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(Illustrated articles are marked with an asterisk.)

COSMICAL CAUSES OF CHANGES OF CLIMATE.

In a former article, under the head of "Changes of Climate," we have given some of the arguments adduced in favor of the haeory that our planet is still undergoing the cooling process, which geology proves that she was undergoing millions of years ago. Another argument in favor of this theory, not founded on observation, is the *a priori* consideration that our earth possesses, interiorly, a temperature far above that of the surrounding planetary space, and that, therefore, according to the laws of distribution and radiation of caloric, a slow loss of heat must take place, tending ultimately to make the temperature of our whole globe equal to that of the space she moves in; that is, according to Pouillet, 240° below the zero of Fahrenheit.

The solar caloric radiation, enormous as it is, is without influence on the temperature of the earth's interior, it having been proved that the whole effect penetrates the surface to a limited number of feet only, and is as easily lost by radiation during the night and the winter as it is received during the day and the summer season. The incapability, of the apparently powerful solar radiation, to prevent a planet from losing its own heat, is forcibly illustrated by the present condition of those tops of our earth's mountain peaks which are elevated above the snow line, where, even under the tropics, a perpendicular midday sun is unable to raise the temperature above 32° Fah. The present condition of our moon is another case in point; we know now that this satellite has cooled down far below the freezing point; that practically it has no atmosphere, and that all its water, long ago, has been chemically combined with the lavas of its surface into hydrated rock, similar to those of our earth, which contain, in solid condition, a mass of water perhaps equal to half that of our oceans. The opinion, of some astronomers of the former century, that the side of the moon turned towards the sun should be subjected to great heat, is sufficiently refuted by the observation of the effects of the sun on our mountain tops above the snow line referred to.

These arguments serve to show the incapability of the sun to prevent the cooling down of the planets and satellites under its influence. In fact, our whole planetary system is an illustration of this simple law of caloric radiation: that the smallest bodies will require the shortest time to cool down, while inversely, the largest will remain hot the longest. The smallest planetary body, with whose physical condition we are acquainted, is the moon, and this has cooled down far below the freezing point. The next planetary body, the only one, in fact, with which we are intimately acquainted, is our earth, and this has cooled down, exactly so far as to allow the solar radiation to develop vegetable and animal life on its surface; and a similar condition may perhaps exist on the surface of the planets Mars and Venus, not differing much in size from our earth. When we, however, look at the larger bodies of our planetary system, say Jupiter, which surpasses our earth in size more than 12,000 times, we find a very different condition of affairs. In the first place, its density is only one third more than that of water; while the density of our earth surpasses that of water five times. This proves from the outset that matter is on Jupiter by no means in the same condition as on our earth; that probably it has a much higher temperature of its own, so high as to keep in a gaseous condition many substances which are liquid or solid on our earth. Very recent observations with the spectroscope and telescope combined have indeed proved this to be actually the fact, and that this planet, as well as Saturn, Uranus and Neptune, possesses so high a temperature as even to shine with, besides the reflected solar light, some luminosity of their own.

If, finally, we look at the central body of our planetary system, the sun, which surpasses Jupiter in the same ratio that Jupiter surpasses our earth, we find that the cooling process has advanced the least; in fact, the heat of the sun is still so great as to be entirely beyond our present means of estimating temperatures.

Human life and even the historical record is short, while the changes spoken of extend over such long periods of time as to be an eternity compared with them. No wonder, therefore, that the practical evidences are slight, so slight indeed that we should feel inclined to disbelieve such changes, and to accept a theory of perfect stability of condition. There are indeed some who adhere to this belief; but unfortunately for them, there looms up the geological record, proving stupendous changes from the time when the most excessive tropical climate prevailed at the poles; while, between the tropics, an excessive torrid zone and boiling ocean formed an unsurpassable barrier for the vegetable and animal life around the poles of each hemisphere. Before that time, there was a period that the earth's temperature was so high as to occupy four times its present bulk, and to be self-luminous. Then perhaps the moon was cooled to the temperature possessed now by the earth and she may have been inhabited; a condition similar to that of Jupiter at the present day, where the moons may have inhabitants, though the planet itself cannot.

If these above conceptions are correct, worlds have their times of preparatory development, of youth, of manhood, and of decay. Jupiter is in its preparatory stage; our earth has passed its youth and is just entering into manhood; our moon has had its time of decay and is now a dead planet. This will continue, with the difference that, after millions of ages, these conditions will be shifted from one set of celestial bodies to another

THE NEW MANHATTAN MARKET.

One of the largest structures in the United States is the Manhattan market, situated between 34th and 35th streets and Eleventh and Twelfth avenues in this city. Its dimensions are 900 feet in length by 200 feet in breadth. Its foundations rest principally on piles driven to depths varying from 14 to 50 feet; on these, heavy beds of concrete are laid, above which, and level with the upper line of the foundation, the floor is placed. This is 160,000 square feet or over three acres and a half in extent. It consists of, first, a layer of concrete four inches, then two inches of asphalt, and finally a coating of Portland cement, one and a half inches in thickness. The latter is to be colored in various designs and all will be impervious to water. Drainways are provided on either side of the building, through which all refuse will be carried to the river as often as the water from the 1,000 Croton hydrants is allowed to play upon it. With such a flow, it is believed that the atmosphere and the market generally will be kept thoroughly pure and clean.

The walls are built of Philadelphia brick and light colored (Lockport) stone, the latter being used for trimming and for portions of the ornamentation. The architectural style of the building is what is known as the Lombard. The massive sides and roof are finely symmetrical, and it is claimed that they present some of the finest specimens of mason's and bricklayer's work in existence. On either front, the name of the structure and the date of the commencement of the work are inscribed.

From the walls rises the arch—of iron and slate—which forms the roof. The arch proper springs to an altitude of 135 feet, and extends to within 75 feet of either front. The ends of this archway are domelike in form, and the whole is covered with parti-colored slate, arranged in various figures and designs. The central tower of the building is 236 feet high, and will contain a clock, claimed to be the largest in the world, costing $37,000. The other towers are two on either of the façades, and two on the center line of the sides. All are to be of similar design, and to have dials small in size compared to that on the main tower. Eight elevations, constructed of iron and wood, and built along the crown of the arch, serve as ventilators. The windows are 1,500 in number and are on pivotal centers.

Between the walls and the inner line of pillars which sustain the roof and towers, there are to be ranged between ten and twelve hundred stalls, one half for wholesale and the other for retail dealers in meats and market produce generally, excepting only fish, for which another building is to be constructed. The larger of these stalls will be sixteen feet square, and the smaller, ten by eleven.

In addition to the main structure, which is to be opened to the public early in August, there are to be exterior roadways and a long dock constructed. A line of river steamers are building which, when completed, will be used for the delivery of orders to the shipping in the harbor, and to various predetermined points in Brooklyn and New Jersey, between which and the offices in the main building there will be telegraph lines. In addition to this, suitable positions are to be prepared for market gardeners and produce dealers from Long Island and New Jersey.

The cost of this great market enterprise, together with its docks and steamers, additional buildings, etc., is $2,000,000. Situated in a central position, it will be the great point of supply for the entire city. The structure forms one of the most conspicuous objects in New York, and is visible up and down the river at a distance of several miles.

SPONTANEOUS COMBUSTION.

During an investigation into the causes of a recent fire which broke out in a loaded warehouse in New York, the testimony showed that the fire originated in a case of silk twist, packed in a tight case, with two layers of thick paper and one layer of oilcloth between the inside of the case and the goods, thus wholly excluding the air from without. The goods had evidently been packed while damp, and, therefore, the heat of the weather favored the ignition in the manner supposed.

After the fire was extinguished, an effort was made to have the remainder of the goods removed from the premises, but it was not permitted. In the course of three days, fire was again discovered, and but for the promptitude and efficiency of the firemen, a heavy loss would have resulted. On investigation, it was discovered that this fire also originated in one of the same cases of silk twist, and was beyond question spontaneous.

The Fire Marshal is of opinion that goods packed like the above, no matter whether they be woolen, cotton, hemp or silk, are liable to ignite at any time when the atmosphere favors. In this case, it was shown that the goods had become valueless before the fire, as the process of combustion, which had been going on within the case, had made the silk so rotten that it could be broken with ease. It is believed that many vessels and places of business are destroyed by fire which originates in this manner.

CANAL BOAT TOWING BY ROAD STEAMERS.

We learn from the Troy *Whig* that a trial of Williamson's road engine "Enterprise" was recently made on the tow path of the Erie Canal between Albany and Port Schuyler. The machine is thirteen feet in length by seven feet wide, with an upright boiler. There is a double horizontal engine with two cylinders, each, with a ten inch stroke, enclosed in a box.

There are two driving wheels five feet in diameter, the tires of which are fifteen inches wide, covered with stout india rubber and protected by iron shoes about five inches wide and set about three feet apart. The steering wheel is three feet in diameter, with a tire twelve inches in width. The seat for the engineer is directly in front of the engine, which is managed by a double crank. On either side of this seat are water tanks, and in the rear are two coal bunkers. The machine can be turned on its own ground and works much the same as a velocipede. In hight, the engine is eight feet from the groudd to the top of the boiler. The smoke stack is hinged, so as to be lowered when passing under bridges. The engine is twenty-four horse power. Four boats, three loaded and one light, were hitched to the steamer and were propelled at the rate of about four and a quarter miles an hour. The first mile was made in thirteen minutes. The "Enterprise" is valued at $5,000, and was built about three years ago. It has worked successfully on roads, and the owners are confident of its success in canal boat towing.

The New York *Sun* remarks: "It is said that all who witnessed the trial were fully satisfied of the practicability of this plan of steam towage, and it appears that its economical advantages are very great. The pressure of steam required to enable the engine to draw three barges is ten pounds to the square inch, and that pressure can kept up with a consumption of one hundred and fifty pounds of coal per hour. By a careful comparison of the cost of towing three boats by the road steamer and one boat by horse power from Albany to Buffalo, in which interest, wear and tear, and all contingencies are taken into consideration, it is estimated that by the use of the road steamer the expense of towage would be $133.86 less for each boat than by horse power, while there would be a gain of four days in time. The usual time consumed in a trip between Buffalo and Albany is ten days; the road steamer would easily make it in six.

It may be that some system of water traction may be devised that will give even better results than these; but if not, it seems to have been fully demonstrated that the land tractor will do more than has generally been deemed possible Should it come into general use there can be little doubt that many improvements in its construction will be suggested by experience, and it is also probable that improvements will be introduced in the construction of boats which will reduce the resistance of the water and lessen the wash of the banks. At all events it is safe to assume that horse power on the large canals will eventually be generally superseded by steam, whether land or water traction is adopted as the substitute for the present system."

The steamer alluded to is known as Thompson's patent, in England where it has been brought into very extensive use, and has been subjected to the severest tests. Mr. Williamson is the owner of the patent for this country. An excellent engraving of the invention with full description will be found on page 319, Vol. XXI of the SCIENTIFIC AMERICAN. The capabilities of the engine for canal boat traction are there set forth. That it is well adapted to such a purpose, there can be no question.

LOOK OUT FOR THE METEORS.

On the 10th of August, unless the calculations of our astronomical *savans* fail us, the earth will pass through a ring of meteors—the remains of the comet of 1862—on which date those of our readers who are wide awake may expect a meteoric display of greater or less brilliancy. We give in another column a very interesting summary of Dr. Schellen's statements concerning meteors and the annual shower in August.

BECAUSE I AM SO LAZY.

An esteemed correspondent, who is a good writer, a good investigator, and who knows just what is useful and interesting for readers of the SCIENTIFIC AMERICAN, says that the only reason why he does not more frequently contribute to our columns is "because I am so lazy." This unfortunate condition besets thousands of the most useful people in the