

partial to open beech and maple woods. I knew of an instance where after a pair of these birds had built a nest and laid three eggs they were robbed of the eggs.

The birds removed most of the nest material to another tree only a few feet distant, constructing another nest in which they laid two eggs. Here again they were disturbed, and they removed the bulk of this nest, as before, constructing a new one some forty rods from the last site, in a tree by the roadside and outside the orchard. They had laid two eggs when these were appropriated by some boys, and the persistent little birds once more took the much-transported nest material and returned to a tree near the site of the first nest, where they built their fourth nest and reared three young.

The last of the group, the crested flycatcher, is in some respects the most remarkable. It is less inclined to be sociable than the others, and even though it may nest within a few rods of a human habitation in some cases, in others it is found in much more wild situations. It rather ignores man than avoids him. The erecting of the feathers of the crown, common to all of the tyrant flycatchers, finds an extreme in this bird, and it has almost an appearance of top-heaviness when, with crest fully erected, it sits on some open twig giving vent to its peculiar cries.

Both the notes and the appearance of the birds at such times are quite ludicrous. This genus of flycatchers build their nests in hollows of trees, an old woodpecker's excavation, or more often a natural decayed cavity of a knothole. Many observers have stated that the bird invariably uses the cast skin of a snake in the construction of its nest, and it has been assumed that this was done for the purpose of frightening away enemies. In the few nests I have examined no snake skins were present.

On June 23 a nest was located in a knothole in a limb of an apple tree in an old orchard. It contained young about one-third grown, as far as I could judge. The following day a piece of board was nailed to a limb in such a manner that the camera could be clamped to it about three feet from the nest. A camera was clamped onto this board and left throughout the forenoon for the bird to become accustomed to. This camera was replaced about 2 P. M. by another with a long tube connected, at the end of which was a bicycle pump. The birds made trips to the nest with food at periods which varied in length according to the readiness with which prey was secured. At the distance of the tube's length it was not possible even with a good opera glass to identify the insects brought, save in one instance, where the prey was a large dragonfly. The birds upon alighting in

the tree would sit quietly for several minutes eying the camera, then drop to the nest entrance and either cling for a moment to take a last look around, or immediately dive in. They were usually inside not more than from fifteen to thirty seconds. On an occasion when a bird took in a dragonfly, the wings were not first removed, and it was evidently not broken up before delivering to the young, as the time spent inside was shorter than usual. When the parent had delivered food it backed out (the cavity was too narrow to permit of turning) and for the first few times clung to the entrance for a moment; but thereafter it dropped and flew instantly. Small as were the young, they gave a very good miniature imitation of the weird cry of this species, when they heard the parents coming. July 1 the young flycatchers had left the nest, and though I heard the cry of the parents occasionally from a distance, I did not again see any of the family.

The spring dates of arrival from the South of these flycatchers is given as phœbe, March 10 to 20; least flycatcher, April 20 to 30; crested flycatcher and kingbird, May 1 to 10; wood pewee, May 10 to 20. Dates of departure for their southern winter homes: Kingbird, wood pewee, and crested flycatcher, September 20 to 30; least flycatcher, October 1 to 10; phœbe, October 20 to 30.

# THE PHYSICS OF THE EARTH.

## PROF. SEE'S FARTHER RESEARCHES.

THE September number of the Proceedings of the American Philosophical Society, held at Philadelphia, which has just appeared, contains an important paper entitled "Farther Researches on the Physics of the Earth, and especially on the Folding of Mountain Ranges, and the Uplift of Plateaus and Continents Produced by Movements of Lava beneath the Crust arising from the Secular Leakage of the Ocean Bottoms," by Prof. T. J. J. See, U.S.N.

In three previous papers during the past two years Prof. See has dealt with the cause of earthquakes and mountain formation, and developed a new theory that mountains are due to the secular leakage of the ocean.

This leakage of water into the heated layer beneath gives rise to movements of lava beneath the crust, and the result is the formation of mountains along the borders of the ocean. Lava is pushed from under the oceans, and it uplifts the crust along the edges of the continents into mountains. This new theory of mountain making has awakened worldwide interest among scientists, and already is generally accepted by the leading investigators of America and Europe.

In the present paper Prof. See takes up especially the folding of complex mountain ranges such as the Alps and Alleghanies, and shows that in all cases the folding was done in the sea, and by movements of lava beneath the crust in earthquakes. Where the Blue Ridge now stands there was once a deep sea, and the crust was folded into successive ridges, just as it is now being folded in the neighborhood of the Aleutian Islands.

In the same way he shows that the Alps were folded in the sea, and the folds so far inverted that they flared out at the tops, giving overturned dips. This formation of fan-shaped structures has been very difficult to explain heretofore, in fact it has completely bewildered geologists for more than a hundred years. They were unable to account for the extreme wrinkling of the earth's crust, on the theory that the earth was shrinking; but it never occurred to them that mountains are after all formed by the sea, and not at all by the shrinkage of the earth. By means of this new theory Prof. See finds that all the difficulties disappear; and one can see how the mountains were folded almost as clearly as if he were an eyewitness to processes which took place many millions of years ago. He does this chiefly by comparing mountains now far inland with those now forming in the depths of the sea. The latter is a *living range* now developing; while the former is a *fossil range*, already dead and far inland.

It follows from this theory that the older mountains are most remote from the sea, while the newer ranges are near the sea, and sometimes still under water. The reader can thus traverse whole geological ages in his imagination, and foretell events which will even outlast the race itself.

In the last part of the paper Prof. See deals with the uplift of plateaus and continents. This is all due to the sea, which by its leakage causes the lava beneath the crust to expand, and finally push out at the edges. This earthquake process has gone on so long that it has at length uplifted whole continents. Charles Darwin, the famous author of the "Origin of

Species," long ago asserted that the forces which slowly and by little starts uplift continents, and those which at successive periods pour forth volcanic matter from open orifices, are identical; but heretofore it could not be proved.

Having found by the processes now at work in the depths of the sea just how mountains are formed, Prof. See shows that all the great plateaus of the globe were uplifted by this same process; which consists in the expulsion of lava from beneath the sea and the pushing of it under the land.

All the great plateaus of the world face the Pacific Ocean, and about the border of this great ocean is what is called the World Ridge. It is a lofty ridge of mountains and plateaus running along the Andes and Rocky mountain chain in America, and then down the east coast of Asia and the Himalayas on the south, toward the Indian Ocean; then down the east coast of Africa. This World Ridge includes all the highest land of the globe, and it everywhere faces the water hemisphere. Prof. See shows that the World Ridge arose by the expulsion of lava from beneath the sea under the land hemisphere of the globe. The lighter material pushed under the land, he says, causes that hemisphere to float largely above the water, while the other hemisphere is almost completely submerged. This explains the cause of the land and water hemisphere of the globe, which has always been so utterly bewildering to men of science.

The discovery and definite assignment of the cause which sustains the earth in equilibrium between the land and water hemispheres is justly regarded as a scientific triumph of the first order. This must be regarded as not the least remarkable among several interesting results on the physics of the earth, deduced from the principle of the secular leakage of the oceans. Earthquake volcanoes, mountain formation, the uplift of islands, plateaus, and continents, seismic sea waves, trenches and holes in the bottom of the sea, the feeble attraction of mountains and plateaus, the equilibrium of the earth between the land and water hemispheres, are all clearly related and dependent upon a single physical cause.

In view of the order and harmony this establishes among the various phenomena, who will not concur in the view of the great Newton, that "Nature is pleased with simplicity, and affects not the pomp of superfluous causes"?

### GERMAN KIESELGUHR.

KIESELGUHR, or infusorial earth, is used as filling material for soap, sealing wax, paints, and colors, and for the manufacture of dynamite, aniline, and alizarin, water glass, cement, mortar, artificial stone, gutta percha and caoutchouc articles, and for a variety of other purposes. It is found in considerable quantities in Hanover. It is a light flour-like mass—gray, brownish, or light green—feels soft and dry to the touch, absorbs water, and in ordinary temperature resists chemical action. It is found in layers in alluvial soil, or in the vicinity of lignite deposits. Large quantities exist near Huetzel in the Lüneberger Heide, and also near Unterlueß in the same part of Hanover. The kieselguhr extracted at Huetzel is dried only in the open air, and it is generally cleaned before being

used. Kieselguhr is also found near Vogelsberg in Hessen, at Jastrabe in Hungary, near Franzensbad in Bohemia, in Tuscany, Sweden, Finland, and also in Canada. The principal characteristics of kieselguhr are the low specific weight it has, which is 0.250 to 0.550, the high absorption, and its quality of being a very bad conductor of heat, making it one of the most reliable means of protection against the radiation of heat. The method of extraction is similar to that of clay for the manufacture of bricks. The product is removed from the open pit, and then spread upon benches, or hill sides, for the purposes of drying by air or sun. Artificial drying processes—by means of hot air—in rooms, drums, or troughs, have not, it is said by the American consul at Hamburg, proved practical in Germany. Kieselguhr roasts easily, but must never be brought into contact with a flame, as it would soon calcinate. The drying of kieselguhr in ovens would not be profitable, and such process would never come into consideration in large concerns. Several processes of drying kieselguhr, by using mechanical means, have been tried in Germany during the last twenty years, but have not proved satisfactory, and have therefore all been discarded. Kieselguhr has also been dried by means of hot air and exhausters, but this process is one applied only in wet weather, in exceptional cases, and with material which has already been dried to a certain extent. This process, however, is not remunerative, and can only be applied with the best quality of kieselguhr—washed for the manufacture of dynamite—and at a time when the market is at a high level. It has to be taken into consideration that kieselguhr contains, as it is extracted, 70 to 90 per cent of water, which evaporates very slowly. Air-dried kieselguhr still contains from 15 to 25 per cent of water. After having been dried, it is ground, and packed in sacks. During transportation, special care is taken to protect the product against moisture. For crushing mills, there are four different systems in use in Germany—Journal of the Royal Society of Arts.

**Deposits of sodium nitrate**, or Chile saltpeter, have been found only in Chile. In the district of Tampa, near the port of Iquique, are extensive beds of nitrate, from 10 to 40 inches thick, covered with a layer of sand from 20 to 80 inches in depth. The crude nitrate, or *caliche*, contains from 48 to 75 per cent of sodium nitrate and from 20 to 40 per cent of sodium chloride. This composition indicates that the deposits are of marine origin. From 1830 to 1907, nearly 40 million tons of nitrate, worth more than one thousand million dollars, have been taken from these beds. In the northern part of Chile are other deposits. These have been little worked, but a company has been formed in London, with a capital of nearly nine million dollars, for their exploitation. Extensive deposits of phosphates have recently been discovered in the island of Mauru, in the Marshall group. Borings have revealed the existence of a stratum of phosphates from 10 to 15 feet in thickness, underlying the entire island. Already about 200,000 tons are exported annually to Japan, Australia, New Zealand, Hawaii, and Europe, particularly Germany. Deposits of phosphates in the forms of phosphorite and apatite are found in Florida and in the province of Estremadura, in Spain.