chemistry; Dr. J. C. Forbes, assistant professor of chemistry; Dr. Lewis C. Punch, associate in pathology, and J. G. Jantz, associate in anatomy.

At Armstrong College, Newcastle, Mr. Clement Heigham has been appointed professor of agriculture, in succession to the late Professor D. A. Gilchrist, and Dr. J. W. Heslop Harrison to be professor of botany, in succession to Professor J. W. Bews, who has resigned.

DISCUSSION

MEAN SEA-LEVEL AS AFFECTED BY SHORELINE CHANGES

It seems to have been quite generally assumed that carefully made tidal observations, extending over a period sufficiently long to eliminate the disturbing effects of meteorological and astronomical causes, will give a value for mean sea-level which at any given place will remain essentially constant. As mean sea-level determinations afford the only satisfactory basis for detecting slow elevation or subsidence of the continent, the validity of the assumption noted is a matter of no small importance.

A number of years ago the writer became convinced that the mean sea-level surface bordering an irregular shore is itself an irregularly warped surface, and that its elevation changes appreciably with changes in the form of the shoreline. Special studies of this problem are now in progress, and a full discussion will be published at an early date. It is desired here to indicate briefly some of the facts upon which the theory of a fluctuating mean sea-level surface is based. The facts are not novel, but their consequences seem not fully to have been appreciated, especially by those citing records of mean sea-level observations as proof of slow continental subsidence or elevation.

We may begin with the simple and obvious case of a bay connecting with the open sea by a narrow inlet and receiving the waters of inflowing rivers. It is known that under such conditions the influx of river water will raise the mean level of the bay. A striking example of this phenomenon is presented by Kennebecasis Lake or Bay, which receives the waters of the St. John River and connects with the sea at St. John, New Brunswick, by the very narrow tidal channel famous for producing the "reversible falls"—from the sea into the embayment when the tide outside is high; from the embayment back into the ocean when the tide outside is low. According to the Canadian hydrographic authorities, the mean level in the embayment is at least two feet higher than the mean level outside. There can be no doubt that many such embayments along our coasts have abnormally high mean levels, the excessive elevation generally amounting at most to but a few inches, but in some cases rising as high as a foot or more. What would happen if storm waves, tidal currents, or other agencies widened or deepened the inlets between sea and embayment, or created additional inlets, so that better egress of waters from the embayment to the sea would be insured? Obviously the ponding of the river waters would be less effective, and the mean level of the embayment would fall. Thus would be created, within the embayment, fictitious indications of an uplift of the land. Or suppose that the inlet were gradually narrowed or shallowed through the deposition of débris by wave or tidal currents, so that the escape of the river waters was more and more obstructed. In this case the mean level within the embayment would gradually rise, and one would find there fictitious indications of a gradual subsidence of the coast.

Let us consider next the case of mean sea-level as affected by prevailing wind directions. It is not difficult to understand that if the wind blows constantly in a given direction, the level of a water body over which it blows must be permanently distorted with an abnormally low level toward the windward shore, and an abnormally high level along the lee shore. A land mass separating two water bodies so affected will have distinctly different mean water levels on its two sides. If one of the water bodies be the ocean, and the other a bay or lagoon separated from the ocean by a bar through which a very narrow inlet permits restricted ebb and flow of the waters, the difference in mean levels on the two sides of the bar will persist. If, however, the inlet be widened, or if new inlets be broken through the bar, the water levels will approach equality; and this will result in a fictitious indication of land elevation on one side of the bar, and a fictitious indication of subsidence on the other.

It can be shown that tidal conditions alone, unaffected by either river inflow or wind direction, will produce local inequalities of mean sea-level which are subject to fluctuations with changes in the form of beaches and inlets. To take a single example, imagine a bay or lagoon separated from the sea by a bar through which a narrow inlet admits the rising ocean so slowly that high tide in the lagoon never rises as high as high tide in the ocean. When the ocean waters fall, the waters in the lagoon will flow back into the ocean, but so slowly that before the lagoon is emptied the ocean waters begin again to rise. Thus low tide in the lagoon is always higher than low tide in the ocean, just as high tide in the lagoon is always lower than high tide in the ocean. Now such tidal inlets are usually broader at the top, and narrower below, with the result that the waters enter and leave the lagoon most freely when the tide is high. As a consequence, the discrepancy between high tide levels in the two water bodies is not so great as that between the low tide levels; and the mean level of the lagoon is therefore higher than the mean level of the ocean. Changes in the number or breadth of inlets much cause changes in the mean level of the lagoon; and such changes are of common occurrence.

The shallowing or deepening of inlets; the growth of bars across the mouths of bays formerly free from such shore features, or the destruction of bars by storm waves; the narrowing of inlets by sand-spit growth, their widening by wave or current action, or the breaching of bars by new inlets formed by storm waves or by the outburst of impounded land waters; any and all of these must be potent causes of local changes in mean sea-level in harbors, bays or lagoons where are found conditions approximating those described above. Nor do the conditions described exhaust the list of those which may give rise to local differences in mean sea-level. They are merely examples intended to illustrate the fundamental principle that local changes in the form of the shore may, under appropriate conditions, produce local changes in mean sea-level. Such changes in mean sea-level may be gradual or sudden, depending on the nature of the shore changes responsible for them; and they may amount to fractions of an inch or to a number of inches, depending on the form and size of inlets and bays and on the range of the tides. Where gradual and imperceptible, yet of significant amount, they are apt wrongly to be attributed to progressive, slow coastal subsidence or coastal elevation.

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QUANTITATIVE DETERMINATION OF ROCK COLOR

THE need for standardization of rock colors has been realized by many petrographers. Sedimentationists, especially, have desired a color standard. In meetings of the Sedimentation Committee of the National Research Council, the possibility of basing important deductions as to alteration and environment of sediments upon slight color differences has been suggested. The difficulty in investigating these suggestions has been the lack of means of detecting the requisite small color variations. The best standard of colors now in use is the Ridgway chart. In fact, its use in sedimentation has become so desirable that the Sedimentation Committee has taken steps toward the preparation of a more simple and cheaper chart, based on that of Ridgway, but especially adapted to field and laboratory descriptions of sediments.

Because the writer does not know of any application of quantitative color measurements to geologic investigation, he believes that the attention of mineralogists, petrographers, sedimentationists and others interested in color work should be called to the fact that instruments are available by means of which colors can be analyzed and synthesized quantitatively. No details of the construction and manipulation of these colorimeters need be given here for this information can be supplied by the dealers selling these instruments. Their wide range of application is indicated by their successful use in industrial plant control and research in a variety of industries including dye, paint, varnish, ink, and soap manufacturing, sugar refining and other industries. Since these instruments have proved their usefulness in practice, it is believed that they will be found to be useful also in the field of pure science wherever color is involved. Their value in petrographic research has been demonstrated by the writer in his study of the relationship between structure and color of the shales of the Cromwell Oil Field of Oklahoma.

The most simple and obvious method of determining rock color by direct comparison of rock fragments with a standard color chart is at best only qualitative. Comparisons of streaks produced in the usual way by drawing fragments of the material over an unglazed porcelain plate enable smaller color differences to be detected than is possible with the use of chips but this method is also unsatisfactory. Streaks vary with slight differences in hardness and texture of the rock as well as with differences in composition. The texture, hardness and whiteness of the streak plate and the pressure applied in obtaining the streak are also significant variables. Moreover, such a streak can not be representative of the sample as a whole because it involves too small a quantity of material and it has the added disadvantage of being neither reproducible nor easily preserved for future reference.

Many of these difficulties can be overcome, as was done in the study of the Cromwell shales, by selecting an average sample, grinding the rock and sieving it. A portion of the powder passing the one sixteenth millimeter screen can then be pressed into a cardboard frame, previously mounted on a datum card, and covered with an ordinary thin cover glass. Black binding tape such as is used in preparing lantern slides serves to hold the glass to the rest of the mount. Such a record is permanent and can be filed. It overcomes the objections of the above-mentioned methods, but it too has some disadvantages. First, the mounting of the powders is time-consuming and,