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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

DISCOVERY OF A FRESH-WATER LAKE NEAR THE SEA OF ARAL.

ACCORDING to information conveyed to the Geographical Society of Paris by M. Edouard Blanc, and printed in the May number of the Proceedings of the Royal Geographical Society of London, an interesting discovery of a fresh-water lake to the south-west of the Sea of Aral has been made by Col. Koslowski, of the Russian geographical service of Turkestan. Up to a comparatively recent date the Sea of Aral was represented on the maps as forming at its south-west corner a deep, narrow gulf (named Aïbu-ghir), extending far into the land, and bordering on the south-east the great Ust-Urt plateau. The Russian military expedition to Khiva (1872-3), in its march round the south-west and south of the Sea of Aral, found no such arm of the sea, and since then the Gulf of Aïbu-ghir has practically disappeared from the maps. In the map which accompanies Baron Kaulbars' work on the delta of the Amu-daria, the so-called Gulf of Aïbu-ghir is shown merely as a depression, without water, and its form and position are only vaguely indicated. Recent surveys effected by Col. Koslowski have revealed the existence of a fresh-water lake, occupying very nearly the position formerly assigned to the Gulf of Aïbu-ghir, but differing in its form. This lake is quite distinct from Lake Sari Kamish, which lies to the south of the table-land of the Ust-Urt, and has recently been the subject of a special exploration by Gen. Glukhovskoi. Unlike the Sari-Kamish depression, which, except at times of great overflows of the Oxus, is mostly dry, Lake Aïbu-ghir has a permanent supply of water, being fed by a fresh-water stream flowing into it from the north-east, which, although not in direct communication with any branch of the Amu-daria, drains the marshes formed by the overflowing of that river. The probable explanation of the formation of this lake is, according to M. Blanc, that it is part of the former great Aralian basin, which has become isolated in consequence of the general and progressive desiccation which has taken place in all this region. The elimination of the salt from its waters might be due to the formation of salines, although no salt-beds under the sand round the shores of the lake have yet been discovered; or it might be supposed that at some recent epoch, during a great overflow of the Oxus, the lake basin was filled with fresh water, the salt water being driven back into the Sea of Aral, and that at the same time a bar was formed by the alluvium brought down by the river, which would prevent the salt water flowing back again into the lake. The map of Col. Koslowski also fixes definitively the contour of the south-eastern escarpment of the Ust-Urt plateau and the topography of the country to the south-west of the Sea of Aral.

IMMORTALITY IN THE LIGHT OF MODERN DYNAMICS.[1]

THE hypothesis in reference to the re-grouping of atoms, in accordance with the calculus of permutations, which I announced in conclusion of my lecture on "Geological and Cosmical Problems," before the Franklin Institute, on November 17, 1890, is not entirely new, and I am bound to say that in at least one of its aspects it was advanced more than a hundred years ago by the great German philosopher Leibnitz, at a time when the sciences of chemistry and physics were not sufficiently advanced to warrant such a speculation. In the light of modern dynamics, however, it deserves our closest attention, for if it can be shown that matter is composed of ultimate particles, call them atoms, centres of force, or what we like, which are indestructible and in a state of continual vibration, I do not see how we can escape the conclusions which are forced upon us by this hypothesis. Some of the points which I am now about to discuss are new, and I am not aware that this entire subject has ever been presented in the manner in which I now propose to deal with it.

According to the nebular hypothesis our earth, like all the rest of the planets, once existed in the shape of a gas-ring, which was thrown off or became detached from the sun during its process of condensation. This ring could not retain its form: it necessarily went to pieces, and these afterwards collected into a single gas-globe, or spherical mass, which kept on pursuing its course around the great central body. The gaseous globe radiated an enormous amount of heat, it grew denser and denser, while its diameter diminished; it underwent an endless series of metaphorphoses, until it finally became the earth as we know it, the planet which has given us birth. So far all this is nothing new.

Now, even if the nebular hypothesis should prove erroneous, the conclusions which I am now about to present will remain in force, for the same ultimate conclusions can be drawn from every other world-hypothesis which has, as yet, been advanced.

Every particle of our earth, every object, every substance which we now have upon or in our earth, must have already existed in that gaseous ring or primitive gas-globe: no matter in what form or condition, it was there. In that gas-globe were the particles which, after countless ages, became united and roamed the great Mississippi valley in the shape of a mastodon; in that globe of gas were the atoms of carbon which now constitute the table on which I am writing these lines; in that immense rotating sphere were the substances which are now united in the body of my humble self.

Could we but follow, in a few days or hours, the changes, the transformations, the endless pilgrimages, which the atoms and molecules of the substances had to undergo during those æons before they became united so as to form, for instance, a human body, what marvels would we behold? The particles of hydrogen, carbon, phosphorus, etc., of which my body is composed, what a history might they not tell? In how many other bodies of the human species, of animals, plants, and inorganic compounds may they not already have existed, separated, united, differently grouped or arranged? What may they not already have gone through and experienced?

If King Solomon, wise king though he was, really pronounced, or was the first to pronounce, the opinion that there is nothing new under the sun, he could not possibly have been aware of the enormous significance which attaches to this idea in the light of modern science. Why should not the dust of Cæsar which is now filling a bung-hole, why should not those atoms and molecules which two thousand years ago were united in the body of Cæsar,—why should they not, after endless transformations, endless changes, endless transitions, become again united in precisely the same manner; in other words, why should not the same Cæsar of whom we read in ancient history, reappear at a given time: in short, why should not every thing now existing be compelled to undergo the same cycle of changes, and reappear, not once, but an infinite number of times? It would be very strange if such were not the case. The following will illustrate this.

Supposing we were to take six dice, such as are used in the

[1] Addendum to a paper on "The Limits of Scientific Inquiry" read before the Franklin Institute, Philadelphia, Nov. 17, 1890, by Dr. H. Hansoldt of Columbia College.

ordinary game. Let us place them in a little box, shake them, and throw them on the table. We will assume that they had fallen so that each cube exhibited the number three on its upper face; of course, a rare chance. Now it can be mathematically shown after how many throws those six numbers are likely to reappear according to the law of chance. It is possible that they may turn up already with the next throw; on the other hand, we may have to cast those dice ten thousand times. Both cases are improbable: the probability lies in a certain number. If, instead of six dice, we were to take seven, the critical number is, of course, so much further removed, viz: it would be necessary to throw oftener to get the seven threes, and so the number of casts increases with every additional cube, till we finally obtain enormous figures. But no matter how many dice, the threes must turn up, if we can throw them long enough, and if, in the case of a thousand dice, it were to take a million years, the threes must appear and reappear again and again after proportionate intervals.

Supposing now, that, instead of dice, we were to take a glass filled with sand. There are, let us assume, twenty thousand sand grains in the glass. Each particular grain occupies a certain position, which is bound to differ from that of all the rest of the sand grains: this the reader will doubtless admit. We shake the glass; the positions are altered, the order of arrangement is disturbed. We shake it again; the sand grains are now in a totally different position. We continue shaking the glass, and the time must come when each individual grain again occupies the exact position which it occupied when we originally started. It is a mathematical necessity, which all will admit who know anything of the calculus of permutations. The twenty thousand sand grains may be looked upon as so many dice, which are bound to fall precisely as they once fell if we can throw them sufficiently often.

Now, I have strong grounds for assuming that my body is composed of atoms, or groups of atoms, of a limited number of elementary substances, or of one elementary substance, if all matter has been evolved from one primary element. The number of these atoms may be ever so great, it has nothing whatever to do with the inevitable result. I know also that all other bodies are composed of such atoms, or groups of atoms (molecules); not only those of the human species, animals, and plants, but of inorganic substances, rocks, metals, fluids, gases; in short, of every thing which exists in, upon, or above the ground in the atmosphere. I know, furthermore, that the atoms of even the hardest and seemingly most enduring substances, such as agate and diamond, are in a state of continual vibration; that nothing can permanently retain its form; that the entire universe always has been, is now, and always will be, in a state of metaphorphosis or continual change.

The time must arrive when the atoms or molecules which are now united in my body, after countless transformations and wanderings through all kinds of bodies, substances, or intermediary stages, will once more unite in the same manner; in other words, the time will arrive when my life, like that of every other individual, will repeat itself. Yes, repeat itself, and not merely once, but an infinite number of times.

And more than this, if one of my readers should imagine that the atoms or molecules which now constitute his body, are thus associated for the first time, I can only admire his simplicity. There is nothing new under the sun. Those molecules were united in this manner before, and before this again, and 100,000,000 times previously, as far as our imagination can carry us back into the abysmal night of the æons of the past. In other words, each of my readers has been, ages ago, what he is now, has lived and gone through all this before, has felt and experienced what he now feels and experiences, down to the minutest details, has opened his *Journal of the Franklin Institute* billions of years ago and read the same lines; not once, but an endless number of times. The recollection, of course, is lost. Life and mind itself, consciousness, or "soul," is only a product of matter, and if the same substances reunite in the same manner, the same phenomena must inevitably recur.

Let the molecules which now constitute my body undergo ever so many metamorphoses, let them even — which, of course, is very improbable — once fill a bung-hole, let them be scattered about in all manner of forms and conditions, in close contact or millions of miles apart; they must come together again, may the thought please or distress me, — this is the iron logic of modern dynamics.

A JOURNEY IN COSTA RICA.

AT the February meeting of the Geographical Society of Paris (reported in the Proceedings of the Royal Geographical Society, London) a letter was read from M. H. Pittier, head of the Physico-Geographical Institute of Costa Rica. His route lay through country not previously explored from a scientific point of view. At a distance of several leagues from the capital, the traveller entered the region of oaks, which he hardly quitted for a whole week. The whole of the district known under the name of Candelaria, which, at the time of Œrsted's visit, was well wooded and rich in interesting plants, has become denuded of vegetation through the carelessness of the inhabitants, and is to-day partly covered with a poor kind of turf, over which are scattered clumps of the fragrant bushes of the "tuete" (*Vernonia brachiata*). Beyond the Rio Tarrazu the character of the country changes, and the road ascends in a zigzag line the mountain slopes, covered with forests of virgin oaks. On the summit of the Cordillera the "Paramo del Abejonal," the vast prairie which occupies the ridge of the mountain is crossed, and then a rapid descent was made to San Marcos. From the latter place to the valley of the Rio General is a journey of five days, across the great mountain of Buena Vista, the geographical importance of which has, according to M. Pittier, been overlooked, owing to insufficient exploration. Although inferior in height to the peaks of Irazu and Turialba, Buena Vista presents more sudden changes of climate and a greater variety of vegetation. The summits are almost continuously swept by a keen, strong wind, which condenses thick mists. Sleet falls frequently, and a white frost forms when the nights are clear. The immense forests, which clothe its flanks up to a great altitude, are formed almost exclusively of oaks, among which the most frequent varieties are the *Weinmannia glabra* and the *Drymis Winteri*. The vegetation of the upper region, above the forests, is alpine in character, but the bamboos were found growing beside representatives of an evidently northern flora. At one point, clearly defined formations of columnar basalt were noted. This, with other indications, led the traveller to the conclusion that the whole of the Cerro de Buena Vista is of eruptive origin, although no traces of former volcanoes were descovered. The mountain is important from a hydrographical point of view. The head waters of the Rio Reventazin occupy the greater part of its northern slope; on the west it feeds the Rios Parrita Grande, Naranjo, Savegre, and Baru; while the various branches of the Rio General take their origin from its southern flank. M. Pittier intended to cross the immense forest-covered plains extending on the left bank of the Rio General as far as the Indian villages of Terrata and Boruca, and to return to San José at the end of February. He states that the maps of all this part of Costa Rica are very faulty.

HIGH WINDS AND BAROMETRIC PRESSURE.

THE relation of high winds to barometric pressure, from observations carried out at the Ben Nevis Observatory, was the subject of a paper from Dr. Alexander Buchan, at a meeting of the Royal Society of Edinburgh on March 2, 1891, an abstract of which is given in the *Scottish Geographical Magazine* for May. This was a question, Dr. Buchan said, which had been much discussed in recent years, — some meteorologists maintaining that the influence of high winds was to depress the barometer, others that it was to raise the barometer, and several others, again, that it had practically no effect whatever. In the discussion of the Ben Nevis observations, particularly from the time that hourly observations began to be obtained from the low-level observatory at Fort William, in July last, the first question that appeared to him calling for thorough investigation was this question of the relation of the winds to the readings of the barometer, inasmuch as, till this relation be approximately determined, the proper discussion of