the expansive energy of the contained water that we owe, in part at least, the upward movement of such materials. It is clear that this is the case in true volcanic dikes, for all the phenomena of a volcano indicate that the mainspring of its movements is to be found in the vapor of water. The close likeness between ordinary volcanic dikes and those which we cannot assuredly connect with volcanoes leads us to the conclusion that all injections whatsoever are most likely due to expanding vapors. Be this as it may, the effects of dikes is to clearly remove the material from a great depth, and place it in more superficial rocks.

Although it is most likely that the crevices into which dikes find their way may occasionally owe their dislocations to the action of contraction attending on certain metamorphic changes, probably the greater part of such ruptures are due to strains connected with changes in the attitudes of the rocks. The dike material thus acts as wedges to fill in all the cavities accessible to the igneous rocks, as far as they are formed. It is evident, that, where this process is numerously repeated, a considerable horizontal extension of the rocks is necessarily brought about. Thus in many parts of New England, as is well shown along its extended shore-line, where the coast reveals the crystalline rocks, from one-tenth to one-twentieth of the superficial area is occupied by such dikes. Generally, where the conditions have been such as to induce an injection of dikes, there is a large amount of vein matter deposited in the same field which still further serves to produce an extension of area. Thus in the region about Eastport the gain in the superficial area due to these two causes amounts to somewhere near three per cent or five per cent of the superficies exposed on the present surface of the rock.

Let us suppose that within any area of the earth's surface the conditions are such as to favor, through the forces which lead to vein-building and those which operate to create dikes, the vertical migration of matter from considerable depths towards the surface. The result on the tensions in the crust at such a point will evidently be such as to favor the construction of mountains. The constant abstraction of material from the depths will lead to a diminution in the bulk of the deposits of that lower level, and a parallel augmentation of the strata nearer the surface. It may well be that the differential contraction of the earth's mass, being greater at lower levels than at higher altitudes in the section, may create a slight tendency to buckle into mountain-ridges in all parts of the crust: but, wherever this general contraction is combined with the crenitic action, we may expect to find a more complete development of mountain-chains; and such points will be the seats of folding, and they may by their wrinkles effect the necessary contraction of the crust, and thus prevent folding in other sections where the contraction of the whole sphere alone tends to produce wrinkling.

It seems to me that this hypothesis may, perhaps, explain the fact that regions which have long been the seat of active sedimentation naturally become the sites of mountain-building. James Hall and others have noted the fact, which so far has remained inexplicable, that the first stage in mountain-building consists in the production of extended sedimentary deposits of more than normal thickness. During the deposition of these sediments the earth's crust appears to be down-borne by their weight. After the subsidence some action sets up which leads finally to a certain elevation of the area, and consequently to a development of erosive action. As the deposits are worn away, the mountains rise higher and higher, as the folding becomes more and more intense.

Although the generalization concerning the formation of mountains which I have just stated has not been critically compared with the many instances of mountain-structure, it seems of sufficiently common occurrence to demand an explanation, and it very likely will prove true for all large mountain systems whatsoever. Is it not possible that we may account for the development of mountains through these series of changes in the following manner? viz., where, as along a shore-line, sediments are thickly accumulated, the first effect may well be the down-sinking of the region; then, as the thickness of the stratified section increases, and the blanket retaining the internal heat becomes deeper, the internal heat will be greatly increased in the lower portions of the section. This will induce an upward migration of the imprisoned waters, and consequently, in time, a transfer of material to higher levels in the rocks. The consequent expansion of these superjacent rocks will make them tend to buckle. The superficial strata may not have received any considerable infiltration or injection of the material, yet they may be contorted by movements in the subjacent rocks which have thus been increased in volume; in other words, an intensification of deposition, if the sediments attain a great depth, may in time lead to a reversal of the down-sinking movement and the construction of a mountain system in what was previously a basin of sedimentation.

This explanation of mountain-folds will probably not at all account for the development of the basilar uplifts or tableland elevations which are developed in connection with all or almost all important chains. It may well be the fact that the expansion of the overlying deposits through the upward deportation of matter is only one element in determining the formation of mountains. It may in the end turn out that mountains are the result of a tolerably complicated series of causations, in which secular refrigeration of the earth, the transfer of weight by the operations of erosion and deposition, and the subterranean migrations of matter, all take a part. It may indeed well be the fact that these internal movements of material are due to more than one cause. I am, however, inclined to believe that to this vertical movement of materials we owe in many cases a share of the conditions which bring about the formation of mountainous dislocations.

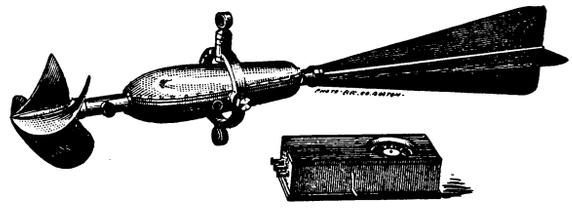
N. S. SHALER.

SCIENTIFIC NEWS IN WASHINGTON.

A New Instrument for measuring the Direction and Velocity of Submarine Currents. — Cabinets of Typical American Rocks, for Use in Colleges and Universities. — Beautiful Specimens of New Jersey Serpentine. — Ojibwa Pictographs in the West. — The Yellow-Fever has disappeared from Florida. — Interesting Phenomenon at Sea.

A Direction-Current Meter.

THE increasing commercial importance of our rivers and harbors, and the recent large annual appropriations for their improvement, have given a fresh impetus to the study of physical hydrography and hydraulics. It has come to be pretty generally recognized that no plans for the permanent improvement of tidal harbors, and such streams as the Mississippi and its tributaries, can be perfected without a thorough knowledge of the physical laws which underlie the complex phenomena they present. The investigation of these laws has stimulated observers and experimenters to the invention of many new and improved devices for the precise measurement of the various factors involved. One of the most interesting of these devices is a direction-current meter, recently perfected by Mr. E. S. Ritchie, the well-known maker of philosophical apparatus, of Boston, and Mr. E. E. Haskell of the United States Coast and Geodetic Survey. The characteristic feature of this meter is that it gives simultaneous measures of the direction and speed of a current. The direction is determined by means of a compass in all respects similar to Mr. Ritchie's trailing compass, which is mounted in an elongated chamber, whose axis coincides with the axis of the meter (see accompanying cut). A system of electro-magnets and



circuits connects the compass with a dial, which may be placed in any convenient position, in such a manner that the observer may make the dial indicate the same azimuth as the compass-needle. The speed of the current is measured by a conical propeller-wheel, whose flukes are curved in conformity with the requirements of theory for maximum rotary effect of moving water, and whose mass is as small as practicable with its requisite stability. The revolutions of the wheel are counted automatically by an electro-

chronographic register. The magnetic azimuth of the meter can be measured within a degree or two, and it is thought that current speeds as low as two-tenths of a foot per second can be accurately registered. This meter was used by the Coast and Geodetic Survey parties in their observations of currents in New York harbor last summer, and proved highly effective.

Cabinets of Typical American Rocks.

About four years ago Major Powell concluded to make a collection of all the typical rocks of the United States, systematically and scientifically arranged, so that a student of mineralogy, by comparing any piece of rock he might find with a corresponding specimen in the test collection, and studying the descriptions which would accompany the latter, might determine the name, composition, and proper classification of the unknown piece of rock he had in his hand. When this collection of typical rocks was complete, Director Powell proposed to have a number of duplicates of it made for gratuitous distribution to the leading colleges and universities of the country, for use in the classrooms as aids to the teaching and study of mineralogy.

Instructions were therefore issued to all the field-parties of the Geological Survey to collect and bring in specimens of the typical rocks of the regions they visited, and at first the work went on bravely. But what was everybody's business soon became nobody's business, the work of collecting was neglected, and finally little or nothing was done about it.

But Major Powell was unwilling to give the matter up, and about a year ago he assigned Prof. J. S. Diller especially to the work, and during the past few months it has been pushed forward with great vigor. A complete set of specimens of the typical rocks of the United States will be sent to the Cincinnati exhibition, and the work of preparing the duplicates is progressing very rapidly. Each set will consist of from one hundred and thirty to one hundred and forty specimens, each four inches long, three inches wide, and one inch thick; and there will be a pamphlet to accompany the collection, giving a description of each specimen. Two hundred of these sets are being prepared, and will be ready for distribution in about a year to those colleges and universities which file with Director Powell official application for them, and agree to make the use of them for which they are designed.

It will be impossible, of course, in a brief notice like the present, to give any thing like an adequate description of one of these collections; but a few outlines may convey to the reader some idea of their scope and the plan upon which they are arranged. Each collection will be divided into two departments. The first will be a sort of alphabetic collection, intended to show the general conditions of rocks, their structure, means of alterations, etc. For instance: one specimen will show a stratified rock, and another an unstratified one; a veined rock will be exhibited, also specimens of rocks jointed in various ways, those containing ripple-marks, limestone weathered by rain, spheroidal weathering in eruptive rocks and shale, rocks changed by the crumpling of strata, etc. In the second division the separate classes of rocks will be represented in their varying forms. For instance: in showing the stratified rocks not metamorphosed, the first specimen will be loose pebbles, or simple masses not cemented together; the second will show these simple masses partially cemented; and the third will show them entirely cemented, like the mill-stone grit and Roxbury puddingstone. In the same way a specimen of loose sand will be shown, such as is found upon the seashore; then sandstone like many of those of the East, where the grains are cemented by oxide of iron; then sandstone like the Potsdam, cemented by siliceous matter; and finally sandstone where the cement is carbonate of lime. Many different kinds and colors of sandstones will be shown, so as to enable the student to recognize by comparison any specimen of common sandstone he may have. In the same way the varieties of the other classes of rocks will be illustrated, — the volcanic; the limestones of every texture, variety of color, and degree of purity; infusorial earth and deposits of hot springs; gypsum; specimens showing all these rocks metamorphosed; sedimentary rocks; eruptive rocks; lavas of the same composition as granite, that came to the surface; and specimens ranging from the most acid granitic rock to the most basic.

From this brief outline it may be seen of what great practical value each of these collections may be made, if used as Major Powell designs that they should be. About forty institutions have already made application for sets.

Fine Specimens of Serpentine.

Among the mineralogical specimens which the National Museum will send with its collection to the Cincinnati exhibition will be some pieces of serpentine which are more beautiful, probably, than any previously exhibited in the United States. They were found in the Gordon limestone-quarry, near Montville, Morris County, N.J., and were collected by Prof. W. S. Yates, who was sent to Montville by the National Museum last summer for the purpose. The specimens are of a light yellowish-green color, differing entirely from the pure green serpentine metamorphosed from olivine rocks, which occurs in mountain-masses near both the Atlantic and Pacific coasts.

Prof. G. P. Merrill, curator of rocks, etc., at the National Museum, who has studied these specimens, has determined that the serpentine has been derived from the alteration of pyroxene; in fact, in nearly all the specimens the process of alteration is incomplete, the serpentine surrounding the pyroxene, which remains unaltered in the centre. A number of the specimens, ranging from a few inches to a foot and a half in diameter, have been cut open, and the exposed surface polished in the laboratory of the Geological Survey, and these show the structure and bring out the colors very beautifully.

These specimens are found in comparatively small masses, — from a few inches to a few feet in diameter, — irregularly distributed through the limestone, and the pyroxene from which it is derived occurs only in such limestone as has been metamorphosed by the mountain-building forces. The only other locality in which similar serpentine has been found in the United States and described is in the Leadville region, Colorado, where it was discovered by Professor Emmons, and treated of in his recent report. A peculiarity both of the commoner serpentine derived from eruptive rocks, and also of that metamorphosed from pyroxene, is the frequent occurrence of slickenside, showing that the rocks have been subjected to great pressure and movement.

Some of the New Jersey serpentine has already been utilized in ornamentation.

Ojibwa Pictographs in the West.

"In the neighborhood of Odanah, on the Bad River," says Capt. Garrick Mallory of the Bureau of Ethnology, in a paper from which extracts have already been made in *Science*, "is a large, vertical, soft rock on which pictographs are still to be observed, although nearly obliterated. The objects figured are chiefly birds and quadrupeds, many of them being repeated, and are all probably totemic. Indeed, that is the direct evidence of an old Indian who saw some of them made in his boyhood. He says that when Indian visitors came by there, that being on a well-known trail, they would each cut his totem on the rock to show to what clan he belonged, either to establish his identity to the resident Indians who might happen to be present, or as a record of his passage. This is interesting in comparison with a similar proceeding in New Mexico and Arizona.

"In my examinations at three reservations in Wisconsin, I discovered some variants of the Medé ceremonies. The full ceremonies of the Medé lodges, which they call 'grand medicine,' were performed twice a year, — in the fall and in the spring. Those in the spring were of a rejoicing character, to welcome the return of the good spirits; those in the fall were in lamentation for the departure of the beneficent spirits. The drums were beaten four days and nights before the dance, which lasted for a whole day. After the dance twelve selected persons built a lodge, about the centre of which were stones, which were heated, and dancing went on around it until the stones were moistened by the sweat of the performers. Singing, of course, was an accompaniment of the dances. These ceremonies were performed by the body of the people, and were independent of the initiations of the secret order. With regard to the candidates who passed initiations, it was observed that they always became stronger and better men; perhaps because those were the ones who had the requisite strength of mind and body to endure the various ordeals, and to understand the mysteries.

"The general remark may be made with regard to the Ojibwa in the several localities where they are now found with the least amount of civilized influence, that they in a marked degree live a life of religious practices, and that their shamanistic societies have a wonderful influence over their sociologic and religious character. This is to so great an extent (before not appreciated), that, in my opinion, a careful study of these people will develop facts corresponding in interest with those which have recently surprised the world as reported by Mr. Cushing among the Zuñi. There is probably no body of Indians in the United States whose inner life can now be studied to greater advantage than the remoter bands of the Ojibwa. With reference to the subject with which this paper is more directly concerned, that is, pictographs in their various modes of representation, it is certain that the understanding of the mythology and religion of these people will furnish the best interpretation to their ancient drawings and etchings.

"It is desirable to explain the mode of using the Medé and other bark records of the Ojibwa. The devices are not only mnemonic, but are also ideographic and descriptive. They are not merely invented to express or memorize the subject, but are evolved therefrom. A general mode of explaining the so-called 'symbolism' is by a suggestion that the charts of the order, or the song of a myth, should be likened to the popular illustrated poems and songs lately published in *Harper's Magazine;* for instance, 'Sally in our Alley,' where every stanza has an appropriate illustration. Now, suppose that the text was obliterated forever, — indeed, the art of reading lost, — the illustrations remaining, as also the memory to many persons of the ballad: the illustrations, kept in order, would supply always the order of the stanzas, and also the general subject-matter of each particular stanza, and the latter would be a reminder of the words. This is what the rolls of birch-bark do to the initiated Ojibwa, and what Schoolcraft pretended, in some cases, to show, but what, for actual understanding, requires the obtaining of the literation of the actual songs and charges of the initiation ceremonies, or in other instances the literation in the aboriginal language of the non-esoteric songs and stories."

Yellow-Fever in Florida.

Dr. Jerome Cochran, of the State Board of Health of Alabama, in a recent report has stated that the late epidemic of yellow-fever in Florida was not introduced into the State by the usual trade channels, but by smugglers. This confirms unofficial statements received by Supervising Surgeon-General Hamilton, of the marine-hospital service, several weeks ago. Dr. Cochran says that the last case was discharged May 11, and the last death May 8, and that there have been active precautions taken to prevent the reappearance of the disease.

Interesting Phenomenon.

Captain Friis, of the Norwegian steamship 'Viking,' reports to the Hydrographic Office that he observed at midnight, April 20, between Chatham and Davis South Shoal, when the moon was in its last quarter and about two hours above the horizon, two dark-looking narrow strata of clouds; the upper one extending across the face of the moon, the upper and lower limbs of the latter appearing above and below the cloud-stratum. The cloud was moving south-westerly. On the same line with the moon, and to the westward of it, was a nearly circular luminous spot, larger than the moon, which looked as the sun might when shining through a thick mist. The second stratum of cloud was about halfway between the first and the horizon. The phenomenon continued until the moon set at two o'clock, when there shot upwards from the upper limb fan-shaped rays of light.

HEALTH MATTERS.

Yellow-Fever.

IN a recent number of the *Medical Record* is published a letter from Dr. Charles Finlay of Havana, dated April 17, 1888, in which he says, —

"In your issue of April 7 there is a short paragraph stating that the microbe of yellow-fever described and cultivated by Dr. Domingos Freire of Rio Janeiro 'has gone the way of many other specific germs,' your grounds for this assertion being that Dr. Gibier 'denies utterly the existence of the germ claimed to be specific.' This conclusion has evidently been come to under the impression that the Parisian bacteriologist just mentioned has had full opportunities for verifying in Havana, within the brief space of six weeks, the results previously obtained in Brazil by Dr. Freire, in such a manner as to warrant his abrupt denial of what he had so warmly approved while experimenting in Paris upon Dr. Freire's Brazilian cultures. That such has not been the case, I think you will admit after hearing the particulars of that investigation.

"Dr. Gibier saw his first yellow-fever case on Nov. 16, at the military hospital of this city. Between that date and Dec. 28, he examined altogether five patients, and performed four autopsies. He collected fresh blood from four of the patients, and urine from three, besides the pieces of viscera and secretions from the cadavers. In the urine of the first patient he thought at first that he had recognized Dr. Freire's micrococcus, but afterward changed his mind, having 'satisfied himself' that what he had seen were mere insignificant organic granulations. In the blood and secretions, as also in the sections of viscera, he failed to discover any micro-organisms, nor did he succeed in developing any colonies in his numerous attempts with the same pathological material. One of the tubes of agar-agar jelly inoculated by him with heart-blood, and presented to a military colleague, did, however, develop a yellow superficial colony, which Dr. Gibier attributed to an accidental atmospheric contamination, although the constituents of the colony turned out to be a tetragenous microbe quite distinct from the plain atmospheric micrococcus with which he had thought it could be identified.

"This scanty material, collected at a time when yellow-fever was sporadic in Havana, almost the only cases signalled being those present at the military hospital, constitutes the sole foundation for the abrupt retractation of Dr. Gibier from his former enthusiastic advocacy of Dr. Freire's views; never considering that the sporadic and epidemic forms of the disease might not be identical, any more than the equivalent forms of cholera have turned out to be, notwithstanding their clinical resemblance. Other observers had previously noticed that the same yellow-fever products which, in their hands, had given colonies when collected from epidemic cases, failed to do so with the sporadic. In collecting blood from yellow-fever patients, Dr. Gibier was noticed to disinfect the skin with bichloride solution, but took no pains to remove any excess of the germicide which might remain and sterilize the drop of blood as it would ooze out on the surface. Neither does it appear that he varied his culture-media as to acidity, alkalinity, etc., nor that he kept his tubes at a uniform summer temperature. Yet, in spite of such obvious deficiencies, Dr. Gibier does not hesitate to condemn as erroneous the results of Dr. Freire's patient and laborious investigations, and likewise all others that might claim to have obtained successful cultures from similar yellow-fever products.

"Dr. Gibier had brought over some cultures proceeding from Dr. Freire's own tubes, inoculated at Rio Janeiro; and shortly after his arrival in Havana, full of faith in their prophylactic virtue, he inoculated himself, and thought he had gone through the phenomena of an experimental attack of yellow-fever. In this, I fancied at the time, and he now acknowledges, that he was mistaken; but after examining my own cultures from yellow-fever blood and urine, obtained by me last summer in Havana, and cultivated in sub-acid agar-agar jelly, he has repeatedly declared that both macroscopically and microscopically they were identical to Dr. Freire's. This coincidence, one would think, should have checked his precipitancy, and induced him, at any rate, to wait until the epidemic season before formulating his conclusions.

"The only excuse, if so it can be called, for such haste in a practised bacteriologist, must lie in his unacquaintance with the disease, and in his anxiety to proclaim a new bacillus of his own, isolated from the intestinal contents of yellow-fever cadavers, and which he believes better entitled than its fellow claimants to be considered as the true yellow-fever germ.

"My object in bringing forward these facts is to guard the American medical public against hasty deductions, and to show that Dr. Gibier's researches have not in any way altered the previ-