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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

DISAPPEARING ENGLAND.

While the question of coast erosion and reclamation is one of comparative insignificance in this country, the subject has, of late years, aroused considerable discussion in England, because of the undoubted ravages of the sea at many points of the littoral of the island. The shores of England are composed largely of clay, chalk, or friable rock which is easily eaten away by the waves of the ocean or the strong currents and tides along the coast. In consequence great stretches of the shore have been worn away and are constantly crumbling further inland with each succeeding year. This gradual destruction has caused great damages to many towns situated on the seashore and has destroyed thousands of acres of valuable farming land. At certain locations, even within the memory of men still living, the sites of prosperous villages of former times are to-day covered by many fathoms of water, sometimes several miles from the present shore line.

Coast erosion following severe storms within recent years has been so marked at many points on the English coast that after extended press discussion a Parliamentary commission has been appointed thoroughly to investigate the subject, and if possible to devise means for the abatement of the injury. While there is little danger that the "tight little island" will completely disappear within the next few generations, there can be no doubt that coast erosion is causing serious loss of land at many points, particularly on the south and east coasts, notwithstanding that the areas gained artificially at other points almost compensate for it. It has been estimated that in the thousand years from 900 to 1900 an area of nearly 550 square miles has been worn away by the erosive action of the waves and ocean currents. That the changes in the littoral outline of England are due almost purely to this action is the opinion of the geologists who have investigated the question, and it is not believed that the subsidence and upheaval of the earth's crust are in any way responsible therefor. The material which is carried away after being eroded from the shore is either immediately borne to the deep sea in suspension, or is washed along the coast in the form of littoral drift. It is hardly possible to estimate the respective proportions of the material which are thus disposed of, but these proportions may vary from 20 to 90 per cent of the whole, though it is hardly likely that the proportion carried out to deep water often approaches the latter figure.

The question of coast protection is a difficult one, and the method in use at present, comprising the construction of walls and groynes along certain areas, results of necessity in the depriving of the foreshore of the material which might otherwise gather there. Thus while a uniform system of protective walls and groynes running from the walls out into the sea will, for the time being, largely prevent the erosion of the coast, it will nevertheless, by abating or largely decreasing the littoral drift, bring about the depletion of the foreshore and will ultimately cause the destruction of both protective walls and groynes. The question of coast protection and reclamation presents engineering difficulties of no mean magnitude, and the overcoming of these difficulties will constitute an interesting phase of future engineering history, for we feel certain that English technical men and men of science will find successful means for combating the destructive power of the sea.

AFTERMATH OF THE SAN FRANCISCO FIRE.

In drawing the proper lessons from a disaster of the magnitude of the San Francisco earthquake and fire, care must be exercised lest too great an emphasis be laid upon particular and unrelated incidents and effects. It has been claimed, and doubtless with some measure of truth, that in the early photographs of the fire, and particularly those of individual buildings or parts of buildings wrecked by the fire, that were published soon after the disaster, there was too much broad generalization based upon insufficient data. It is only now, after there has been time to gather and classify material in the way of photographs and observations by experts, that the public is being placed in possession of well-digested lessons drawn from the disaster. We have recently been favored with a large number of photographs and an extremely interesting discussion of the San Francisco fire and its lessons by Mr. F. W. Fitzpatrick, the secretary-treasurer of the International Society of State and Municipal Building Commissioners and Inspectors, of Washington. The article was called forth by some photographs showing the respective behavior of fireproof tile and of concrete protection in the recent fire, which were published in the SCIENTIFIC AMERICAN of June 9, 1906, and which Mr. Fitzpatrick criticises as giving a one-sided and misleading impression of the facts. The article, which is too long for the columns of the SCIENTIFIC AMERICAN, will be found in the current issue of the SUPPLEMENT. The illustrations consist largely of interior views of columns, girders, floors, and partitions which were affected by the fire, and they are from photographs selected from several hundred made under expert supervision at San Francisco. The article is an impartial and very thoughtful review of the lessons taught by the disaster as to the design and construction of future fireproof buildings.

PROF. SEE'S INVESTIGATION OF THE EARTH'S RIGIDITY.

In the Astronomische Nachrichten Prof. T. J. J. See, U. S. navy, has exhaustively investigated the rigidity of the earth and other heavenly bodies, by mathematical processes depending wholly on the theory of gravitation.

This line of investigation was begun in 1863 by Lord Kelvin, who sought to determine the rigidity of the earth from observations of the tides of the oceans. Tidal observations secured the only means of ascertaining the amount of bodily distortion experienced by the earth under the disturbing forces of the sun and moon; and it was thought that if the earth proved to be highly rigid, the result would contradict the theory long held by geologists that the earth is a globe of molten matter inclosed in a thin crust, like the shell of an egg.

Lord Kelvin reached the conclusion that the earth as a whole is certainly more rigid than glass, but perhaps not quite as rigid as steel.

About 1880 Sir George Darwin took up the investigation, and considerably extended and improved Lord Kelvin's method. By careful study of the fortnightly tides he found the earth to be more rigid than steel; that is, it yielded less under the disturbing action of the sun and moon than a solid globe of steel of the same size. This was justly held to show that our earth could not be a sphere of liquid covered by a thin crust; and geologists had to conform their theories with a globe as rigid as steel.

Prof. See's investigation is purely mathematical, and based on the pressure existing throughout the earth. According to Laplace's law, the density at the center of the earth is equal to that of lead, and the pressure equal to that exerted by a vertical column of quicksilver as long as the distance from St. Louis to San Francisco.

By considering the pressure throughout the whole earth, it is found that even if fluid, our globe would have a rigidity greater than that of wrought iron. The earth's matter under this great pressure acts as a solid, and so vibrates in an earthquake; and the average rigidity of the whole mass is nearly equal to that of nickel steel, such as is used in the armor of a battleship. Nickel steel is one of the strongest and hardest metals known, and it affords us a good idea of the strength and rigidity of the earth. Our globe is thus proved to be capable of withstanding enormous strain; and we need have no fear that earthquakes or volcanic outbursts will ever endanger its stability.

Dr. See proves that the rigidity of the earth's crust is about equal to that of granite, which is one-sixth that of steel; and that toward the center the rigidity rapidly increases. At the earth's center the imprisoned matter is at an enormously high temperature, yet under the tremendous pressure there at work, it is kept three times more rigid than the nickel steel used in the armor of a battleship.

His new method can be applied also to the other planets. Heretofore no method has been known for finding the rigidity of any mass except the earth on which we live. But the gravitational method can be applied with entire confidence to Venus, Mars, Jupiter, or Saturn, and we can find their rigidity almost as accurately as we can that of our own globe.

It turns out that the rigidity of Venus is greater than that of platinum, and most likely about identical with that of wrought iron. The rigidity of Mars is about equal to that of gold, while the rigidity of Mercury, the moon, and other satellites is about equal to that of glass.

The average rigidity of the great planets, Jupiter, Saturn, Uranus, and Neptune, lies between eighteen and three times that of nickel steel. The great rigidity of these bodies is due to the great pressure acting throughout such large masses. In the case of the sun the result is still more extreme. The average rigidity of all the sun's layers is over two thousand times that of nickel steel.

This result affords a good idea of the effect of gravity in compressing and hardening a mass, even when it is self-luminous and at enormously high temperature.

Having shown by laborious calculation that these bodies are so rigid, Prof. See has gone one step farther, and inquired what effect this rigidity will have on the currents often supposed to circulate within these masses. As pressure directly increases the fluid friction of moving currents and tends to bring them to rest, it is not surprising to find that the rigidity almost prevents circulation, especially deep down in these masses.

Many geologists have held that liquid currents exist in the earth; and astronomers have been accustomed to assume that fluid currents in the sun descend almost to its center. In view of these results, it is not surprising to find that he denies the possibility of currents in the earth, and claims that currents in the sun and great planets must all be quite shallow.

These currents cannot descend to any appreciable depth, because the pressure and rigidity are too great. In the case of the earth, we cannot well conceive of currents in matter more rigid than granite; and in the case of the sun, a rigidity twenty-two times that of nickel steel only one-tenth of the way to the center makes circulation of currents below that depth likewise inconceivable.

DISCOVERIES IN THE SARGASSO SEA.

There is a sea in the middle of the very ocean itself, the limits of which are as well defined as those of any other known large body of water; its characteristics are so peculiar, too, that it is impossible for anyone to mistake them. The first glimpse Columbus had of this sea reminded him, so it is said, of an "undulating meadow"; as far as the eye could reach, the sea was covered with a greenish yellow plant, just as completely as water lilies do a pond. Ever since that day when the immortal Christopher first saw the weed, and doubtless for thousands of years before then, the Sargasso Sea (for such is the name of this strange body of water) has existed. Its boundaries may be indicated by tracing a triangle, the three corners of which are represented by the Azores, the Canaries, and Cape de Verde. Within these limits the surface of the sea is covered with so thick a coating of seaweed as to prevent vessels from sailing through it. Steamers also avoid it, whenever possible, because of the fouling of their screws and paddles by the weed.

During the course of 1905 H. R. H. Prince Albert of Monaco sailed for this sea in his famous vessel, the "Princesse Alice," with three objects in view, viz., the study of bathypelagic faunas in general, of the faunas of the Sargasso Sea, and of the meteorology of the upper atmosphere. The vessel sailed from Marseilles on July 20 and returned on September 24, 1905. The results of the 64 days' voyage have recently been published, and form highly interesting reading.

No less than 118 soundings were made up to a depth of 5,580 meters (18,302 feet) and 28 samples of water were taken in Richard bottles and Buchanan tubes. Some very interesting zoölogical finds were made, of which the following is a brief description. With a bag-net there were secured (at depths ranging from 606 to 11,364 feet) numerous Alcyonariæ, several interesting crinoids, and two extremely rare specimens of *Gephyrocrinus Grimaldii*, already discovered by the prince on a previous occasion. Among other crustaceæ there was a specimen of the *Polycheles eryoniformis* Bouv., a new species which recalls the Jurassic eryon by its dilated carapace. Another net, sunk to a depth of 11,364 feet, brought up a rich find, comprising a new type of *Cinroteuthis* of a uniform black color, with large black brachial papillæ; a small Cephalopod, of an undoubtedly new type and species, having telescopic eyes and an extremely singular trilobial luminous organ. By far the most productive accessory of the campaign was found to be a wide-mouthed vertical net; in fact, adequately to describe the numerous specimens secured with its aid would require a booklet. Forty-one descents were made, to a depth of 17,712 feet, and, in most cases, the specimens obtained were similar to those obtained in the course of researches made a year ago elsewhere. The most striking objects were a new Ulmarida of the color of wine lees, closely related to the Aurelia, and constituting the first member of this family found in deep waters; of the Ostracod family there were some large spherical *Gigantocypris*, and several specimens of a large black (or almost black) Ostracod, the shape of which may be likened to the pip of a ripe pear, several relatively speaking new species of Nemertæ, especially a large orange-colored variety, hitherto rarely found among bathypelagic fauna; and finally some transparent Annelidæ with large red eyes, and several types of Phronima, one entirely new. In the Sargasso Sea the net also brought up one of those curious crustaceans of the Eryoneicus type; it is quite new, and M. Bouvier,