

duced greater or less quantity, as also the quality, according to the favorable or unfavorable conditions existing. The Coscuez group is said by tradition to be very rich and the quality of the stones said to be of the particular "canutillo" form and of superb quality. Many attempts have been made to find the actual "locus in quo" of the productive formation, but up to the present without success.

Recently, however, an emerald producing formation of great importance has been discovered by the aid of old Spanish parchments in the Somondoco district, locally known by the name of Chivor, but as yet has not been worked by the discoverers; at present only the old Spanish tunnels and workings, indicating that in past centuries great mining operations had been carried on there, have been overhauled, giving proof of the existence of emeralds of considerable crystallization. It is intended to open up these extensive workings, so long lost to the world since the suspension of the works by order of the King of Spain in the year 1792, owing to the fact that all the emerald properties, Muzo and Coscuez included, produced a loss and not a profit to the kingdom of Spain. This was due to the dishonesty of the captains of the mines, who, by law, were obliged to deliver the fifth part of the production to the King of Spain in return for the assistance afforded to them by the Royal House in the form of troops and ammunition to protect them from hostile tribes. It was during this suspension that so many mines were lost sight of and completely overgrown with tropical vegetation, as were also the bridle-paths which led to them through the forests and mountains. Even towns with 2,000 inhabitants dependent on the mines were abandoned; some have been rediscovered by accident, a hunter coming upon a paved street, or some stone foundations of a house. The Spaniards always built their houses with stone foundations. Among these lost towns Muzo may also be counted. At one time it boasted of seventeen churches and a large population. To-day there is one church and only about 300 people. It is interesting to note that, with one or two exceptions only, all the mines of any worth now being worked were known to the Spaniards, and in the majority of cases considerable workings are evident.

THE HEAVENS IN SEPTEMBER, 1902.

BY HENRY NORRIS RUSSELL, PH.D.

As the sun moves southward, and the shortening days bring the coolness of autumn, it seems appropriate to inquire: What is the nature of this immense supply of heat? By actual measurement (allowing for the heat absorbed by our atmosphere) it is found that the heat received by the earth under a vertical sun is enough, if all of it could be utilized, to run a one horse power engine for every four square feet of exposed surface. On account, however, of the absorption of heat by the air and the great mechanical losses in any form of heat engine, not 10 per cent of this power can be put to practical use. Nevertheless the energy is there, though we cannot harness it.

Now the cross-section of the earth, as seen from the sun, is about 1,200 million million square feet. So the rate at which the sun expends energy in warming the earth amounts to about 300 million million horse power.

But this is not all. If there were a number more planets each as large as the earth and at the same distance from the sun, they would form a close-packed spherical shell inclosing the sun completely, and intercepting all its radiation. This sphere would be 186,000,000 miles in diameter and would contain over 2,000,000,000 planets. The total radiation of the sun must then be 2,000,000,000 times what the earth receives. The corresponding number of horse power is about 600,000,000,000,000,000,000—a number quite beyond our power to grasp. It amounts to over 10,000 horse power for every square foot of the sun's whole surface.

What can supply the sun with this enormous amount of energy?

If the sun's heat was not kept up in some way, calculation shows that it would cool off entirely in a very few thousand years. Even if it were all composed of the best of fuel, its combustion would only keep it radiant for five or six thousand years more.

A satisfactory explanation has been given by Helmholtz, who assumes that the whole mass of the sun is slowly contracting. The mass of the descending layers and the force of solar gravity that acts on them are so great that a very large amount of heat is evolved by the process. His calculations show that the whole amount of the sun's radiation in a year would be accounted for by a decrease of 250 feet in the sun's diameter. The whole shrinkage of the sun in the 300 years since the invention of the telescope would be about fifteen miles. Twenty times as great a change could hardly be detected by the best modern observations. So we shall have to wait a few thousand years before any evidence of this shrinkage can be obtained by observation.

THE HEAVENS.

At 9 P. M. on the 15th Cygnus is overhead. Lyra lies to the west of it, then Hercules, Corona and Boötes, the last near setting. Ophiuchus and Serpens are in the southwest, and Scorpio is setting there. Sagittarius is west of south. Jupiter is just due south, and Saturn is an hour west of him. Between them, and a little distance above, are the two double stars of Capricornus—both worth looking at with a fieldglass.

Aquila is above them, marked by the brilliant Altair, east of which is the little group of Delphinus. The southeastern sky is very dull, the only bright star being the lonely Fomalhaut, in the constellation of the Southern Fish, low down near the horizon.

Pegasus and Andromeda lie east of the zenith, with Aries and Perseus below and to the left. Capella is just rising in the northeast. Cepheus is above the Pole, Cassiopeia to the right, and Ursa Minor and Draco to the left of it, while Ursa Major is well down toward the northern horizon.

THE PLANETS.

Mercury is evening star throughout the month. On the 24th he is at his greatest elongation, but being south of the sun, sets less than an hour after sunset, and is, therefore, hard to see. On the 20th he passes close to the bright star Spica, their apparent distance being less than ¼ of a degree. This will be an interesting sight, though one must look sharp to see it in the twilight.

Venus is morning star, rising rather less than two hours before the sun. Although 150,000,000 miles distant, she is still the brightest of the planets. Mars is morning star in Cancer, rising about 2 A. M. in the middle of the month and gradually increasing in brightness.

Jupiter is in Capricornus, and is by far the brightest object in the evening skies. Saturn, which is in Sagittarius, comes next to him in this respect.

Uranus is in Ophiuchus. On the 10th he is in quadrature with the sun, and comes to the meridian at 6 P. M.

Neptune is in Gemini, and is also in quadrature with the sun on the 27th, being due south at 6 A. M.

THE MOON.

New moon occurs at noon on the 1st, first quarter at noon on the 9th, full moon at 1 A. M. on the 17th, and last quarter at 6 P. M. on the 23d. The moon is nearest us on the 19th and farthest away on the 7th. She is in conjunction with Mercury on the 3d, Uranus on the 9th, Saturn on the 12th, Jupiter on the 14th, Neptune on the 24th, Mars on the 27th and Venus on the 30th.

At 7 P. M. on the 23d the sun crosses the celestial equator, entering upon the sign of Libra, and, according to the almanacs, autumn commences.

THE SUPPLANTING OF AGRICULTURE BY CHEMISTRY.

Senator Berthelot, the well-known French chemist, has published an interesting paper anent the chemical synthesis of aliments, in which he foresees in the difficulties it still presents the economical emancipation of the human race, and the transformation of this planet into a vast pleasure ground. The more the conquest of electrical energy advances the nearer it appears to M. Berthelot that mankind approaches toward the substitution of chemistry for agriculture.

Just as agriculture was evolved from the hunting, fishing and pastoral stages of primitive mankind, so chemistry now sets up to displace with its products agricultural industries based on the production of living organisms, animal and vegetable, by the creation of nutritive matters. The farm is already being edged out by the factory, and engineers and mechanics will soon take the place of peasants and field laborers. It is not long since the possibility of creating by synthesis all the organic matters was held to be chimerical; now the possibility has been demonstrated so often as to render it undeniable. Alimentary stuffs may be broadly divided into three fundamental classes—fats, sugars and albumenoids. As early as 1854 M. Berthelot by chemical synthesis created bodies exactly similar to natural fats by means of substances related to them, namely, glycerine and acid. He also generated these two substances with hydrocarbons. Sugar can now be produced in the chemist's laboratory by similar combinations. Chemical synthesis has not yet created the albumenoids, which are more complex and more liable to spoil. There is no doubt, however, but this feat will shortly be accomplished. Chemical discoveries have already given rise to changes in agriculture. Madder has gone out of cultivation in the south of France, indigo in the West Indies and vanilla in other tropical places, owing to the chemical substitutes, and chemical foodstuffs are no more an impossibility than chemical dyestuffs. M. Berthelot, however, utters a note of warning against the illusion of thinking that food can be condensed into lozenges and pills, and that one's meals can be carried in a small chocolate box in one's waistcoat pocket. The human organism has its habits which are tantamount

to necessities, and among its habits is that of burning from 250 to 300 grammes of carbon daily, and of eliminating from 15 to 20 grammes of nitrogen. Allowance must also be made for the waste in the body of about one-seventh of the food it consumes. A certain bulk or weight of food will, therefore, continue to be indispensable, and though this may be chemical food it is not likely ever to become so condensed that a man can carry a week's rations on the march without inconvenience as is sometimes suggested.

ANOTHER GREAT HYDRAULIC ELECTRIC POWER PLANT.

A company has organized in Los Angeles to build a large power plant on the banks of Feather River. This plant will be the largest electrical power development scheme yet undertaken or proposed in western America, and will rival that of the Niagara power plant. It will be located in Plumas county, Cal., from which point current will be transmitted to San Francisco, a distance of 180 miles. The water supply is to be obtained from the North Fork of Feather River, and impounded in two reservoirs of unusual size, one of which will cover 8,000 acres, and the other, in Butte Valley, a few miles distant and some 250 feet lower, will cover about 2,000 acres. The watershed area tributary to these reservoirs is about 600 square miles, on which the most prominent elevation is Lawson's Peak, a region of perpetual snow. The average rainfall of that region for the last twenty years has been about 67 inches, and for the twenty years previous to that about 70 inches, with a range of from 33 inches as a minimum to 103 inches as a maximum.

It is well known that Feather River is the largest tributary of the Sacramento, and only second to the Sacramento in discharge of any of the streams of the State, while the greater portion of the flow of the Feather comes from the watersheds tributary to the reservoir sites purchased by the new company. These reservoirs, when constructed, will be without parallel in the western half of the United States, and will be so designed as to equalize the flow of the stream available for power to about 1,500 cubic feet per second. From the main reservoir in Big Meadows it is proposed to construct a canal about 10 miles in length to the Butte Valley reservoir, the water being delivered into this reservoir, whence it will be carried along the edge of the canyon of Feather River by a series of tunnels for a distance of 5 miles to Mosquito Creek, where it will be given a vertical fall of 1,600 feet, producing a total of about 270,000 horse power.

The favorable character of the dam sites for these reservoirs and the absence of serious engineering obstacles on the conduits will render this enormous undertaking comparatively inexpensive and vastly cheaper per unit of power than any other power plant yet constructed in the West. It will enable the company to deliver the power even at the long distance of transmission contemplated, in successful competition with other plants. When it is remembered that the total development of power at Niagara thus far has not exceeded 100,000 horse power, a better conception of the magnitude of this new enterprise and its possibilities may be had. A corporation has been organized, to be known as the Western Power Company, with an authorized capital of \$5,000,000, whose headquarters will be Los Angeles.

The feasibility of transmitting electricity over 180 miles has been fully demonstrated. Only a short time ago the Bay Counties Power Company completed connections with San Francisco over lines of the Standard Electric Company, and is now transmitting power to that city via Oakland around the head of San Francisco Bay with a pressure of 40,000 volts over a distance of 223 miles.

WHERE WOOD ENGRAVING ORIGINATED.

Much controversy was at one time excited about the country that could claim to have originated wood engraving. A very simple process was known to the Egyptians for the production of stamps, and it has been asserted that the Chinese printed from blocks of pear tree as early as the tenth century. The independent origination of the art has been generally credited to Germany among modern nations. In the Cologne district a St. Christopher, which has often been reproduced, was cut in 1423, a St. Sebastian in 1437, and a Madonna has been dated 1418. Playing cards were, however, in use in France in the middle of the fourteenth century, and the figures were impressions from wood blocks. It is allowable for France to dispute the priority of Germany, and many attempts have been made to claim the art as due to French enterprise. M. Henri Bouchot, of the Bibliothèque-Nationale, now declares that a part of a block with a representation of a Crucifixion has been discovered in a country town of France. The costumes are evidently those worn in the middle of the fourteenth century, and it is assumed that the wood block belongs to some time between 1340 and 1350.