of nature, the coral carbonate had been changed to phosphate of lime; but subsequent researches proved the phosphatic rocks to have had their origin in the air, not under water. They were simply the remains of what in a more arid climate would have been regular guano beds, their organic matter having been dissolved and washed away by rain.

To convert these phosphatic deposits into commercial fertilizers, it was simply necessary to restore the organic elements which had originally accompanied them, for which purpose nothing seemed so appropriate as the refuse of fish oil factories. All along our northern coast, enormous quantities of menhaden were annually taken for their oil; and the compressed fiber and bone remaining after the extraction of the oil afforded a vast quantity of nitrogenous matter, similar to that produced in the digestive organs of fish-eating sea fowl. The company which had undertaken to utilize the phosphatic deposits of the Pacific islands set up their works at Wood's Hole, Mass., at the heart of the menhaden fishery, and there the fish of the Atlantic were made to supply the wasted elements originally drawn from the fish of the Pacific.

A model of these works is shown in the Government Building, at Philadelphia; and in the company's special pavilion are models of their other works, with a full exhibit of the processes employed, the materials used, and the products obtained.

The exhaustion of the richer beds of Pacific phosphates (and only the richer would pay for transportation) led to a search for like deposits nearer home, resulting in the discovery of the extensive deposits of Great Swan Island, in the Caribbean Sea, about a hundred miles from the coast of Honduras. But this source was soon eclipsed in value and interest by the rich phosphatic deposits along the South Carolina coast. Though known for nearly a century, the fertilizing character of these beds was not detected until 1867, when Dr. Ravenal discovered that their characteristic nodules of supposed marl rock were really composed almost entirely of phosphate of lime, and immediately made arrangements for their collection and conversion into commercial fertilizers, in the place of the Swan Island phosphates he had hitherto been using.

Previously, the interest attaching to these beds had been chiefly scientific, arising from the strange revelations of ancient life made by their fossil remains—revelations of a time long anterior to the historical period, when our familiar domestic animals, once supposed to have originated with man in Asia, horses, sheep, bulls, and hogs—were living here with animals peculiarly American, as certain deer, musk rats, beavers, hares, opossums, and the South American tapir.

The phosphatic nodules in question are found along the water courses of the Sea Island region between Charleston and Savannah, the largest development occurring on Chisolin's Island, about midway between these two cities, at the junction of the rivers Coosaw and Bull. The island, about six miles long by two miles wide, is underlaid with strata of nodules varying in thickness from one to three feet. At the diggings of the Pacific Guano Company, to whom the island belongs, the phosphatic stratum lies from two to five feet below the surface, and is about three feet thick. Nodules are also found in quantities in the beds of adjacent creeks. Properly treated, they yield an average of phosphoric acid equal to sixty per cent of phosphate of lime. The Swan Island's phosphates are less rich, except in the deeper deposits, some of which yield as high as eighty per cent of lime phosphate.

In the conversion of these phosphatic rocks into soluble fertilizers, they are first dried and pulverized; then, after being reinforced by the richly nitrogenous fish fiber, the whole is digested with sulphuric acid, producing an artificial guano analogous in nature and composition to the purest Peruvian guano, and equally efficient for the nutrition of growing crops.

By this industry, one of the most abundant and uneatable of our coast fishes, the menhaden, is made one of the most valuable. During the past year, upwards of twenty-six hundred men, with three hundred and forty-three vessels, nine of them steamers, were employed in the menhaden fishery. The capital involved was nearly three million dollars, and over five hundred and sixty million fish were taken. Besides the 2,681,487 gallons of oil obtained for commercial purposes, these fish yielded over fifty thousand tuns of compressed fiber and bone, carrying more than seven and a half million pounds of ammonia in the best possible organic form, the equivalent of 26,000 tuns of Chincha Island guano, and over 1,000,000 lbs. of phosphate of lime, readily convertible into agricultural products.

THE STRUCTURE AND AGE OF THE ROCKY MOUNTAINS.

From the Missouri river westward, the whole country gradually rises, at an average grade of barely ten feet to the mile, until about the meridian of 105½° W. is reached, and then the Rocky Mountains rise abruptly from the plain. Thence to somewhat beyond 108° W. the country is traversed by numerous mountain ranges, separable into two series. The first series comprises two complex axes of elevation, the front or eastern and the Sangre de Christo, whose trend is from N. 10° W. to N. 30° W. The second series is made up of the San Juan, Los Piños, La Plata, and San Miguel ranges, which have a trend of N. 30° W. to N. 45° W. Each series shows a parallelism in its ranges, and the whole system terminates *en échelon* southward, most of the axes ending in Colorado.

The eastern range, which consists of several closely packed parallel axes, and rises sharply from the plain, is composed of metamorphic rocks, badly fissured by dykes of lava, and not unfrequently capped by lava overflows. The schists are much torn and faulted, and side throws of mineral veins are not uncommon. Along the median line of the axis, exposed here and there by deep cuts, a compact granite, more or less syenitic, appears to prevail. The sedimentary rocks occur as "hog backs" along the eastern base, and curve round the southern terminations of the several axes.

The second range, provisionally named the Sangre de Christo by Dr. Stevenson—to whom (Report of Engineer Department, Wheeler Expedition, 1875) we are indebted for these particulars—is in the main almost parallel with the eastern range, but is much more complex in its structure. Its width is about twenty-five miles in the northern part, diminishing to twelve miles at Sangre de Christo Pass. With its extension, the Spanish range, it is, in Dr. Stephenson's opinion, but the southern portion of a magnificent group which once covered the whole region from East River to South Park. It remains for future explorations to solve the many problems which its complicated structure involves. In the main portion no rocks have been found of later date than the carboniferous.

The third great axis is the San Juan, for the most part buried under a great mass of volcanic rocks, which almost conceal those of sedimentary origin. Wherever exposed, a marked unconformability is seen between the carboniferous and the overlying rocks. The older formations are inclined at a very high angle, while the cretaceous and (doubtfully) the triassic, which are conformable to each other, have a very small dip.

The next great axis toward the west is the one termed by Dr. Newberry the Los Piños, in part the divide between the Rio de los Piños and the Rio Piedra. The only rocks involved are the carboniferous and (probably) the Silurian. On each side of the range, which is not more than five or six miles wide, the cretaceous rocks are seen forming mesas and dipping only two or three degrees.

The next axis, the La Plata (Newberry) forms in part the divide between the Rio de la Plata and Rio de los Animas. The course of the uplift is almost northwest, and the dip is very gentle where the strata have not been locally disturbed by lava dykes. The only rocks involved are the palæozoic, against which the triassic and the cretaceous abut at a slight angle.

The San Miguel axis is still farther westward, and, like the La Plata, involves only palæozoic rocks, those of mesozoic times forming mesas around it. Beyond, to the westward, extends a cretaceous plateau separating the Rocky Mountains from the Great Basin.

From his admittedly partial explorations, Dr. Stevenson finds it sufficiently evident that the Rocky Mountains are not the result of a single grand upheaval, and that the several axes are not wholly synchronous in origin. The general diminution of disturbance westward, as shown by the diminishing steepness of dip, together with the general trend of the several axes, shows that the disturbing force was propagated from the east or east of northeast.

The relations of the strata of the several periods make it easy to determine the era and the comparative energy of the successive upheavals. The first was at the close of the carboniferous period. The Silurian and the carboniferous are everywhere conformable, showing that, during the time of their deposition, there must have been either comparative quiet or continued subsidence. The line of continuous action thereafter seems to have been that now occupied by the eastern range. In this region there was a subsidence during the trias, which but slightly, if at all, affected the interior

The second epoch of elevation began toward the close of the triassic, and was marked by an exceedingly energetic action along the eastern line, accompanied by a grand eruption of igneous rocks. The conformability of the trias and the cretaceous in the San Juan area shows that the energy of the convulsions diminished westward and southwestward from the main line of disturbance. After the second upheaval there was an extensive subsidence, the record of which appears in the prevalence of cretaceous deposits over the whole Rocky Mountain area.

The third epoch of elevation followed hard upon the cretaceous period. The action is generally violent, in some parts terrific, resulting in a perfect maze of cross faulting. Everywhere north and east of the Rio Grande, the volcanic disturbance was excessive, a vast area being buried under a sheet of lava from two thousand to three thousand feet thick; and enormous dykes, stretching from the Sangre de Christo southeastward far out into the plain, remain to attest the widespread effects of the disturbance.

During the tertiary age, another but much slighter elevation took place, giving the rocks of that age a dip of five degrees. Of the four upheavals, the first and third were much the most general in their effects. The first was synchronous with that during which the Appalachian chain was completed.

INCENDIARY LOCOMOTIVES.

Conflagrations produced by sparks and fire from locomotives are by no means of unusual occurrence. It only necessary to observe after nightfall the fiery shower, with which every engine not supplied with proper spark arresting devices liberally besprinkles the track and its immediate vicinity, to discover why wooden buildings, oil in tanks, and hay ricks are constantly being destroyed, and in autumn to feel some wonderment that the adjacent fields of ripe grain or sun-dried prairie grass are not more frequently kindled. It cannot be doubted that many a fire is ignited in cities, as well as in country villages through which an express train rushes at fifty miles per hour, the unknown cause of which is the locomotive, scores of miles away before the fire breaks forth.

We are exceptionally patient people, however, and individually at least prefer suffering the loss of a burnt barn than to become involved in legal proceedings *versus* a huge and wealthy corporation. But on the other hand, immunity on the part of the railroads in this respect begets carelessness likewise on their part, notably in the provision of the devices, easily obtainable, which will prevent their locomotives being perambulating incendiaries. The consequence is an increase of the evil; so that not only has a loser a private end to gain in seeking prompt redress from the railroad company, but he has a public duty to perform in enforcing his right. The railroad, it should be remembered, enjoys its privileges by the sufferance of the people, and it is conditioned not only to serve the public in certain ways but to exercise diligence not to work injury to the public. It is therefore responsible for its negligence; and generally it is incumbent on the railroad to show conclusively that the person injured actively contributed by his individual neglect to effect the result, if it would save itself from being cast in damages. The tendency on the part of courts and juries is to hold all corporations with great strictness to their duties; and in this rigid enforcement of the law is found the safeguard of the people against the abnormal exactions which great controlling monopolies would otherwise too often be in position to demand.

The manner in which the law regards fires produced by locomotives is cogently stated in a decision recently reached by our highest tribunal, the Supreme Court of the United States. The case was that of R. M. Richardson *vs.* the Grand Trunk Railway Company of Canada. Certain buildings for freight purposes and for his individual benefit had, by Richardson, been erected, with the company's permission, on land owned by the railroad. These were destroyed by fire from a locomotive, and the action was brought to recover. In its opinion, the court said that the issue to be determined was whether the defendants had been guilty of negligence—that is, whether they had failed to exercise that caution and diligence which the circumstances demanded, and which prudent men ordinarily exercise. Hence the standard by which their conduct was to be measured was not the conduct of other railroad companies in the vicinity, certainly not their usual conduct. Besides, the degree of care which the law requires, in order to guard against injury to others, varies greatly according to the circumstances of the case. When the fire which caused the destruction to the plaintiffs' buildings occurred, it was a dry time, and there was a high wind. At such a time greater vigilance was demanded than might ordinarily be required. The usual practice of other companies in that section of the country sheds no light upon the duty of the defendants when running locomotives over long wooden bridges in near proximity to frame buildings, where danger is more than commonly imminent. Evidence was held admissible as tending to prove the possibility and a consequent probability that some locomotive caused the fire, and as tending to show a negligent habit of the officers and agents of the railroad company. It was further held that it made no difference that a large part of the property destroyed was wrongfully on the railway, the court sustaining the ruling in a case cited that the company in such a case was bound to exercise ordinary care to avoid injury, even to a trespasser.

The Arrival of Professor Huxley.

Professor Huxley, the celebrated English scientist, has arrived in this country. He is at present traveling privately, and will devote the greater part of his brief visit to the Centennial Exposition. It was not his intention to deliver any lectures here, but he has lately reconsidered his determination, and has consented to give three discourses during the latter part of September, in this city. The topics are not yet announced, but this is immaterial, as there is sufficient curiosity to see an investigator, whose name and works are as familiar to us as to his own countrymen, to fill the largest hall New York possesses. Meanwhile, until our people shall have the promised opportunity of collectively greeting the eminent gentleman, we take the liveliest pleasure in extending to him, on the part of the scientific workers, the inventors, and the mechanics of this country, a most cordial and hearty welcome.

Preventive of Hydrophobia.

In a letter published in a recent number of Professor Gubler's *Journal de Thérapeutique*, another addition is made to the already formidable list of prophylactics against hydrophobia. Dr. Grzymala, of Krivoe Ozeroe, Podolie, reports that during the last ten years he has treated at least 100 cases—in human subjects as well as beasts—of bites by hydrophobic animals with the powdered leaves of *xanthium spinosum*, with success in every case except one, although cases of bites inflicted at the same time, but treated in other ways, had terminated in death. The drug is described as possessing sudorific, sialagogue, and slightly diuretic properties, but less pronounced than those of jaborandi. The dose for an adult is 9 grains of dry powder of the leaves, repeated three times a day and continued during three weeks; to children under 12 years, half the quantity is given.

TO BLEACH SPONGE.—Soak it well in dilute muriatic acid for twelve hours. Wash well with water, to remove the lime, then immerse it in a solution of hyposulphate of soda, to which dilute muriatic acid has been added a moment before. After it is bleached sufficiently remove it, wash again, and dry it. It may thus be bleached almost snow white.