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ARTICLE VII.

PERIODICITY A LAW OF NATURE.[1]

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[This paper and the following by Professor Martin were read at the International Lord's Day Congress in connection with the Panama-Pacific Exposition, which met in Oakland, California, July 27 to August 1, 1915. A most important volume of about 600 pages, containing all the papers read on that occasion, with 74 portraits and ten other illustrations, will be issued shortly by the New York Sabbath Committee, who kindly permit the appearance of the present papers in advance of their publication.]

WHATEVER may be true of doctrines of evolution in general, the theory which represents all variations as infinitesimal, and all progress as uniform, has little foundation in fact. All nature is periodicity writ large. And in this respect the physical world is, we may well believe, an analogue of the spiritual. It is well to heed its lessons. For in it there is revealed a plan of the divine mind.

ASTRONOMICAL PERIODS.

Astronomy reveals the law in both the major and the minor movements of the heavenly bodies. The succession of day and night, occasioned by the revolution of the earth, is an illustration of the law so familiar that we need but refer to it. The succession of the seasons in the temperate zones is equally familiar, though its advantage is not so evident. But in the temperate zones all nature goes to sleep in winter to awake with accumulated vigor in the spring, and to quicken the

drowsy powers which are to produce the verdure of summer and the fruits of autumn. It is true that the tropics are without a change of seasons. But it is also true that the tropics have never developed a high degree of civilization.

GEOLOGICAL PERIODS.

Geology reveals to us less known but equally impressive cycles of development. In the majestic rhetoric of the Book of Genesis the creation of the world is represented as accomplished, not instantly, nor by a monotonous, gradual process of evolution, but in six days, each with its evening and morning; and this rhetoric is amply justified by the facts. Geological development has been by periods and epochs and episodes of which the testimony of the rocks bears indubitable evidence. Our ablest geologists find no difficulty in recognizing in the earth itself the seven periods of creation indicated in Genesis.

Entering further into details it is significant to notice, that in giving the history of the coal fields of the eastern part of the United States Dana significantly speaks of the "Appalachian Revolution." But there were more periods than that marked by the grand revolution. The facts are that, during the Paleozoic period, while for ages there was a slow subsidence of the coal-bearing area, this was not by any means at a uniform rate. The grand cycle was rimmed with numerous epicycles. Like Ezekiel's vision, there were wheels within wheels. More than a score of separate veins of coal indicate as many haltings of the grand movement and beginnings of new periods of growth. The grand revolution came when, from the depths of the Appalachian Sea, the whole region began to rise, finally bringing to light those successive accumulations which, in the numerous coal deposits, are exposed

on the surface. How many episodes of rest accompanied this upward movement we have not the evidence to determine. But analogy leads us to suppose that they were as numerous as those which attended the contrary movement.

But anon this upward movement halted and the land became comparatively stationary, while fitful erosive agencies of frost and wind and water wore the mountains down to their present insignificant proportions, distributing the soil over the margin of the ocean to reappear in future ages in new continental areas containing untold reserve stores of nature for the support of new and more perfect species of plants and animals. And so the long Paleozoic period came to an end.

But this was by no means a finality. The Mesozoic period followed with its marvelous development of reptiles, whose immense length and outlandish forms are well represented in the names which have been given to them. There was the *Oudenodon trigoniceps, Anchisaurus colurus, Ceretosaurus nasicornis,* and *Brontosaurus* (*Apatosaurus*) of Wyoming, sixty feet in length; and of aërial life there was *Rhamphorhynchus phyllurus, Pterodactylus spectabilis, and Archaeopteryx macrura.*

Passing over the descriptions of these strange forms of life in the abnormal conditions of the Mesozoic period, we come to the Tertiary period, in which marvelous changes occurred in the forms of both plants and animals and in the whole physical geography of the world. All the high mountains of the present time were elevated during this period, and they are high because they are so young that erosive agencies have only fairly begun the work of reducing them to base level. The Himalayas are young; the Caucasus Mountains are young; the Alps are young; the Rocky

Mountains are young; and the Cascade Mountains of the California coast, some of whose peaks are now pouring forth fresh volumes of lava and ashes, are youngest of all.

It is significant, also, that both the beginning and the close of the Tertiary period were marked by world-wide changes in the species of animals and plants which are spread over the earth. The beginning of the Tertiary period is marked by the introduction of the numerous mammalian genera with which man is associated and to one of which he belongs; while the close of the period was marked by the destruction of many of these and by the widespread redistribution of both plants and animals of the temperate zones.

EPISODES OF THE GLACIAL EPOCH.

Most impressive of all are the sequences of the Pleistocene (or Quaternary) period through which the Tertiary period merged into the present. It is now clearly seen that, during the existence of man in this period, a glacial epoch ensued, with several episodes of the advance and retreat of continental ice sheets which penetrated far into both temperate zones. Moreover, the episodes of the Glacial epoch in the northern hemisphere have, I am confident, had much to do in determining the development and migrations of the human race. Necessity has always been the mother of invention. Sinful man had to be driven out of Eden, and to be compelled to contend by the sweat of his brow with the adverse forces of nature, in order to receive the discipline requisite for the attainment of his proper development of mind and character. To this end vast climatic changes have occurred since the advent of man, all over the temperate zones, and especially near the geographic center where anthropologists as well as the Bible say man first appeared.

Everything points to the episodes of the Glacial epoch as a contributing cause of the early development of civilization in Central Asia; and it is to Central Asia that we look for the origin of nearly all our domestic plants and animals. It is around the margin of that prolific region that the various languages and races of men originated; while it is there that we find clearest evidences of the occurrence of a deluge which compelled the human race to set out on a new career. The animals most closely associated with man also began a new career with this great event.

It is a striking illustration of the law of periodicity which so intimately concerns human history, that the Glacial epoch was a period of rest to those portions of the world where the most highly civilized and progressive nations are now found. When early man was developing in the well-watered regions surrounding the mountain masses of Central Asia, all northern Europe, and all British America and the northern portion of the United States were being plowed and harrowed and levelled by the continental ice sheets, a mile in thickness, which concealed those portions of the earth from human view, and were preparing those vast reserved stores of agricultural wealth which we are now inheriting. It is one of the most impressive of all natural revolutions that the desiccation of Central Asia which compelled the early migrations of the human race, should have been coördinated with the simultaneous withdrawal of the continental ice sheets of Europe and America, opening to man the vast fields for development which he is now appropriating. When man was approaching the climax of his early civilization in Babylonia and Turkestan, the fertile plains of Russia and northern Germany, the prairie lands of the Mississippi Valley and those of the Red River of the North, were being kept in reserve for his benefit

by a vast covering of glacial ice. In the climatic changes which ensued, as already indicated, Central Asia became extensively desiccated, and unable to contain its growing population, at the same time that the ice retreated from the glaciated areas and opened up Europe and North America for the emigrations that are still in progress.

PERIODICITY THE BASIS OF NATURAL SELECTION.

At this point we may go a little more into detail, and note that, according to the doctrine of natural selection, it is the changing conditions in the habitat of animals and plants which determine what variations shall be preserved, and that only those variations are of advantage which are adapted to the changing conditions. Thus it was that the rhinoceros and the elephant, when driven out, by their geometrical increase, from the genial climate of the tropics to seek a habitat in northern regions, took on for a time a dense hairy covering, enabling them to endure the rigors of the glacial climate of Europe, Siberia, and North America, only to succumb to the warmer climatic changes which followed, and to leave their skeletons as impressive witnesses to the ever recurring periodic variations of climate. A large number of other species which also accompanied man in his earliest days could not endure these changes, and have become extinct either entirely or in some portions of the earth once inhabited by them; thus leaving room for the species that could be domesticated by man. It is significant, also, that the present age is one of comparative stability, both of land levels and of the specific character of living organisms — fairly corresponding to the seventh of the days in Genesis. Chamberlin and Salisbury speak of the earth as "now passing

slowly into a period of quiescence,"[1] while Dana says that "after the great alternations in level and in climate of the early and middle Quaternary [Glacial epoch], the earth appears to have reached, as the recent period opened, one of its stages of relative quiet."[2]

PERIODICITY THE BASIS OF PROGRESS.

Here it is in place also to remark that the general law of periodicity of which I have spoken is by no means an arbitrary enforcement, but rests upon mechanical principles inherent in the nature of things. The energy of a projectile depends upon its velocity. If the velocity is doubled, its energy is quadrupled. The growth of vegetation depends upon the accumulation of productive elements in the soil to such an extent that they can rapidly be assimilated by plant life. Time is required for such accumulation. As already remarked the prosperity of the most highly civilized areas in Europe and America grows out of the soil which slowly accumulated under the moving ice sheets of the Glacial epoch. The vegetation of the successive veins of coal grew on beds of sediment which had been deposited during successive periods of rest in the earth movements. As illustrating the law in smaller matters it is in place to call attention to the well-known fact that rotation of crops, and occasional absolute rest for the soil are essential to successful agriculture. In countries where commercial fertilizers are not obtainable, the soil is regularly recuperated by a two-year rest after a single crop has been taken from it.

So, capitalists are fast finding out that the efficiency of a workman is determined not so much by the number of work-

[1] Geology, vol. iii. p. 519.

[2] Manual of Geology (4th ed., 1895), p. 1012.

ing hours per day as by the extent to which he can concentrate his efforts upon the work in hand. All parties are benefited by an eight-hour shift in place of a twelve-hour shift. In limiting the continuous hours of labor to which locomotive engineers and other railroad employees are subjected our legislators are recognizing an imperative law of nature. The expenditure of force must be preceded by a period of rest in which the force necessary for efficiency may be accumulated. This is the natural law. From a scientific point of view it remains to be determined whether the periodic seventh day of rest conforms to a law of nature embodied in the constitution of society and of the individuals composing it. That this is so will appear more fully in the other addresses this evening.

THE WEEKLY PERIOD NATURAL.

From the foregoing and many other broad analogies the scientific man is prepared easily to recognize the existence and importance of such a period of rest and change as is provided in the weekly Sabbath. Especially is this so when he finds that from the earliest times, and among most widely scattered nations, a weekly holiday has been observed. To such an extent has this hebdomadal division of time been recognized that we cannot well resist the conclusion that it has a basis in the order of nature, and that the Creator has so formed us that it is one of our natural necessities which we ignore at our peril.

Many conjectures have been made concerning the origin of this tendency among men to observe a weekly day of rest and recreation. The most reasonable of these is that it arose from the changes of the moon. The four quarters of the moon are each seven days in continuance, or so nearly so that the

fraction over is not observable except in a long period. The changes of the moon and their influence on the earth are certainly very striking phenomena. With them the tides rise and fall. By them, in the opinion of many, the weather is affected. But, however that may be, the apparent birth of the moon at the beginning of the first quarter, its enlargement to full moon during the seven days of the second quarter, its weekly diminution until it disappears at the end of the fourth quarter, are phenomena which must have impressed mankind from the very beginning of his existence, and so, naturally, have laid the basis for this division of time afterwards sanctioned by solemn religious authority.

The Sabbath as it was given in the Mosaic legislation is indeed unique in its character, but is not for that reason any less scientific. Days of rest from ordinary labor have been recognized from earliest times by all the races of mankind. As summarized by Professor Toy[1] of Harvard University, it was unlawful in the Hawaiian Islands on certain days to light fires or to bathe, and at certain times the king withdrew into privacy giving up his ordinary pursuits. In Borneo work was forbidden on certain days in connection with the harvest. In Polynesia the periods of the great religious ceremonies, the time of preparation for war, deaths, and the sickness of chiefs were seasons of restrictions.

"The similarity of these observances to those connected with the Hebrew Sabbath is obvious; what is common to all is the prohibition of ordinary work on special occasions. . . . The duration of these seasons of abstinence among various peoples in various ages has varied greatly — they lasted sometimes for days, sometimes for months or years. . . . The origin of these times of restriction must be referred to a remote antiquity, lying back of our historical monuments. In the earliest form in which we find them

[1] Art. "The Earliest Form of the Sabbath," Journal of Biblical Literature, vol. xviii. pp. 190–194.

they are established customs resting on precedent, and not supposed to need explanation."

But calendars based upon the changes of the moon were employed in ancient Egypt and Babylonia, on the west coast of Africa, in Hawaii, and in New Zealand. In Babylonia the days seem to have been the 7th, 14th, 19th, 21st, and 28th of the month; in Hawaii they were the 3d–6th, 14th–15th, 24th–25th, and 27th–28th.

The calendar of the Jews seems clearly to have a connection with that of Babylonia. This appears in the parallel accounts of the Deluge which are given in the Bible and on the Babylonian tablets. In the Biblical account the seventh-day period repeatedly occurs. It was "seven days" after Noah entered the ark that the waters of the flood were upon the earth, and all the fountains of the great deep broken up. It was "seven days" between the sending out of the first and the second dove; again it was after another "seven days" that the third dove came back with a fresh olive leaf. In the Babylonian account of the Deluge the duration of the flood is said to have been fourteen days. On the seventh day the flood ceased, and on the fourteenth day the raven was sent out "to notice the drying of the water."

We are not surprised, therefore, to find in the cuneiform documents a term *sabattu* or *sabattum*, substantially identical in form and meaning with the Hebrew word *sabbatōn*. Whether the Hebrews derived this weekly division of time from the Babylonians, or, what is more probable, the Hebrew and Babylonian institutions had a common origin, is not important for us to determine. It is enough that we find the institution in existence in the earliest records of these two peoples. It is of more account that we find this division of time recognized so distinctly and enforced with such power-

ful sanctions in the Mosaic law. But in the law of Moses the institution is so limited, so freed from superstitious associations, and so adapted to the wants of the individual and of society, that it is practically a new institution. In the words of Professor Toy again: "The creation of the Hebrew Sabbath was a singular achievement of the religious genius which, at a later time, gave the day its higher significance."

Many natural reasons confirm the belief that, like the nightly period of rest, the weekly day of rest was made for man, and that he disregards it at his peril. The speakers who follow me will present these reasons so fully that I need but refer to them here. Without fear of successful contradiction, however, I may assert that ample investigations have demonstrated that the daily rest from labor and care is not all that is needed by the human system, and that a periodic weekly rest of from thirty to thirty-six consecutive quiet hours is needed to restore the waste of six days' continuous labor. The deteriorating influence of continuous labor without the Sabbath rest is easily recognized by the great body of men and women employed in the telegraph offices, upon the railroads, and in all our great industrial organizations. Pretty generally the employees are demanding this rest, while employers are coming to see that their own interests will not suffer thereby. The experience of our criminal courts, also, demonstrates an intimate relation of Sabbath desecration to crime.

The following testimony of William von Humboldt concerning the experiment in France, during the Revolution, of substituting a tenth-day holiday for the seventh day of rest is worthy of special attention as coming from one of such high scientific attainments.

"However it may seem to lie, and in one respect really may lie, within the power of the will to shorten or lengthen the usual

period of labor, still I am satisfied that the six days are the really true, fit, and adequate measure of time for work, whether as respects the physical strength of man, or his perseverance in a uniform occupation. There is also something human in the arrangement by which those animals which assist man in his work enjoy rest along with him. . . . An example of this occurred within my own experience. When I was in Paris during the time of the Revolution, it happened that, without regard to the divine institution, this appointment was made to give way to the dry, wretched decimal system. Every tenth day was directed to be observed as the Sunday, and all ordinary business went on for nine days in succession. When it became distinctly evident that this was far too much, many kept holiday on the Sabbath also, as far as the police allowed; and so arose, on the other hand, too much leisure. In this way one always oscillates between the two extremes, so soon as one leaves the regular and ordained middle path."[1]

RELIGIOUS FAITH ESSENTIAL TO THE HIGHEST EFFICIENCY.

But the great service which the day of Sabbath rest renders man is in the realm of his spiritual nature. Man cannot live by bread alone. His physical system develops best when his whole nature has its wants supplied. The peace of mind accompanying true religion is a real physical asset. For, man is born to trouble as the sparks fly upward. Uncertainty hangs over all his worldly plans. He cannot see the end from the beginning. He cannot tell what a day may bring forth. In everything he is compelled to accept probability as the guide of life, and often this is of the slightest degree. That faith in God which enables one, when he has done his best, to lie down in quietness and to "rest in the Lord and wait patiently for him," not only affords blessedness of the highest order, but adds to his efficiency in every emergency that may arise. The modern advocates of "efficiency," therefore, should welcome the Sabbath and emphasize its importance.

[1] **Letters, vol. i. p. 207, quoted by Rev. W. W. Atterbury in Sabbath Essays, Boston, 1880, p. 29.**

IMPORTANCE OF THE RELIGIOUS SANCTIONS.

Accepting the seven-day period as a correct measure of one of our needs of periodic rest, we can confidently defend the two following propositions: 1. That the needed day of rest cannot be preserved without its religious sanction: 2. That the religious faith so necessary for that peace of mind which secures the highest degree of human efficiency cannot be secured without the weekly Sabbath.

1. It has been truly said that while it is generally recognized as true that "honesty is the best policy," men are not made honest by that motive. Appeals to selfish motives are notoriously weak. The selfish mind is shortsighted. Seeming present advantage blinds the vision, and defeats its ulterior ends. Only those who recognize the divine sanction will be kept in the straight path of wisdom. Only the conscience which listens to the divine commands, "Thou shalt not steal," "Thou shalt not bear false witness against thy neighbor," is sufficiently alive to be persistently honest in the face of all temptations.

And so it will be in respect of all the commands of the Decalogue, but especially of that to "remember the Sabbath day to keep it holy." The insidious demands of pleasure and of mercenary ends blind the eyes of the most farseeing worldly-minded philanthropists. Besides, the seeming welfare of the individual must in many things yield to the demands of the whole body of citizens. The greed of selfish captains of industry will ride roughshod over the interests of their employees, except the strong arm of the law, supported by divine sanctions, comes in to intervene. Thoughtless pleasure seekers will overburden those who cater to their desires, and will make the weekly holiday unendurable to those in the vicinity who do not join in their carousals,

unless the day is so regarded by all as to reduce labor to a minimum. The majority of those who labor for the enrichment of the capitalist, and the minority who minister to the pleasure of the carousing multitude, alike need the protection which the divine sanction gives to the weekly day of rest.

2. The Sabbath is absolutely essential for the cultivation and development of not only man's religious nature, but as well of all his other higher interests. Its periodicity gives that opportunity for coöperation and concentration which is essential to all intellectual and social progress and enjoyment. The primary object of Sabbath observances is the dissemination of religious truth. And this is their most important service. The weekly gatherings of the people in any community or neighborhood to contemplate the sublime themes of the Christian religion are of the highest conceivable importance and value. Only under the conditions there found can the means be provided for the proper enforcement of those inspiring truths. In these gatherings music, liturgy, ceremony, and oratory combine in varying degrees to unfold and emphasize the revelation which has been sent down from heaven. Without the opportunity afforded by the generally observed seventh day of rest from labor there can be no adequate enforcement of the truths which feed the religious nature of man, and give the desired efficiency to his material activities.

Incidentally, also, the religious services of the Sabbath provide us with the best of all social opportunities. It is with the greatest satisfaction that I remember the weekly services of the little country church which it was my privilege habitually to attend during my childhood. In attendance upon those services I became acquainted with the best families living miles away in every direction. I saw their faces. I

exchanged greetings with them and became familiar with their personal affairs from week to week, and year to year. I listened with them every Sabbath to the same music, the same ennobling sermons, and the same Scripture readings, and repeated with them the same liturgies comprehensive of the whole system of divine revelation. Truly, those who forsake the assembling of themselves together for Sabbath worship lose the richest and most satisfying social privileges lying within their reach. No irregular gatherings can satisfactorily supply the social service rendered by the religious exercises of the Sabbath day.

The more we study the institutions of the Sabbath, and the more we see of its help in the development of our religious nature and of the all-round satisfaction it gives to our social instincts and to the protection which it gives to the poor from the rapacity of worldly-minded capitalists, and to all from the frivolity of reckless pleasure seekers, the more we must admire that Jewish law which purified the institution and forced it upon the world with its powerful religious sanctions. If in this, as we believe, it was only reënacting a law of nature, it but emphasizes its permanent authority. In this and other religious festivals the Mosaic law recognizes the need of opportunity for that concentration of thought and effort which is secured by nature's law of periodicity.

In providing, as we are now so generally doing, for the numerous state, national, and comprehensive world-wide gatherings for the promotion of religious, social, and political interests, it is interesting to see how we are following in the footsteps of the great Hebrew lawgiver.

By our improvements in rapid transportation we are secur-

ing the national advantages which accrued to the Jews from the smallness of their country. As on the occasion of the various assemblies in connection with this international exposition we are assembling from all parts of the world to promote mutual acquaintance, and further the higher interests of humanity, so did the Jews gather at their central place of worship three times a year to cherish the memory of the Lord's doings with them and their fathers, thus to maintain the "unity of faith" which bound them together.

With all that the printing press has done for the dissemination of knowledge, it has not rendered useless the assembling of ourselves together on the Sabbath day and on other periodical occasions. It is encouraging to see that we are wisely returning with new zest to the original methods of promoting the higher religious and social interests of the race. It is, as when here and now we are with one accord in one place, that we receive the richest outpourings of the Spirit, and the deepest impressions of intellectual as well as spiritual truth. The Sabbath, while it is the most important, is but one of the numerous periods of prolonged rest which are "made for man." Happy is the people that cheerfully reënacts these laws of nature, and observes the times and seasons appointed for them by a divine wisdom which is higher than theirs.