second book of the Æneid. The city of Troy was captured and was burning. All was in confusion. The family of Æneas was gathered ready for flight, but Anchises would not go. An omen, lambent flames on the head of his grandson, began only to shake his purpose to perish with his country. He prayed for more positive guidance. It is Æneas who describes the scene:

"Hardly had the old man spoken when across the darkness a star ran down from the sky carrying a brilliant light torch. We saw it go sweeping along above the roof of the house. It lighted up the streets, and disappeared in the woods on Mount Ida. A long train, a line of light, remained across the sky, and all around the place was a sulphurous smell. A heavy sound of thunder came from the left. Overcome now, my father raised his hands to heaven, addressed the gods and worshipped the sacred star. 'Now, now,' he cried, 'no longer delay.'"

This story is, of course, all legendary, but Virgil's description of the scene is true to life as conceived by pagan Rome in his day.

The images that fell down from Jupiter, or that fell from the skies, are often spoken of by Greek and by Latin writers. I mention three or four cases only where this allusion points to a meteoric origin as possible or probable. The earliest representative of Venus at old Paphos, on the island of Cyprus, was one of these heaven-descended images. It was not the Venus of the Capitol, nor the Venus of Milo, but as described was a rude triangular stone.

Cicero, in the grand closing passage of his oration against Verres, calls upon Ceres, whose statue he says was not made by hands but was believed to have fallen from the skies. The earliest of the images of Pallas at Athens was said to have had a like origin. Pausanias saw at Delphi a stone of moderate size which they anointed every day, and covered during every festival with new shorn wool. They are of opinion, he adds respecting this stone, that it was the one given by Cybele to Saturn to swallow as a substitute for the infant Jupiter, which Saturn after swallowing vomited out on the earth.

There is a marvellous story of a peculiar stone in the poem Lithika by the apocryphal Orpheus. Phœbus Apollo gave the stone to the Trojan Helenus, and Helenus used it in soothsaying. It was called Orites, and by some *Siderites*. It had the faculty of speech, and when Helenus wished to consult it he performed special ablutions and fasts for twenty-one days, then made various sacrifices, bathed the stone in a living fountain, dressed it and carried it in his bosom. The stone now became alive, and to make it speak he would take it in his arms and dandle it, when the stone would begin to cry like a child for the breast. Helenus would now question the stone, and receive its answers. By means of these he was able to foretell the ruin of the Trojan State. Whoever framed that story had, I believe, before him a real stone, and the description is very like that of a meteorite, saying nothing of its having come from Apollo. The Orphic writer says that it was rough, rounded, heavy, black, and close-grained. Fibres like wrinkles were drawn in circular forms over the whole surface above and below.

Here I show you a stone such as was described—rounded,

black, heavy, close-grained, and having fibres like wrinkles in circular forms over the whole surface above and below.

The name *Siderites* was at a later date applied to the load-stone, but by this writer the two stones are separately described, and are apparently distinct. If this name was of Greek origin it seems to be allied to *sideros*, *iron*, and this heavy stone, like nearly all meteorites, probably contained iron. If, however, this name came from a Latin source (for it is used both by Greek and by Latin writers) it has affinities with *Sidus*, a star, and its meteoric character is still more clearly indicated.

One of the most interesting of the stories about images that have fallen from heaven, is the basis of that beautiful tragedy of Euripides. "Iphigeneia in Tauris." To many of you the story is familiar, but it will bear repetition.

The goddess Diana detained at Aulis the Grecian fleets by contrary winds, and required the sacrifice of Iphigeneia, the daughter of Agamemnon, before the Greeks could set sail. The father consented; and the daughter, apparently sacrificed, was really rescued by Diana, and borne to the Tauric, or Crimean peninsula on the north shore of the Black Sea. She was then made a priestess in the temple of the goddess. At this shrine the barbaric inhabitants used to sacrifice before an image of Diana, that fell from heaven, all strangers that were shipwrecked upon the coast. The unhappy Iphigeneia, forced to take a leading part in these human sacrifices, laments her sad lot:—

"But now a stranger on this strand,
'Gainst which the wild waves beat,
I hold my dreary, joyless seat,
Far distant from my native land;
Nor nuptial bed is mine, nor child, nor friend.
At Argos now no more I raise
The festal song in Juno's praise;
Nor o'er the loom sweet sounding bend,
As the creative shuttle flies,
Give forms of Titans fierce to rise,
And dreadful with her purple spear
Image Athenian Pallas there.
But on this barbarous shore
Th' unhappy stranger's fate I moan,
The ruthless altar stained with gore,
His deep and dying groan;
And for each tear that weeps his woes,
From me a tear of pity flows."

Orestes, the brother of Iphigeneia, had avenged upon his mother the murder of his father. For this he was driven by the Furies. While stretched before the shrine of Phœbus he heard the divine voice from the golden tripod, commanding him to speed his way to the wild coast of the Taurians, thence to take by fraud or by fortune the statue of Diana that fell from heaven, and carry it to Attica. Doing this he should have rest from the Furies.

He was captured, however, along with his friend Pylades, and brought to the altar to be sacrificed. The relationship of the brother and sister became here revealed, and they together fled, carrying with them the image. It was not without a struggle that they reached the shore, but finally,

"On his left arm sustained
Orestes bore his sister through the tide,
Mounted the bark's tall side and on the deck
Safe placed her and Diana's holy image
Which fell from heaven."

Neptune favoured the Greeks, Minerva forbade pursuit, and the image was borne to Halae (or as some said to Brauron) in Attica.

Cicero spoke of the Trojan Palladium as something that fell from the sky: *quod de coelo delapsum*. Other classical writers, notably Ovid, speak of it in similar terms. The story in its various forms points toward a stonefall as its basis. One form of it runs thus:—

Pallas and her foster sister Athena were wrestling with each other, when Pallas was accidentally killed. In grief Athena made an image of Pallas and set it up on Olympus. When King Ilus was about building his city on the Trojan plain he prayed for a favourable omen. In response to his prayer Jupiter cast this image down at the feet of the suppliant king. In the new city it was set up in a temple specially erected to contain and protect it. So long as Troy could keep safely this image, the city, it was firmly believed, could not be taken by its foes.

According to one story, the Greeks stole the image before capturing the city. As many cities afterwards claimed to possess the treasure as claimed to be the birthplace of Homer. According to the Romans, Æneas carried the Palladium to Italy, and the image was regarded as the most sacred treasure of the Roman State. For centuries even in historic times it was so carefully kept by the Vestal Virgins that the Pontifex Maximus was not allowed to see it.

We naturally have doubts about the nature, or even the existence, of an object so kept out of sight. What it was that the Vestals thus guarded, or whether they had anything to represent the image of Pallas, will probably never be known. But it is far otherwise with another famous object of Roman worship. To the east of the Trojan plain on which the Palladium fell, rise the mountains of Phrygia and Galatia. In Pessinus, near the border line of these two countries, and in the caves and woods near Pessinus, the goddess Cybele, the mother of the great gods, Jupiter, Neptune and Pluto, was specially worshipped. This worship may not have been more degrading than the worship of many other Asiatic divinities. But it was wretched and unmanly almost beyond our possible conception. It furnished to Catullus the theme for the most celebrated of his poems, one of the strongest pictures in all literature. The Grecian athlete entered her service with joyful music and dancing. Too late he looks back from the Asiatic shore, out of his hopeless degradation, on the nobleness of his former Grecian life. The lion of Cybele drives him in craven fear again into the wild woods, to spend his days in the menial servitude. The Roman poet exclaims, "O goddess, great goddess Cybele, goddess queen of Dindymus; far from *my* house be all thy frenzies; others, others, drive thou frantic."

At some unknown early time a meteoric stone fell near to Pessinus. It was taken to the shrine of Cybele, and there set up and worshipped as her image. This image and its worship very early attained a wide celebrity. About two hundred years before Christ, in the time of the second Punic war, the stone was transported to Rome. The detailed history of the transfer is given by several writers in varied terms. It forms one of Livy's charming stories, it is told in poetic terms by Ovid, it is given as a tradition by Herodian. For every detail of the history I do not ask confiding belief, but the principal event is, I suppose, historically true.

In the year 205 before Christ, Hannibal had, since crossing the Alps, been holding his place in Italy for more than a dozen years, threatening the existence of the Roman State. The fortunes of war were now somewhat adverse to the Carthagenian general. A shower of stones alarmed the Romans. The decemvirs consulted the Sybilline books, and there found certain verses which imported that whensoever a foreign enemy shall have carried war into the land of Italy he may be expelled and conquered if the Idæan mother be brought from Pessinus to Rome. These words were reported to the Senate. Encouraging responses came at the same time from the Pythian oracle at Delphi.

The Senate set about considering how the goddess might be transported to Rome. There was then no alliance with the States of Asia. But King Attalus was on friendly terms with the Romans because they had a common enemy in Philip II. of Macedon. The Senate, therefore, selected an imposing embassy from the noblest Romans. A convoy of five quinqueremes was ordered for them, that they might make an appearance suited to the grandeur of the Roman people. The embassy landed on their way and made inquiry of the oracle at Delphi, and were informed "that they would attain what they were in search of by means of King Attalus, and that when they should have carried the goddess to Rome they were to take care that whoever was the best man in the city should perform the rite of hospitality to her." The king received them kindly, but refused their request; whereupon an earthquake tremor shook the place, and the goddess herself spoke from her shrine, "It is my will, Rome is a worthy place for any god; delay not." The king yielded; a thousand axes hewed down the sacred pines, and a thousand hands built the vessel. The completed and painted ship received the stone, and bore it to the mouth of the Tiber.

It was the spring of the following year before the ship arrived. Meanwhile new prodigies frightened the people. A brilliant meteor had crossed Italy from east to west, a little south of Rome, and a heavy detonation followed. From this, or from some other meteor, another shower of stones had fallen. In expiation, according to the custom of the country in case of stonefalls, religious exercises during nine days were ordered. The Senate after careful deliberation selected one of the Scipios, deciding that he of all the good men in the

city was the best, and they deputed him to receive the stone. The whole city went out to meet the goddess. Matrons and daughters, senators and knights, the vestals and the common people all joined the throng. But a drought had reduced the water of the Tiber so that the vessel grounded upon the bar. All the efforts of the men pulling upon the ropes failed to move it. A noble matron who had been slandered stepped forward into the water. Dipping her hands three times into the waves and raising them three times to heaven, she besought the goddess to vindicate her good name if she had been unjustly slandered. She laid hold of the rope and the vessel followed her slightest movement, amid the plaudits of the multitude.

Scipio, as he had been ordered by the Senate, waded out into the water, received the stone from the priests, carried it to the land, and delivered it to the principal matrons of the city, a band of whom were in waiting to receive it. They, relieving each other in succession and handing it from one set to another, carried it to the gates of the city, and thence through the streets to the temple of Victory on the Palatine Hill. Censers were placed at the doors of the houses wherever the procession passed, and incense was burned in them, all praying that the goddess would enter the city with good will and a favourable disposition. The people in crowds carried presents to the temple. A religious feast and an eight days' festival with games were established to be celebrated thereafter each year in the early part of April.

Before another year had passed Hannibal, after having maintained his army in Italy for fifteen years, was forced to withdraw again to Africa. From the liberal offerings of the people, in gratitude for deliverance, a temple was erected to Cybele, long known as the Temple of the Great Mother of the Gods, so that twelve years after its arrival at Rome the stone was taken from the Temple of Victory and set up in its new home. A silver statue of the goddess was constructed, to which the stone was made to serve in place of a head. Here, in public view, for at least five hundred years that stone was a prominent object of Roman worship. Its physical appearance is described by several writers. It was conical in shape, ending in a point, this shape giving occasion to the name *Needle of Cybele*. It was brown in colour, and looked like a piece of lava. Arnobius, a Christian writer just before the accession of Constantine, and over five hundred years from the date of its arrival at Rome, says of the stone:

"If historians speak the truth and insert no false accounts into their records, there was brought from Phrygia, sent by King Attalus, nothing else in fact than a kind of stone, not a large one, one that could be carried in a man's hand without strain, in colour tawny and black, having prominent, irregular, angular points, a stone which we all see to-day, having a rough irregular place as the sign of a mouth, and having no prominence corresponding to the face of an image." Arnobius goes on to ask whether it was possible that this stone drove the strong enemy Hannibal out of Italy—made him who shook the Roman State, unlike himself, a craven and a coward.

Just when this stone disappeared from public view I do not know. In directing the recent excavations on the Palatine Hill, Prof. Lanciani was at first in great hopes of finding it; because it had no intrinsic value to the many spoliators of Rome, nor to the former excavators of Roman temples. But the place in which he expected to find it was absolutely empty. At a later date, however, he found in a rare volume an account of excavations made on the Palatine Hill in 1730, in which the private chapel of the Empress was found and explored. In this we perhaps have an account, and, it is to be feared, the last account of a sight of the Cybele stone. The writer says: "I am sorry that no fragment of a statue, or bas-relief, or inscription has been found in the chapel, because this absence of any positive indication prevents us from ascertaining the name of the divinity to whom the place was principally dedicated. The only object which I discovered in it was a stone nearly three feet high, conical in shape, of a deep brown colour, looking very much like a piece of lava, and ending in a sharp point. No attention was paid to it, and I know not what became of it." This description is almost identical with that given by Arnobius, and others, of the stone from Pessinus.

Another stone of meteoric origin was brought to Rome, and there for a brief period was most fantastically worshipped. This was near the beginning of the third century after Christ. It came, like the other stones of which I have spoken, from Asia. In the city of Emesa, on the banks of the Orontes, about midway between Damascus and Antioch, there was in those days a magnificent temple of the Sun. A gorgeous worship was maintained before a stone that fell from heaven, that served as the image of the Sun-god. The description of the stone is not very unlike that of the Cybele meteorite. Herodian, who probably saw it, says: "It is a large stone, rounded on the base, and gradually tapering upwards to a sharp point; it is shaped like a cone. Its colour is black, and there is a sacred tradition that it fell from heaven. They show certain small prominences and depressions in the stone, and those who see them persuade their eyes that they are seeing an image of the Sun not made by hands."

This Sun-god was named Heliogabalus, and before the altar a boy of nine years of age began to serve as priest. Such a Syrian service did not make the boy grow manly nor virtuous, and when at the age of fifteen he became emperor through the money and intrigues of his grandmother, and the murder of the Emperor Macrinus, we have for three years at Rome the view of the sorriest scrapegrace that ever sat on a throne. He assumed with the name of Antoninus also the name of his god Heliogabalus. To the great disgust of the Roman Senate and people, he brought with him from Syria the image of his god, the sacred stone, and himself continued before it his priestly service with all its fantastic forms and gesticulations. He built within the city walls a grand and beautiful temple, with a great number of altars around it; he repaired thither every morning, and sacrificed hecatombs of bulls and an infinite number of sheep, loading the altars with aromatics, and pouring out firkins of the oldest and richest wines. He himself led the choruses, and women of his own country danced with him in circles around the altars, while the whole senatorian and equestrian orders stood in a ring like the audience of a theatre.

But now he must have a wife for his god. So he broke into the apartments guarded by the vestals and carried to the palace the Trojan Palladium, or what he supposed was that object, and was intending to celebrate the nuptials of the two images. His god, however, he concluded, would not be pleased with a warlike wife like Pallas; therefore, he ordered to be brought from Carthage an ancient image of Urania, or the Moon, which had been set up by Dido when she first built old Carthage. With this image he demanded the immense treasures in her temple, and he also collected from every direction immense sums of money to furnish to the Moon a suitable marriage portion when married to the Sun.

He built another temple in the suburbs of Rome, to which the Emesa stone, the god (?) was carried in procession every year, while the populace were entertained with games, and shows, and feastings and carousings. Herodian thus describes this performance:—

"The god was brought from the city to this place in a chariot glittering with gold and precious stones, and drawn by six large white horses without the least spot, superbly harnessed with gold, and other curious trappings, reflecting a variety of colours. Antoninus himself held the reins—nor was any mortal permitted to be in the chariot; but all kept attendant around him as charioteer to the deity, while he ran backward, leading the horses, with his face to the chariot, that he might have a constant view of his god. In this manner he performed the whole procession, running backwards with the reins in his hands, and always keeping his eyes on the god, and that he might not stumble or slip (as he could not see where he went), the whole way was strewn with golden sand, and his guards ran with him and supported him on either side. The people attended the solemnity, running on each side of the way with tapers and flambeaux, and throwing down garlands and flowers as they passed. All the effigies of the other gods, the most costly ornaments and gifts of the temples, and the brilliant arms and ensigns of the imperial dignity, with all the rich furniture of the palace, helped to grace the procession. The horse and all the rest of the army marched in pomp before and after the chariot."

The reign of a foolish boy at this period of Rome's history was necessarily a short one, and at the age of eighteen the soldiers killed him and let the Roman populace have the body to drag through the city streets. The worship of the Sun-god at once ceased, and, no doubt, the stone also was thrown away. The Cybele stone, however, remained an object of public worship, since the quotation from Arnobius, which I have given, was written nearly a century later than the reign of Heliogabalus.

I propose to speak briefly of one more meteorite whose

worship has had a world-wide fame: the image of the Ephesian Artemis. This worship had its centre at Ephesus, but was widely extended along the shores of the Mediterranean. Temple after temple was built on the same site at Ephesus, each superior to the preceding, until the structure was reckoned one of the seven wonders of the world. As a temple, it became the theatre of a most elaborate religious ceremonial. As an asylum, it protected from pursuit and arrest all kinds of fugitives from justice or vengeance. As a museum, it possessed some of the finest products of Greek art, notably works of Phidias and Apelles. As a bank, it received and guarded the treasures which merchants and princes from all lands brought for safe keeping. In its own right it possessed extensive lands and large revenues. The great city of Ephesus assumed as her leading title that of νεωκόρος, or temple-warden of Artemis, putting his name on her coins, and in her monumental inscriptions.

The image, which was the central object in this temple, was said to have fallen from heaven. Copies of it in all sizes and forms were made of gold, of silver, of bronze, of stone and of wood, by Ephesian artificers, and were supplied by them to markets in all lands. What a lifelike picture is given us in the 19th chapter of the Acts of the Apostles, of the excited crowd of Ephesians, urged on by the silversmiths, who made for sale the silver shrines of the goddess, and who saw that their craft was in danger if men learned to regard Artemis as no real divinity, and to despise the image that fell down from the sky.

We cannot suppose that the Ephesian Artemis image of the first century was a meteorite, though we have the distinct appellation, Diipetes, fallen from the sky. But I believe that there was a meteoric stone that was the original of the Ephesian images, and it seems not at all improbable that in some one of the destructions of the temple it disappeared. Or, in the progress of time, there may have been a desire to represent the goddess in a more artistic form than the shapeless stone afforded.

Many forms of the Ephesian Artemis are still preserved, and they have, amid all their variations, a certain peculiar character in common. That common character seems to me to confirm the statement that the original image fell from heaven. This goddess is regarded, let me say, as different from the Grecian Artemis, the beautiful huntress so well known in Greek art, and I am speaking only of the images of the Ephesian Artemis.

There is one peculiarity in the outward forms of the meteorites that is characteristic of nearly all of them. I mean the moulded forms, and the depressions all over the surfaces. They are better appreciated by being seen, than by any description I can give you. They are common to meteorites of all kinds, from the most friable stone to the most compact iron. (I show you one, a stone from Iowa—also the plaster cast of another, a stone from some fall, I know not which one.) Those who have lately visited the collection in the Peabody Museum may recollect the model of an iron that fell two or three years ago in Arkansas, which displays most beautifully these depressions.

Let now an artist attempt to idealise any one of these moulded forms, and to make something like a human shape out of one of them. He must necessarily set it upright, and he must give it a head. You have then a head surmounting one of these moulded forms. Let now the convenience and the taste of the artificers of the images have some liberty to act—and we know that they did act, for we have considerable variety in these images—and a development in the conventional representation of the image is sure to follow.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE State of Pennsylvania has made a grant of 150,000 dollars to Lehigh University.

DR. RALPH STOCKMAN has been appointed to succeed the late Prof. Charteris in the chair of Materia Medica and Therapeutics in the University of Glasgow.

IT is announced that the late Dr. Matthew Hinchliffe, of Dewsbury, Yorkshire, has bequeathed about 50,000*l.*—almost the whole of his property—for purposes of higher education in Dewsbury.

IN connection with the opening of a technical day school at the Borough Polytechnic Institute next month, and the general development of the Institute, the Governors have made the following appointments:—Mr. E. T. Marsh, head-master; Dr. F. Mollwo Perkin, head of the chemistry department; Mr. G. E. Draycott, lecturer in engineering.

SENIOR county scholarships, tenable for three years, providing free tuition (up to 30*l.* a year) and a maintenance grant of 60*l.* a year, have been awarded by the Technical Education Board of the London County Council to the following candidates:—Charles Cornfield Garrard, of Finsbury Technical College, who intends to proceed to Germany for three years to study chemistry; George William Howe, of Woolwich Polytechnic, who intends to proceed to the Durham College of Science, Newcastle-upon-Tyne, to study engineering; Edith Ellen Humphrey, of Bedford College, who intends to proceed to Germany for three years to study chemistry; Frederick Edwin Whittle, an intermediate county scholar of the Central Technical College, who desires to continue his engineering studies at the college. A senior county scholarship, tenable for one year, has been awarded to William Laurence Waters, of the Central Technical College, to enable him to complete his engineering course. The following special grants have been made:—To H. C. Green, H. H. F. Hyndman and W. H. Winch, grants of 50*l.* each for the coming year, to assist them in their studies at the Universities of Oxford and Cambridge; to T. M. Lowry, A. W. Poole, and H. E. Stevenson, grants of 30*l.* each for the coming year, to assist them in their studies at the Central Technical College, St. John's College, Cambridge, and the East London Technical College, respectively.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Chemical Society**, June 17.—Prof. Dewar, President, in the chair.—The following papers were read:—Molecular refraction of dissolved salts and acids, Part ii., by J. H. Gladstone and W. Hibbert. The molecular refraction of a salt in aqueous solution is sometimes greater and sometimes less than that of the same salt in the crystalline state. The authors have also made determinations of the refraction constants of various substances—hydrogen chloride, nitric acid, lithium chloride, and ferric chloride—in water and organic solvents.—On a space formula for benzene, by J. N. Collie. The author has devised a new space formula for benzene in which the six hydrogen atoms are divided into two sets of three each, one set being situated inside the molecule, whilst the other set is on the outside.—On the production of some nitro- and amido-oxypicolines, by A. Lapworth and J. N. Collie. Dioxypicoline, $C_6H_7NO_2$, is readily nitrated, yielding a nitrodioxypicoline, $C_6H_6N_2O_4$; this, on reduction, yields an amidodioxypicoline $C_6H_8N_2O_2$, which is easily hydrolysed with formation of a trioxypicoline, $C_6H_7NO_3$.—Further experiments on the absorption of moisture by deliquescent substances, by H. W. Hake. From experiments made on a number of deliquescent substances the author concludes that during deliquescence a quantity of water corresponding to a definite hydrate is taken up.—The fusing point, boiling point and specific gravity of nitrobenzene, by R. J. Friswell. In view of the discordant values given by various authors for the above constants, the author has re-determined the physical constants of both solid and liquid nitrobenzene.—The action of light on a solution of nitrobenzene in concentrated sulphuric acid, by R. J. Friswell. A solution of nitrobenzene in concentrated sulphuric acid is very rapidly blackened by exposure to sunlight or burning magnesium ribbon.—The reduction of perthiocyanic acid, by F. D. Chattaway and H. P. Stevens. The reduction of perthiocyanic acid by tin and hydrochloric acid gives an almost quantitative yield of thiourea and carbon bisulphide in accordance with the equation:—$H_2N_2C_2S_3 + 2H = CS(NH_2)_2 + CS_2$.—The so-called hydrates of isopropyl alcohol, by T. E. Thorpe. The author has been unable to find any experimental evidence in favour of the existence of the four hydrates of isopropyl alcohol which have been described.—The carbohydrates of cereal straws, by C. F. Cross, E. F. Bevan and C. Smith.—Studies on the constitution of tri-derivatives of naphthalene. No. 16. Conversion of chloronaphthalenedisulphonic acids into dichloronaphthalenesulphonic acids, by H. E. Armstrong and W. P. Wynne. The authors find that the conversion of naphthalenesul-