calculated apparent volume of the standard 100 c.c. The size of the tube is so arranged that this mark falls on the narrower portion of the tube, just below the expanded part. The pressure tube C is then raised or lowered until the mercury in B stands at the mark, when the stopcock at the top of B is closed. Thus a volume of air is enclosed which at 0° and 760 mm. and in the dry state would occupy exactly 100 c.c. In order to determine the corrected volume of a gas it is then only necessary to introduce it into the measuring tube A, allow it to cool to the temperature of the room, and then adjust B until the mark is a little higher than the mercury meniscus in A; C is next raised until the mercury in B rises to the mark, when B and C are finally simultaneously lowered until the level of the mercury in A and B is the same. The gas in A and the air in B are evidently equally compressed, and thus the volume read off upon the measuring tube A represents the corrected volume at 0° and 760 mm. The simplicity of the arrangement and the rapidity with which it can be worked are sure to recommend it for general use; and its applicability to the estimation of nitrogen in organic substances, which Prof. Lunge discusses in detail, will doubtless be especially appreciated by those who employ the volumetric method.

THE additions to the Zoological Society's Gardens during the past week include two Red Tiger Cats (*Felis planiceps* jv.) from Malacca, a —— Fish Eagle (*Polioaëtus ichthyaëtus*) from the Himalayas, deposited; a Gayal (*Bibos frontalis* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on March 20 = 9h. 53m. 31s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 2008	—	—	9 59 44	− 7 11
(2) π Leonis	5	Yellowish-red.	9 54 24	+ 8 34
(3) α Ursæ Majoris ...	2	Yellow.	10 57 0	+62 21
(4) β Ursæ Majoris ...	2	White.	10 55 12	+56 59
(5) D.M. + 68° 617 ...	6	Red.	10 37 26	+67 59
(6) R Virginis	Var.	Red-yellow.	12 32 55	+ 7 35·6
(7) U Boötis	Var.	—	14 49 15	+18 8·6

Remarks.

(1) This nebula is described in the General Catalogue as "Very bright; large; very much extended in a direction 45°; at first very gradually, then very suddenly much brighter in the middle to an extended nucleus." The spectrum of the nebula was observed by Lieut. Herschel in 1868, but his observations are not quite complete. He states that a continuous spectrum was suspected, and that there were probably no lines present. Further observations are obviously required.

(2) A star of Group II. Dunér states that the bands 2–8 are well seen, but that 4 and 5 are somewhat feeble. The spectrum is not strongly marked. The star is probably approaching the temperature at which the bands will be replaced by lines, and affords an opportunity of studying the order of the appearance of the lines.

(3) A star of the solar type (Gothard). The usual differential observations are required.

(4) A star of Group IV. (Gothard). The usual observations are required.

(5) One of the finest examples of stars with spectra of Group VI. Dunér states that the four bright zones and all the bands which he has numbered 1–10 are visible. In this star, band 6 is weaker than the other carbon bands. Band 5 is strong; 1, 2, and 3 are weaker; and 7 and 8 are visible with difficulty.

(6) This variable will reach a maximum on March 28. The period is about 146 days and the magnitudes at maximum and minimum 6·5–7·5 and 10–10·9 respectively (Gore). The spectrum is a remarkable one of the Group II. type, and the great range suggests the possible appearance of bright lines at maximum, as in R Andromedæ, &c., observed by Mr. Espin. Mr. Espin has noticed that in the variables, where F is very bright, the bright lines do not appear until some time *after* the maximum. It is therefore important to continue observations for a considerable period.

(7) No record of the spectrum of this variable appears to have been published. The period is about 176 days. The magnitude at maximum is 9–9·5, and that at minimum 13·5 (Gore). A maximum will be reached about March 23.

A. FOWLER.

THE MÉGUÉIA METEORITE.—This meteorite was observed to fall at Méguéia, in Russia, on June 18, 1889, and a short account of Prof. Simaschko's analysis of it is found in the current number of *L'Astronomie*. It is noted that the meteorite belongs to that remarkable division containing carbon in combination with hydrogen and oxygen. The meteorites of this class are Alais, 1806, Cold Bokkeveldt, 1838, Kaba, 1857, Orgueil, 1864, and Nogoya, 1880. The Méguéia meteorite is covered with a thin (0·5 mm.) crust, is black, partly dull and partly shiny, and somewhat friable. A microscopical examination showed dark grey specks distributed through the black mass, varying in size from a mustard-seed to a hemp-seed. These grey specks have a more or less chondritic structure, and are different in composition from the mass of the meteorite. Besides these chondrules, the greenish, semi-transparent particles of olivine are seen as in almost all other meteorites, whilst nickel-iron is disseminated through the mass in small grains, and occurs in a half-fused state on the crust. Account is also given of white angular scales, much resembling certain fossils, but this is not the first time that the chondrules with their eccentrically radiating crystallization have been mistaken for organisms. Like other carbonaceous meteorites, that of Méguéia has a bituminous smell.

THE VELOCITY OF THE PROPAGATION OF GRAVITATION.—M. J. Van Hepperger, in a paper read before the Vienna Academy of Science, has assigned an inferior limit to the velocity of propagation of gravitation. It results from this limit that the time taken by gravitation to travel the radius of the earth's orbit does not exceed a second.

THE VATICAN OBSERVATORY.—The work to be undertaken at this new Observatory will be in connection with meteorology, terrestrial magnetism, seismology, and astronomy. The astronomical portion will mainly be directed to the photography of the sun and other celestial bodies, and to take part in the construction of the photographic map of the heavens, under the direction of the International Committee.

DOUBLE-STAR OBSERVATIONS.—Mr. S. W. Burnham, of the Lick Observatory, gives his sixteenth catalogue of double-stars in *Astronomische Nachrichten*, Nos. 2956–57. The observations were made in May, June, and July 1889, and 62 new pairs have been discovered and measured during this period.

SUN-SPOT IN HIGH LATITUDES.—The *Comptes rendus* of the Paris Academy of Sciences for March 10 contains a short note by M. G. Dierckx, in which he states that he observed a sun-spot on March 4 in N. lat. 65°. If this were substantiated, it would be an almost unprecedented observation. But the photograph of the sun taken at the Royal Observatory, Greenwich, on that day, shows no trace of a spot in so high a latitude. A fine group did indeed appear on the sun on March 4, but its latitude was only 34°. This, however, is a very interesting circumstance, for though spots have been observed at considerably greater distances from the equator, they have usually been only small, and have lasted but a few hours, or two or three days at most. It would seem probable, therefore, this is the group which M. Dierckx observed, but that he made some error in determining its latitude.

GEOGRAPHICAL NOTES.

THE limits of the ever-frozen soil in Siberia are the subject of a paper by M. Yatchevsky, in the *Izvestia* of the Russian Geographical Society (vol. xxv. 5). It is now generally admitted that Karl Baer's criticism of Middendorff's measurements in the Sherghin shaft at Yakutsk—from which measurements Middendorff concluded that the depth of frozen soil at Yakutsk reaches 600 feet—are well founded. The walls of the shaft, which was pierced seven years before Middendorff came to Yakutsk, had cooled in the meantime through the free access of cold air, and therefore a smaller increment of increase of temperature with depth was found by Middendorff than would have been found if the measurements had been made in a shaft immediately after its being pierced. Nevertheless, the fact of the frozen soil extending to a great depth, especially in the valley of the Lena, is not to be contested; nor can there be any doubt as to the extension of frozen soil over large parts of Siberia. M. Yatchevsky attempts to determine its limits from general considerations about the average yearly temperature of separate regions, and the thickness of their snow-covering; and he gives a map of the probable southern limits of the frozen soil in Siberia, which do not differ much from the yearly isotherm of − 2° C. It must, however, be remarked that though the map approximately shows where the ever-frozen soil *may* be found beneath the thin layer of soil which thaws every summer, it ought not to be concluded that ever-frozen soil *will* be found everywhere within those limits. For instance, the granite rocks on the surface of the Vitrin plateau being immediately covered with immense marshes, the water from these marshes infiltrates into the rocks, and, while the marshes are covered during the winter with a crust of ice, their depths remain unfrozen. It may thus be considered certain that immense spaces will be found within the theoretical limits marked on the map, where no ever-frozen soil will be discovered. The Russian Geographical Society is sending out a series of questions, in the hope of obtaining accurate information, and it would be well if the same thing were done in Canada.

ACCORDING to a letter from Iceland, dated Reykjavik, February 5, 1890, a translation of which is printed in the current number of the *Board of Trade Journal*, the population of Iceland during the four years from 1885 to 1888 inclusive has diminished by about 2400, the total number at the close of each of these years having been, in 1885, 71,613; in 1886, 71,521; in 1887, 69,641; and in 1888, 69,224. This diminution was greatest (1880) in 1887, the explanation for which may be sought in the enormous emigration to America which took place in that year. The diminution in the remaining years, though less sensible, must be attributed to the same cause, as in these years the number of births exceeded that of deaths. The chief diminution has been shown by the northern and eastern districts. The prefecture of Hunavatn in particular has fallen off in respect to inhabitants from 4800 in 1885 to 3785 in 1888. In Reykjavik, the capital, the population has risen from 3460 to 3599.

ATMOSPHERIC DUST.[1]

THE infinitely small particles of matter we call *dust*, though possessed of a form and structure which escape the naked eye, play, as you are doubtless aware, important parts in the phenomena of nature. A certain kind of dust has the power of decomposing organic bodies, and bringing about in them definite changes known as putrefaction, while others exert a baneful influence on health, and act as a source of infectious diseases. Again, from its lightness and extreme mobility, dust is a means of scattering solid matter over the earth. It may float in the atmosphere as mud does in water, and blown by the wind will perhaps travel thousands of miles before again alighting on the earth. Thus Ehrenberg, in 1828, detected in the air of Berlin the presence of organisms belonging to African regions, and he found in the air of Portugal fragments of Infusoriæ from the steppes of America. The smoke of the burning of Chicago was, according to Mr. Clarence King (Director of the United States Geological Survey), seen on the Pacific coast.

Dust is concerned in many interesting meteorological phenomena, such as fogs, as it is generally admitted that fogs are due to the deposit of moisture on atmospheric motes. Again, the scattering of light depends on the presence of dust, and you may remember my showing you on a former occasion that beautiful experiment of Tyndall, illustrating the disappearance of a ray of light when made to travel through a glass receiver free from dust, whilst reappearing as soon as dust is admitted into the vessel. There is no atmosphere without dust, although it varies largely in quantity, from the summit of the highest mountain, where the least is found, to the low plains, at the seaside level, where it occurs in the largest quantities.

The origin of dust may be looked upon, without exaggeration, as universal. Trees shed their bark and leaves, which are powdered in dry weather and carried about by ever-varying currents of air, plants dry up and crumble into dust, the skin of man and animal is constantly shedding a dusty material of a scaly form. The ground in dry weather, high roads under a midsummer's sun, emit clouds of dust consisting of very fine particles of earth. The fine river and desert sand, a species of dust, is silica ground down into a fine powder under the action of water.

If the vegetable and mineral world crumbles into *dust*, on the other hand it is highly probable that dust was the original state of matter before the earth and heavenly bodies were formed; and here we enter the region of theory and probabilities. In a science like meteorology, where a wide door is open to speculation, we should avoid as much as possible stepping out of the track of known facts; still there is a limit to physical observation, and in some cases we can do no more than glance into the possible or probable source of natural phenomena. Are we on this account to give up inquiring for *causes*? This question I shall beg to leave you to decide, but where we have such an experienced authority as Norman Lockyer, I think the weight attached to possibilities and theories is sufficiently great to warant my drawing your attention for a few moments to the probable origin of the stars and of our earth.

I dare say many of you have read the interesting article in the *Nineteenth Century* of November last, by Norman Lockyer, and entitled "The History of a Star." The author proposes to clear in our imagination a limited part of space, and then set possible causes to work; that dark void will sooner or later be filled with some form of matter so fine that it is impossible to give it a chemical name, but the matter will eventually condense into a kind of dust mixed with hydrogen gas, and constitute what are called nebulæ. These nebulæ are found by spectrum analysis to be made up of known substances, which are magnesium, carbon, oxygen, iron, silicon, and sulphur. Fortunately for persons interested in such inquiries, this dust comes down to us in a tangible form. Not only have we dust shed from the sky on the earth, but large masses, magnificent specimens of meteorites which have fallen from the heavens at different times, some of them weighing tons, may be submitted to examination. From the spectroscopic analysis of the dust of meteorites we find that in addition to hydrogen their chief constituents are magnesium, iron, silicon, oxygen, and sulphur.

There are swarms of dust travelling through space, and their motion may be gigantic. We know, for instance, some stars to be moving so quickly that, from Sir Robert Ball's calculations, one among them would travel from London to Pekin in something like two minutes. From photographs taken of the stars and nebulæ, we are entitled to conclude that the swarms of dust meet and interlace each other, becoming raised from friction and collision to a very high temperature, and giving rise to what looks like a star. The light would last so long as the swarms collide, but would go out should the collision fail; or, again, such a source of supply of heat may be withdrawn by the complete passage of one stream of dust-swarms through another. We shall, therefore, have various bodies in the heavens, suddenly or gradually increasing or decreasing in brightness, quite irregularly, unlike those other bodies where we get a periodical variation in consequence of the revolution of one of them round the other. Hence, as Norman Lockyer expresses it clearly, "it cannot be too strongly insisted upon that the chief among the new ideas introduced by the recent work is that a great many stars are not stars like the sun, but simply collections of meteorites, the particles of which may be probably thirty, forty, or fifty miles apart."

The swarms of dust referred to above undergo condensation by attraction or gravitation; they will become hotter and brighter as their volume decreases, and we shall pass from the nebulæ to what we call true stars.

The author of the paper I am quoting from imagines such condensed masses of meteoric dust being pelted or bombarded by meteoric material, producing heat and light, which effect will continue so long as the pelting is kept up. To this circumstance is due the formation of stars like suns. Our earth originally belonged to that class of heavenly bodies, but from a subsequent process of cooling assumed its present character.

While apologizing for this digression into extra-atmospheric dust, I shall propose to divide atmospheric dust into *organic*, or *combustible*, and *mineral*, or *incombustible*. The dust scattered everywhere in the atmosphere, and which is lighted up in

[1] An Address delivered to the Royal Meteorological Society, January 15, 1890, by Dr. William Marcet, F.R.S., President.