POSITION OF THE PLANETS IN MARCH.

SATURN

is morning star until the 4th, and then evening star. He is in opposition to the sun on the 4th, at 10 h. 20 m. A. M., and is in fine position for observation, being on the meridian at midnight. The observer will find him in the east as soon as it is dark enough for the stars to come out. He is retrograding or moving westward, and seemingly making a slow approach to his former companion Regulus, the bright star on the northwest. His aspect is specially interesting to the telescopic observer, who will find his rings gradually closing around him until they disappear from view in September. Saturn took on a variety of colors during the last month, shining sometimes as a red star and sometimes as a pale yellow star with a leaden tint, but always exhibiting the serene light that marks the difference between a planet and a twinkling star.

The moon is in conjunction with Saturn on the 23d, the day before the full, at 9 h. 2 m. A. M., being 3° 5′ north.

The right ascension of Saturn on the 1st is 11 h. 4 m., his declination is 8° 18′ north, his diameter is 18″.6, and he is in the constellation Leo.

Saturn rises on the 1st at 5 h. 53 m. P. M. On the 31st he sets at 4 h. 49 m. A. M.

VENUS

is morning star. Early risers during the last month were impressed with her beautiful appearance in the southeast, in the morning, where she shone with surpassing brilliancy, continuing to be visible until sunrise, and even after. She will be charming to behold during the present month, though she has lost about one-third of her brightness on account of her increasing distance from the earth. She will not reign alone, for about the middle of the month a rival enters upon the scene to dispute her sway. This is Jupiter, then far enough from the sun to be visible. The two planets will be seen to approach each other until, at the end of the month, Venus rises about an hour and a half before the sun, and Jupiter follows about twenty minutes later. The observer must command a clear view of the southeast horizon in the early morning to enjoy the celestial picture under the best conditions.

The waning moon is in conjunction with Venus on the 6th, at 11 h. 26 m. P. M., being 5° 35′ south.

The right ascension of Venus on the 1st is 19 h. 50 m., her declination is 19° 3′ south, her diameter is 21″.2, and she is in the constellation Sagittarius.

Venus rises on the first at 4 h. 14 m. A. M. On the 31st she rises at 4 h. 7 m. A. M.

JUPITER

is morning star. His presence in the morning sky in near vicinity to Venus, when the month closes, is the most interesting feature on his March record. He is in conjunction with Mercury on the 5th at 2 h. 32 m. A. M., being 1° 26′ north, but both planets are then too near the sun to be visible.

The waning moon is in conjunction with Jupiter on the 8th, at 10h. 1m. P. M., being 4° 24′ south.

The right ascension of Jupiter on the 1st is 22h. 4m., his declination is 12°46′ south, his diameter is 31″.4, and he is in the constellation Aquarius.

Jupiter rises on the 1st at 6h. 6m. A. M. On the 31st he rises at 4h. 26m. A. M.

MERCURY

is morning star until the 23d, and, after that time, he is evening star. He is in superior conjunction with the sun on the 23d at 7h. 58m. P. M., when he passes beyond the sun, and reappears on his eastern side as evening star.

The right ascension of Mercury on the 1st is 21h. 50m., his declination is 15° 17′ south, his diameter is 5″.2, and he is in the constellation Aquarius.

Mercury rises on the 1st at 6h. 3m. A. M. On the 31st he sets at 6h. 56m. P. M.

MARS

is evening star. He enjoys the distinction of being the only planet visible in the west in the early evening, where he may be found till nearly 9 o'clock. He shines with a faint ruddy light as he makes his way eastward and northward among the small stars of Pisces. For this reason the time of his setting varies little during the month.

The three-days-old crescent moon is in conjunction with Mars on the 13th, at 3h. 21m. A. M., being 3° 25′ south.

The right ascension of Mars on the 1st is 1h. 33m., his declination is 9° 47′ north, his diameter is 5″, and he is in the constellation Pisces.

Mars sets on the 1st at 9h. 27m. P. M. On the 31st he sets at 9h. 18m. P. M.

URANUS

is morning star. He is retrograding and apparently approaching Spica, the bright star on the west. He is now visible to the naked eye as a star of the sixth magnitude.

The right ascension of Uranus is 13h. 57m., his declination is 11° 20′ south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus rises on the 1st at 9h. 53m. P. M. On the 31st he rises at 7h. 51m. P. M.

NEPTUNE

is evening star. His right ascension on the 1st is 4h. 10m., his declination is 19° 24′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 0h. 40m. A. M. On the 31st he sets at 10h. 44m. P. M.

Mercury, Saturn, Mars, and Neptune are evening stars at the close of the month. Venus, Jupiter, and Uranus are morning stars.

Fish Remains in the Lower Silurian.

The Devonian has for many years been popularly known as the "age of fishes." During this geological period the ichthyic life of the earth attained a most wonderful development, and it was long the current belief that during this time fishes first appeared upon the earth. The fact that the fauna was most highly differentiated and varied has been a stumbling block to evolutionists, who could find no ancestors in older rocks from which the Devonian forms could have arisen. The discovery of fish remains in the Ludlow (Upper Silurian) rocks of Great Britain and later on in the island of Osel, in the Baltic Sea, carried the fauna back one stage in the geological scale as far as Europe was concerned. The occurrence of certain markings on rocks of Clinton age in New York was long ago known; but it was not until 1885 that fish remains were actually found in America below the Devonian. In that year Professor Claypole described some remains from the Onondaga Salt group of Pennsylvania, and mentioned some minute spines from the Clinton which were thought to belong possibly to fishes.

In 1888 Mr. Matthews noted the discovery of fish in New Brunswick in strata referred to the Lower Helderberg, so that it was known then that fish remains actually occurred in Upper Silurian strata in North America as well as in Europe. This being so, the remains of vertebrates were expected to occur in older rocks than these.

In 1888, in a collection of fossils made near Canon City, Colorado, about eighty miles south of Denver, by Mr. T. W. Stanton, Mr. C. D. Wolcott, paleontologist of the United States Geological Survey, recognized the remains of fish. Their association with fossils of a Lower Silurian aspect was so unusual as to give rise to the belief that the rocks had been disturbed, and that Devonian and Silurian forms had become mingled. Further material being desired, Mr. Stanton was instructed to collect during the past summer in Colorado and to check up his original observations upon the section. This was done, and from a study of the material, Mr. Wolcott concluded the remains were from strata of Trenton age. To verify it, however, he went last December to Canon City, studied the section, and collected material from the fish bed and above it. As a result the announcement was made at a meeting of the Biological Society of Washington, on February 7, that fish remains had been found in strata of Trenton age.

The remains are of the same type as the placoganoid fish from the Upper Silurian of the island of Osel. Two forms have so far been recognized. One is related to the Elasmobranchii, or the sharks, and consists of the outer covering of the notochord. The other is probably one of the Placodermii, a group of extinct Paleozoic fish, and consists of numbers of fragments of the scales.

A study of the invertebrate remains found associated with the fish, by Mr. Wolcott, showed the fauna to be Trenton in its facies. Out of 33 species identified, no less than 21 are identical with forms occurring in the Mississippi valley. This fauna is found 180 feet above the beds with the fish remains.

The discovery here noted is of the greatest interest. It not only carries the vertebrate fauna much farther back in time than any previous record, but it is the first recorded discovery of vertebrates at so low a horizon in the world. As might have been expected, the forms are low types, and represent the possible ancestors of the Devonian forms. It will now be confidently anticipated that other similar remains will be found in other strata of Lower Silurian age.

JOSEPH F. JAMES.

Washington, D. C., February 9, 1881.

History of the Thermometer.

The invention of the thermometer marks an epoch in science, for it alone has permitted of obtaining a knowledge of the laws that govern calorific phenomena. The first idea of it is perhaps due to the celebrated Van Helmont, who devised an apparatus which, to use his words, was "to prove that the water contained in a bulb attached to a hollow rod rises or descends according to the temperature of the surrounding medium."

In the seventeenth century, the necessity of an apparatus adapted for measuring the differences of the temperature was so greatly felt that Galileo, Bacon, Scarpi, Fludd, Borelli, and other scientists of the epoch devoted themselves in this direction to researches that were not always crowned with success. It is not till 1621 that we find a beginning of the solution in the experiments of a Dutchman, Cornelius Van Drebbel This physicist's thermometer consisted of a tube filled with air, closed at its upper extremity and dipping at its other extremity (which was open) in a bottle containing nitric acid diluted with water. According as the external temperature rose or fell, the air in the tube increased or diminished in volume, and consequently the liquid descended or rose.

This instrument, called the *calendare vitrum* (indicating glass) by its inventor, constituted what has since been called an air thermometer, but as its graduation was based upon no definite principle, it was incapable of furnishing any comparable reading.

Along about 1650 the members of the Accademia del Cimento, at Florence, introduced into the thermometer certain improvements that gave it nearly the form that it has to-day; and its principle was based upon the expansion of liquids. The tube was filled with colored alcohol. In order to graduate it, it was taken to a cellar and the place was marked where the liquid came to a rest. Then, starting from this, the portions situated above and below the mark were divided into one hundred equal parts. As may be seen, it was impossible with such a system to construct two instruments that should agree. Nevertheless, it was the only apparatus that was made use of for half a century.

Finally, in the latter part of the seventeenth century, the physicist Renaldini, of Pisa, a professor at Padua, proposed that all thermometers should take the freezing degree of water as a fixed point, and, as a second fixed point, that to which alcohol rises in a tube dipping in melted butter, the intervening space to be divided into equal parts.

From this epoch, then, dates the present thermometer, and the first instrument due to this innovation dates back to 1701. This was constructed by Newton, and was the first thermometer giving comparable readings that had been devised. The liquid that he adopted was linseed oil, which is capable of supporting a higher temperature than alcohol without boiling, and his fixed point of graduation for the upper limit was the heat of the human body, and for the lower, the point at which the oil stops at the moment of its congelation.

A search soon began to be made for a thermometric agent other than oil (which was too feebly expanded by heat and which congeals at but a slightly elevated temperature), and, in 1714, Gabriel Fahrenheit, of Dantzig, almost completely solved the problem in the construction of the thermometer that now bears his name. This was immediately adopted in Germany and England (where it is still employed) and was introduced into France. But along about 1730, scientists gave preference to the one that Reaumur had just devised.

Finally, in 1741, Celsius, a professor at Upsal, constructed the instrument called the centigrade thermometer.

The three last-named instruments are the ones most commonly used, and differ only in the graduation of each.—*La Science en Famille.*

Numerous Uses for Aluminum.

Among the uses for aluminum suggested by Mr. Eugene H. Cowles, president of the Lockport Company, according to *Modern Light and Heat*, are the following: At fifty cents per pound the new metal will compete with copper at seventeen cents, the latter being 3·56 times as heavy as an equal bulk of aluminum. But the electrical conductivity of aluminum that is ninety-eight per cent pure is only seventy-five per cent that of copper, so that one-third more area would be required to do the same work. A reduction of forty-five per cent in weight of motors for electric cars can be secured by using the new metal, which in itself is no small advantage, seeing that the latter promise to come into extensive use in the near future. The coating and lasting qualities of aluminum far surpass those of tin, and it will cover three times as much surface for equal weights, making it necessary to sell tin at sixteen cents per pound in competition with the other at fifty. Nickel at seventy cents would no longer be used for plated ware or coinage, the new metal being much cheaper and cleaner. He expects to see it sell at two to three hundred dollars per ton, and at these figures it will be the cheapest metal next to iron and steel. The price must fall lower and lower as the facilities increase for making the material and the market adapts itself to the absorption of larger quantities of the new metal.

W. BARCLAY PARSONS, chief engineer, is constructing in the Allegheny Mountains of northern Pennsylvania a system of lumber railways, using gradients frequently of 3·5 per cent and at times up to and over 4 per cent. The power used is a Shay engine, a machine with three vertical cylinders driving a horizontal shaft, which is geared to all the wheels, tender included. This shaft is jointed so that the longest rigid wheel base is 56 inches. Such an engine uses the whole weight for adhesion, and at a ratio of ¼ with a weight of 60 tons would develop 30,000 pounds tractive power.