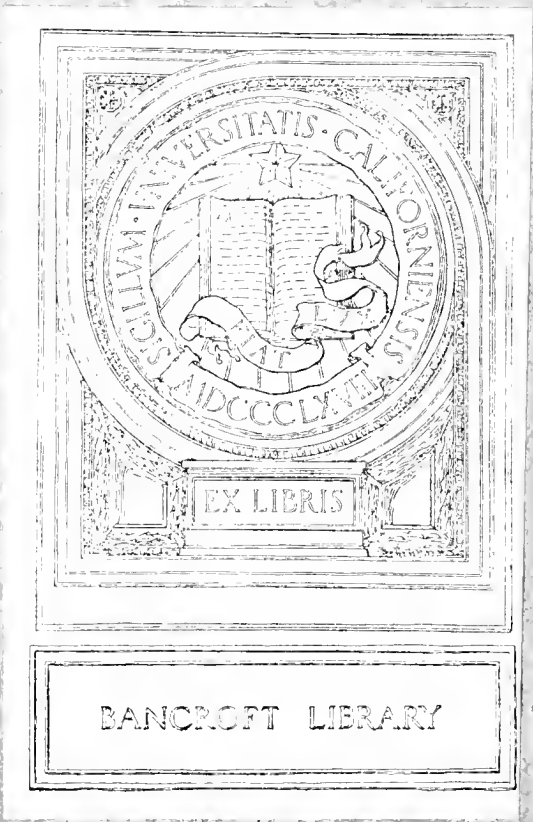


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VOL. 1.

MARCH 1885.

NO. 1.

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PACIFIC
SCIENCE MONTHLY

STEPHEN BOWERS, PH. D., EDITOR.

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PACIFIC SCIENCE MONTHLY.

MARCH, 1885.

American Earthquakes.

By Prof. Richard Owen, L.L.D.

Can we point to any law or general principle, regulating the distribution in time and space, of American earthquakes? Before endeavoring to answer this question, attention may be directed to certain papers leading to generalizations, on the subject of earthquakes, contributed by the present writer, at various times, chiefly to the A. A. A. G. and published in their proceedings. Without specifying each paper, their generalizations may be briefly re-stated, so far as seems necessary to render more intelligible the remarks on American earthquakes.

I. The earth deriving its existence and continuance as a habitable planet, (as scientists generally think) from the sun, it is to be expected that terrestrial phenomena should still be dependent on solar manifestations and their modifying influences.

II. As light, heat, electricity, magnetism, chemical force and nervous energy are all convertible modes of molecular motion, and we derive our light and heat from the sun, it seems probable that we derive directly or indirectly, all the other forms of motion from our solar parent including seis-

mological impulses.

III. In continuation of these statements, let us examine the relation of continents, in their configuration, to the axis of rotation and that of revolution or progression of the earth in her orbit. If we pass two great circles through the poles of rotation, and make one of them cut also vertically through the Caspian sea, and the other be at right angles to the former (consequently touching South America in about the meridian of Pernambuco) we find our globe divided into four segments (like the four quarters of an orange or apple) by lines of depression, *parallel to the axis of rotation*; and each segment will be found to contain a double continent, provided we consider the isles of the Pacific as indicating the summits of mountains in a sunken continent. Thus one (the central segment) contains Europe and Africa; a second, on the west, North and South America; a third, on the east, Asia and Australasia; a fourth, opposite Europe and Africa, may be designated North and South Oceanica.

IV. But beside this planetary shrinkage, at the division lines of four segments, and elevation of continents between, there was brought about an inclination of the axis of rotation (amounting at present to about 23½ de-

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grees) to the axis of revolution, translation or progression of the earth's orbit, usually called the plane of the ecliptic, and traced on our globe as the apparent path of the sun, then the continents, in the formation of their outlines, assumed a trend at right angles to the plane of the ecliptic; hence corresponding with the axis of REVOLUTION. This fact, that continental outlines thus formed an angle of $23\frac{1}{2}$ degrees with meridians, was pointed out, more than twenty years since by the writer in his work "Key to the Geology of the Globe;" and it has since been admitted by various scientists, in their printed works, such as Professors Dana and Dawson.

V. It was shown further, at a later period, that the eastern trends of continents, beginning at the straits of Macassar and of Lombok (where Wallace found a *continental* difference between the flora and fauna each side of this region) and measuring, on the equator, 72 360.5 degrees, were respectively one fifth of the circumference of the globe apart: viz 1st. The east trend of Africa 72 degrees west of Macassar (or of the east trend of Asia, including Japan); 2d—The east trend of South America 72 degrees west of Africa's east trend; and 3d—The east trend of North America 72 degrees west of the east of South America; 4th—The east trend of South Oceanica (or of South Australasia near New Zealand) 72 degrees west of the east trend of North America. As these trends, running north $23\frac{1}{2}$ degrees east, represent coast lines at right angles to certain phases of the ecliptic, so their mates, i. e. coast lines intersecting these eastern trends at the equator and running north $23\frac{1}{2}$ degrees west, will be found at right angles to other

phases of the ecliptic. It is true that the axis of the ecliptic is considered almost or quite invariable; but its *position relatively to the axis of the earth's rotation* is being constantly modified by the attraction of the moon and sun on the equatorial protuberance, giving rise to the precession of the equinoxes.

It is further noticeable that each of these general continental trends is made up of minor trends, partly coinciding with the axis of rotation, partly with the axis of revolution.

VI. Subsequent papers pointed out that each continent had a geographical center; and that a radius of 72-2-36 degrees would usually embrace nearly the whole of a continent, while a radius of $23\frac{1}{2}$ degrees or 24 degrees would embrace, *within* its area, most of the Paleozoic and Mesozoic formations; while, *outside* of it, up to radius 36 degrees, would be chiefly Cenozoic area.

VII. It was further shown that Monte Rosa, in Switzerland, is, as nearly as may be, the pole of the land hemisphere; and that in shrinking the earth has conformed to the law of fissuring from that culminating point (of Miocene age) in radiating lines of 30 degrees apart, forming thereby such depressions as the east coast of Spain to Gulf of Genoa, the Adriatic to Venice (intermediate elevation the Apennines); further depressions radiating to Bay of Biscay, German Ocean, Baltic, &c.

VIII. From Mallet's catalogue of 7,000 earthquakes, the generalization was pointed out that (by comparing places of simultaneous seismic action, or close approximation, in *time*) earth movements were observed to be frequently propagated along great circles; and further that while important

movements followed the great circles of continental trends, a majority of movements passed through the pole of the land hemisphere at Monte Rosa, along some one of the six fissures, or great circles, alluded to above; or else through one of the separate continental centers, such as Tatra in Europe or the Height of Land, near Lake Superior in North America.

IX. In the paper on British Earthquakes, it was proved that the majority passed along a great circle which connects Etna, Stromboli, &c. with Hecla, and on its route traverses the east of England and center of Scotland, giving rise to the earth tremors at Comrie in Scotland, which sometimes have occurred almost daily for months in succession. But the eastern continental trend of South America is the great circle, which, passing from the ever active volcano Tomzaruro, in New Zealand, to the ever active volcano Fogo in the Cape Verde Islands, desolated Lisbon in 1755; and, sometimes affecting the north west coast of France and south counties of England, passes near Bornholen, where a late number of "Nature" (see page 156 of the number for Dec. 18th, 1884) shows an axis, north west of which Scandinavia is rising, while south east of that axis the coast of Europe is slowly subsiding.

X. The seismic belts of north America will be found chiefly along five great circles. No. 1 is the great eastern continental belt which runs parallel to the Appalachians, and commenced its activity in Paleozoic times, giving rise to the orography of that chain, and still giving us occasional tremors from Maine to Georgia, especially at East Haddam, Connecticut, which like Comrie, is often shaken.

Thence it reaches the volcanoes of Guatemala. The great circle of this belt continued its seismism on the opposite side of the globe, by elevating in Paleozoic times the western Ghatts of Hindostan. No. 2 is the mate of No. 1 (inasmuch as it crosses No. 1 at the equator, trending north $23\frac{1}{2}$ west, while No. 1 trends north $23\frac{1}{2}$ east). No. 2 marks the volcanoes of Lower California, of the Sierra Nevada and of Alaska, as well as the earthquake region of California. No. 3 is the portion which passes through America, of the great circle constituting the Asiatic eastern trend and defining the belt of linear volcanoes in Kamtchatka, Japan, &c. In North America it follows the depressed chain of lakes from Great Slave lake to Manitoba and the center of the continent west of Lake Superior; thence the belt traverses the earthquake region in north Madrid and other portions of the Mississippi valley disturbed in 1811-12; in the West Indies it crosses between Cuba and San Domingo. In South America it passes from Caracas, which was desolated at about the same period as New Madrid, and crosses South America to the southern portion of Brazil. No. 4 is the mate to Africa's eastern continental trend, and is that important seismic belt which, after its circuit from volcanic Bourbon (re-union) and from the oft upheaved islands connected with the volcano of Santorin, to Hecla in Iceland, passes through our Yellowstone National Park with its 10,000 or more geysers, and traversing Salt Lake region and running nearly parallel to the Wahsatch mountains, propagates the earth's movements to Southern California. Lastly, No. 5 is also an important great circle along the vol-

canic regions of South America as well as some in North America. It is the belt which beginning near Behring's straits traverses the earthquake regions of Pekin and Canton, the volcanoes of Sumatra and Java, passes along the volcanoes of Chili and Peru, Central America and close to Rainier, St. Helen's and other volcanoes of North America, thus also again traversing California.

As regards the distribution in *time*, America has not been long enough discovered to give us sufficient observed data to prove a generalization; but in a paper read before the A. A. S. the writer showed from Mallet's Catalogue that earthquakes were relatively much more numerous in Central Europe about the year 1663, when the magnetic meridian corresponded with the geographical for that region, than those recorded for more westerly localities. Again it was shown that earthquakes, about the year 1814, when the needle attained *its greatest westing* for middle Europe, were relatively more abundant in America, as well as relatively fewer in Europe.

Judging then from what we know up to this time, it seems probable that earthquakes would be somewhat more numerous about every 333 years from 1663 *in Europe*, (as that seems the period of oscillation for the needle as shown in another paper) and about 666 years from 1814 *in America*, as that is apparently about the period which elapses from the time the magnetic needle occupies its greatest westing, until it oscillates east and *returns again* to its greatest westing, corresponding, it is thought by some, with great sun-spot periods modifying the earth's meteorology. The chief seismic movements in North America it may be

seen from the above, if correct, may be expected along the line of the Appalachians, or centrally through the valley of the Mississippi, or along the California and Oregon regions, of the Sierra Nevada, &c.

Mr. Edison's Search.

Thomas A. Edison says: "The great secret of doing away with the intermediary furnaces, boilers, steam engines and dynamos will be found, probably, within ten years. I have been working away at it for some months and have got to the point where an apparently insurmountable obstacle confronts me. Working at the problem now seems to me very much like driving a ship straight for the face of precipice and then you come to grief picking yourself up and trying it again to-morrow. There is an opening in the barrier somewhere and some lucky man find it. I have got far enough in my investigations to know that the thing is possible. I can get quite a current now directly from the combustion of fuel. Jabloehkoff, tried his hand in the same thing some years ago, and so did some Germans, but the results were laboratory curiosities only. I give myself five years to work at it and shall think myself lucky if I succeed in that time.

"The unscientific world has no conception of what such a discovery would mean. I would put an end to boilers and steam engines; it would make power about one-tenth as cheap as it is now; it would enable a steamship to cross the Atlantic at a nominal cost; it would enable every poor man to run his own carriage; it would revolutionize the industrial world."

Heat.

[By Rev. F. D. Seward, B. A.]

THE old theory that heat is a substance hid away among the atoms of matter has been abandoned, partly because it could not explain certain facts; as for example, the production of heat by friction percussion and pressure; and especially because a theory has been proposed which has explained every fact so far, and the mind rests in it, as in the Copernican theory of the solar system. But the phraseology of the former theory has been retained in part; particularly the term "capacity for heat," since water has "capacity" to store away 30 times as much heat as mercury has, whatever the theory; and of course in cooling, water gives off 30 times as much heat as the same amount of mercury.

From supposing heat to be a substance, we have come to know that it is simply "a vibratory motion of the ultimate particles of matter," as sound is vibratory motion of the string, the reed, the bell, the vocal organs, which produce the sound. The analogy of the five senses gives a strong presumption in favor of such a theory; for in the sense of touch and taste there is actual contact, and even in the sense of smell there is actual contact with particles given off from the odorous body; but in sound, which allows of a possible distance of twenty miles there is no contact, only vibration. So, when heat and light comes from the sun and from the distant stars, we might expect vibration, instead of contact with particles given off.

In the process of combustion a match (tipped with phosphorus and other substance which burn at a very low temperature,) is lighted by the heat

produced by friction, then, as in the candle, the heat which slowly melts the tallow, which is raised to the flame by capillary attraction; and then the atoms of carbon in the heated tallow clash with atoms of oxygen in the surrounding air and the motion of translation is changed to vibration, which is heat. Of course the power which draws the atoms of carbon and oxygen together is not gravitation but chemical action, a force indefinitely greater. The slowness of combustion is because only a few of these atoms can meet each other at the same time, while in gun powder, and other explosives, there is a previous mixing of the atoms in proper proportions, ready to clash when the spark is given.

We talk about the power of steam; but steam is only a convenient lever; the power all comes from the fire. So muscular power comes from the food digested—burned—in the stomach; for the stomach of every animal is a furnace, and the heat of the furnace produces mechanical force, whether in the locomotive or in the animal; and heat and mechanical force are convertible each into the other and back again, without actual loss. And this is analogous with what we see around us. There is change everywhere, but nothing goes out of existence. Ice becomes water; water steam, and even hydrogen and oxygen; the form and qualities being greatly change, but not one atom of the matter is lost; and all may be changed back again into water. So, heat in the locomotive is changed into the forward motion of the train, and this again into heat when the brakes are put on; and, aside from the friction of the axles, the resistance of the air, and the heat produced in stopping a train would start it again to the

same speed in the same time, if all could be used. The ratio of convertibility is 772 foot-pounds; that is, the heat which would raise one pound of water one degree (Fahr.) would lift it 772 feet; and a pound weight, by stopping from a fall of 772 feet, would produce heat enough to warm a pound of water one degree, if all used. In 1844 Mr. Joule, of Manchester, Eng., stirred water, mercury and sperm oil by forces which could be measured, and noticed the heat developed. He also caused pieces of cast iron to rub together, and forced water through capillary tubes; and in every case the ratio was substantially the same; and the figures "772" are the mean of 110 experiments, and are now universally accepted. With this ratio it has been figured that the mere stopping of the earth in its orbit would cause as much heat as the burning of 14 worlds of solid coal as large as our earth. Then in starting us in our course around the sun, as much power as this was exerted, whether given at a separate impulse, or in common with the whole solar system according to the Nebular Hypothesis. And since such power was exerted in starting our little speck, how much more was used in giving their motion to all planets, the sun and all the stars which the telescope reveals.

In practical matters, we see that the enormous capacity of water to store away heat explains why the ocean never freezes, and never becomes hot as the desert's burning sand. Therefore the mildness of our ocean climate, both in winter and in summer; and especially when an ocean current like that of the Gulf stream flows by the banks of New Foundland, and wraps the British Isles, it gives off in that

high latitude the enormous heat received in the tropics. So with the Japan current of the Pacific Coast. So also of the "water protection" to fruit on the shores of eastern lakes. But more than this; water reaches its greatest density at 39 degrees, seven degrees above freezing, and the surface drops cooling toward this point give place to warmer drops from below, and thus nearly all the heat of the whole lake to its bottom is given off to warm the fields around, before its temperature falls to the freezing point. Thus spring buds are saved, and corn from a June frost, and the unripe grapes of autumn. But further; in freezing, water gives off 143 degrees of heat. So that a pound of water at 32 degrees in merely changing into ice at 32 degrees would warm 143 pounds of water one degree. So steam in turning to water at the same temperature, gives off heat enough to warm 967 pounds of water one degree; and of course ice in turning to water consumes 143 degrees of heat, and water in turning to steam consumes 967 degrees. Therefore a fire which quickly warms a kettle of water to boiling, must burn a long time to boil it all away. True, boiling water, is as hot as steam; but it is still water, and an enormous amount of work must be done to pull its molecules apart, and left them to occupy 770 times their present room.

Now all the world's work is done by the sun. The power of every waterfall was given by the sun when it lifted water from land and sea into the clouds to fall as rain and go over the mill-dam and Niagara. The power of every steam engine came from the sun as it caused the wood to grow, and the vegetation which formed the coal. All muscular power of man and beast

came from the sun through food. And yet all the heat which our earth receives from the sun is only as one to 2,300,000,000. Whence comes to the sun the supply for all this waste? Take a sphere as large as the sun, (880,000 miles in diameter,) and cover its whole outer surface with a layer of coal 17 miles thick; and the burning of all this coal would supply the sun with heat only one year. Whence comes so much coal every year? And certainly the sun has been at least as extravagant of its heat ever since the solar system began; and if the Nebular Hypothesis is even substantially true, that was indefinitely earlier than even the earliest geologic time. But the human race is especially concerned with the future supply; for if the sun shall have to practice even a little economy it may be hard for the children of men. Meteors may possibly give a partial supply. Stopping the earth in its orbit would produce as much heat as by burning fourteen worlds of coal; and if the earth should fall to the sun, the heat produced would equal that of 5,600 worlds of coal; and this would keep up the sun's heat 622 years. If then, once in 622 years, a world as heavy as ours should fall to the sun from our distance, 92,500,000 miles, the supply would be furnished; or if a corresponding number of smaller meteors. Now, in our western evening sky there is a faint brightness called the "zodiacal light," some 30 degrees wide at the base and reaching almost to the zenith, which may be the reflection of the sun's light from a belt of meteoric matter revolving around the sun; and some have thought that these by falling to the sun might keep up its supply of heat. But "revolving around" is not "falling to;" and

though some might fall, as to the earth, yet, since our great meteoric shower of 1833 did not perceptibly raise our temperature, we must look for some more promising source of supply. Besides, all meteoric matter must be exhausted in the course of time, even if the sun is traveling through a universe full of it, unless the universe is absolutely infinite in extent. Then from the utter failure of every effort to find an adequate supply for the sun's heat, let us listen to the firm voice of analogy from the Nebular Hypothesis. The solar system has been gradually cooling since before the first planet, Neptune, was thrown off. Our human race, with its history of an hour, came into existence at this stage of cooling process; and we and our children and your children's children to thousands of generations may live and enjoy before the sun is perceptibly cooler. But modern research tends no more strongly to any conclusion than that the sun must stop shining, stop warming. The clock must run down and stop, and Byron's "Dream of Darkness," be realized, unless some hand, outside the clock, shall wind it. But if the sun must go out in time, it began its shining in time, just as a clock, which cannot run forever, has not been running forever. Geology carried men's ideas of the duration of time back enormously; and the Nebular Hypothesis taking on more and more of the appearance of truth, carried our ideas back indefinitely further still. But whether our clock is a day clock or an eight-day clock, or a clock of a thousand years, or of a thousand million years; if it is running down it has not been running eternally, or it would have run down long ago. What must have an end.

has had a beginning. It is not the enormous quantity of heat the sun is giving off, but the fact that it is giving it off, which proves that it is going out. The clock is running down, somebody wound it once. Somebody made it and wound it. If he made it so that it would run 6,000 years, this is wonderful. If he made it so that it would run 6,000 times the length of all geologic time—this is almost infinitely more wonderful. If he made it so that it would run well all this time, so we see it is still running well, so much the more wonderful his power, wisdom, goodness and righteousness. Now, if Darwin's development hypothesis, shall prove true, (as I have no idea it will.) Yet, if we shall find that in making and endowing the nebulous mist the Creator planned it so skillfully that not only the physical part of the solar system should run smoothly to the end, but that when the world became fitted for vegetable and animal life, these appeared in their untold variety, each perfect after its kind, without his immediate hand; and not only vegetable and animal life, but also the mind, and especially the heart of man with his conscience and free will, how much more utterly lost we shall be to express the greatness, wisdom and goodness of the great first cause, a personal God.

The Effect of Tobacco.

Science has scrutinized boy smokers in France, and has discovered that the majority of them suffer from disturbed circulation, palpitation of the heart, "sluggishness of the intellect," and craving for alcoholic stimulants, while the rest were troubled with intermittent pulse, sleeplessness nose-bleeding, chronic nightmare and

all other ills, all of which disappeared where the boys were induced to give up smoking. The investigation, says the *San Diego Union*, but confirms the results of many other inquiries. The cigarette seems harmless, because it is so small and dainty, and even fragile in appearance. But its smoke of mingled tobacco and paper, drawn in upon the lungs, will undermine the strength of manhood; to youth it is deadly. The habit of cigarette smoking is increasing among the boys of the land at an alarming rate, and threatens to endanger the manhood of the coming generations. There is need of a good deal of educational work in this direction among the young, and it is a work distinctively for parents to undertake.

Cavern Near Ventura.

In company with D. H. Bailey we visited a spot about two miles up the coast, where it was said a cave had been discovered some years ago. In ascending the ridge of the Coast Range mountains about two hundred feet above the ocean, we came to a descent to this subterranean vault, but found it surrounded by perpendicular walls from thirty to fifty feet high. We traced the cavern about one hundred yards further where we reached another opening surrounded by perpendicular walls, but that on the west was but ten or twelve feet in height. Fastening a rope to some bushes we let ourselves down and were enabled to penetrate the opening about 100 feet into the mountain. We found the passage narrow at the bottom, but widening toward the top to a dozen feet, or more. The roof or ceiling is nearly thirty feet high. Both walls and ceiling are of indurated clay, and with the side excavations seem to be a resort for

wild animals. The main excavation is somewhat tortuous, yet imposing in appearance. After penetrating to the depth of one hundred feet, we came to a perpendicular rise of about twelve feet, which we found impossible to ascend without the aid of a ladder, consequently were compelled to retrace our steps. The cave is well worth visiting and should be thoroughly explored. A ladder, ropes and lanterns would be necessary for the undertaking.

Editor's Department.

WE send out the first number of the PACIFIC SCIENCE MONTHLY, the numbers of which we trust its readers will find of sufficient interest to preserve for binding. It will be issued about the first of each month, and will contain from twelve to sixteen pages of matter. We are prepared to publish the MONTHLY for one year and at the exceedingly low price of FIFTY CENTS. This brings it within the range of all who are interested in Science. We are willing to admit a few advertisements on the second and third pages of the cover.

WE send the PACIFIC SCIENCE MONTHLY to many who are not subscribers, trusting that they will at once send in their names accompanied by the price—50 cts—for a year's subscription. Back numbers can be had at any time. We hope to obtain a large list by the time we are ready to send out the April number

Evolution.

We extract the following from the *Methodist Review* written by its learned editor, Rev. Daniel Curry, D. D., LL. D., and which we commend to both the advocates and opposers of the theory of evolution.—

The manner in which this whole subject has been treated is very far from edifying. First, the infidel scientists, from a few partially ascertained and very imperfectly collated facts, leaped to the conclusion that they had effectually overthrown every possible form and degree of supernaturalism, and they so proclaimed with undisguised pleasure. And then the friends of the Bible, taking the alarm, began to discern, not simply the conclusions of their assailants, but their indubitable facts, and the few clearly ascertained principles deduced from them. The result has been a war of words, not at all creditable to either party. But a third class—neither infidels nor blinded followers of traditional opinions—have dared to look into these things in order to find what they do really teach. The full report of their studies and examinations has not been published—probably it never will be made so full and complete as to be no longer susceptible of additions and emendations; but this much is clearly determined—that all has been proved by the researches made in the science of nature has failed to cast the shadow of a doubt upon any of the

great and saving truths of religion, as they are revealed in the Scriptures, and cherished in the hearts of believers, and conserved by the living Church. Nor is there any cause for misgiving in respect to anything that science may hereafter demonstrate—for the plane of its operations and that of the supernatural truths of religion are not the same, and by no possible extension can the former come into collision with the latter. The highway of faith is all its own; the eagle's eye has not seen nor the lion's whelp trod it.

The worst service that can be done for religion, in this business, is that rendered by its incompetent would-be defenders, who, with more zeal than discretion, rush into the contest against more expert antagonists, either to be discomfited in attempting to defend what is not true, or to give away their cause by false concessions. A large share of the discussions of these matters, heard from the pulpit or found in the newspapers, come within range of this criticism. Only those thoroughly learned in the points at issue can discuss them in the pulpit, except to betray the cause they would defend, and the best learned will not be apt to bring them there at all. There is reason to believe that this folly is not much less in fashion than it was a few years ago.

The history of ecclesiastical proceeding in respect to the finding of science

is not altogether an honorable one, as may be seen in such cases as that of Galileo. The literalistic theory of biblical interpretation which controlled the thinking mind of Christendom from a very early age of the Church down to the immediate past—and is still powerful to mislead—has compelled the Church, first to antagonize the progress of science, and then to retreat before it. So it fought the Copernican system, but was compelled at last to yield the point; and so, for a long time, it held on longer. Perhaps it has not yet fully given it up. But a better method of thinking is now almost universally accepted by those who must dictate the opinions of the Church of the future, which demands that spiritual Christianity shall not be subjected to scientific test of modes of thought. Such subjects as the methods of creation, the age of the world, the genesis of living things, and the development of species, all belong to the same class with the laws of gravitation, the motion of the heavenly bodies, and the precession of the equinoxes; and none of them fall within the sphere of theology. They are all of the earth earthy, and should be left for secular men to deal with. "We have a more sure word of prophecy."

Society of Natural History Meetings in February.

Feb. 6.—The Society met at the Library rooms at 7:30 p. m. Dr. Bowers, the president in the chair. The min-

notes were read and approved. Gen. Van-dever, Mrs. Nellie Wooley, R. G. Surdnam and Miss Seymour were elected members. Two new names were offered for membership. It was resolved to invite Prof. John Murray to give a reading entertainment under the auspices of the Society. Mr. A. D. Seward presented a specimen of hydraulic cement rock from Minnesota. The corresponding secretary, Mrs. Ida M. Walker, read a highly interesting paper on earthquakes in the United States, from Prof. Richard Owen, of New Harmony, Ind. This was illustrated by a globe in the hands of Rev. F. D. Seward. Altogether it was one of the most interesting papers that has yet come before the Society. It was briefly discussed by several persons present, and Prof. Owen was most cordially thanked for his able paper. Rev. F. D. Seward was appointed to read a paper on heat at the next meeting.

Feb. 16th — The Society met Monday evening, at 7:30 p. m. Dr. S. P. Guiberson and Mrs. Carmichael were elected members of the Society. Mrs. I. Barnard presented a "horned toad" (*Phrynosoma coronatus*). Other specimens were donated to the museum. Rev. F. D. Seward read a highly interesting paper on Heat, a synopsis of which is published in this issue. A vote of thanks was tendered to the author for his able production. The subject was discussed by several mem-

bers present. Prof. Meredith was appointed to read a paper at the next meeting of the Society.

Society of Natural History.

THE Ventura Society of Natural History was organized June 16th, 1881. The present object of the association is the study of science and the collection of specimens illustrating the natural history, geology, archaeology, etc. of Ventura county. Committees were appointed on botany, entomology, paleontology, geology, archaeology, dendrology, conchology, crustacea, astronomy, etc. By the kindness of Rev. S. R. Weld of the society has the use of a telescope, which adds much to its interest. The meetings are held twice each month and are well attended. A cabinet of good specimens illustrating the paleontology and mineralogy of the county is already secured, and is increasing continually. The following is a list of the members:

Adams, Mrs. W. G.
 Archibald, Clarence
 Bowers, Stephen
 Bowers, Mrs. Maggie
 Barlow, Charles
 Barlow, Mrs. C. A.
 Buckman, F. S.
 Bard, Mrs. C. L.
 Brewster, J. C.
 Brewster, Mrs. J. C.
 Barnard, I.
 Barnard, Mrs. I.
 Blackburn, Mrs. D. S.
 Bonzstel, Miss Cora
 Bristol, Rev. S.

Collins, J. S.
 Collins, Mrs. J. S.
 Carmichael, ^{ncarts}
 Dunning, Mrs. Ella
 Foster, E. P.
 Foster, Mrs. E. P.
 Faddis, Miss Minnie
 Gilbert, Miss Fannie
 Guiberson, Dr. S. P.
 Hall, E. S.
 Hare, L. H.
 Keene, Josiah
 Kendall, A. C.
 Kendall, Miss Estella
 McKeeby, L. C.
 McKeeby, Mrs. L. C.
 Meredith, C. T.
 McMillan, Miss
 Morrison, Thos. H.
 Morrison, Mrs. T. H.
 Murphy, Rev. T. D.
 Mercer, L. E.
 Reese, Miss Ada
 Robinson, Capt. R.
 Robinson, Mrs. R.
 Seward, Rev. F. D.
 Steepleton, Mrs. T. B.
 Saxby, Mrs. I. T.
 Saxby, Bert J.
 Seward, A. D.
 Shepard, Dr. J. H.
 Seward, Miss Anna
 Seymour, Miss Marie
 Surdam, R. G.
 Taggart, Mrs. E.
 Vandever, Gen. Wm.
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