

out sufficient reason. Congress is asked by the convention to 'organize a civil bureau of public works' in a certain way, and for certain reasons. It is difficult for an onlooker to interpret the way and reasons, otherwise than that the army engineers are in possession of a good thing which some of their civil brethren covet: hence the intervention of congress is invoked to change the established order, to put the one class out and the other in, or, if this may not be, that the good thing be at least divided. The reasons given are weak, and open to dispute, some easily refuted; and the request that the basis of organization of the proposed bureau should be studied and reported on by a board consisting of seven members — three military engineers, three civil engineers, and a lawyer — savors quite strongly of place-making for some of the leaders in the movement. All this is unfortunate. There are strong and good reasons why the organization for the conduct of public works should be recast, just as necessity for re-organization has been found in other departments of administration. That these reasons exist is proven by the fact that a letter from the chief of engineers, U. S. army, General Newton, was read at the meeting, expressing sympathy with any move which would better the public service. The betterment of the public service ought to have impressed itself upon the Cleveland meeting as being the only ground upon which they could go before the country with reasonable expectation of being listened to. Instead of this, the convention considered the question as one of class, and seeks to secure class legislation in a way which is itself a suggestion that congress is incapable of doing its own work.

#### *THE COAST AND GEODETIC SURVEY.*

THE time was long ago when any one would think of asking what is the use of having any coast survey at all, — one might almost say, long past, when any one would expect that the work of such an organization could ever be brought to an end. As originally constituted, by the act of 1843, the organization was empowered to proceed with the accurate mapping of the Atlantic and Pacific coasts of the United States, — a work which involved a trigonometric survey of the coast-lands to be conducted with the utmost precision. This formed also the only suitable basis for the hydrography of the coasts.

Those interested in the thorough prosecution of this work were not slow to appreciate the obvious

advantages of connecting the independent surveys of these coasts into a single homogeneous system. The surveys of individual states might thus be supplied with the precise determination of points for their own topographic and geologic work, and the entire domain of the United States be covered by a net-work of triangles of the utmost accuracy. The foundations of this vast work were laid nearly fifteen years ago; and in its execution natural precedence has been given to those regions where there was the most urgent call for the work. Such a connecting-link is a necessary part of a survey of the 'coasts and adjacent islands, etc., of the United States,' as originally provided for by law, in order to bring into harmony the measurements along the Atlantic and Pacific coasts. As Professor Hilgard has pointed out, this is sufficiently obvious to allow the belief that it would have been specified in the original law, if, at the time of its enactment (1807), the country had had a 'western coast.'

But this is not all: what is the obvious requirement of the law has led, in addition, not only to the incidental accomplishment of important scientific results, but also to many advantages of the most practical significance. To appreciate the former, we need only recall that our national domain extends in an east and west line over about one-eighth of the circumference of the entire earth, and that the accurate measurement of this line, as undertaken by the survey, will constitute much the longest arc-parallel ever measured for determining the size and figure of the earth. The same survey will afford accurate elevations of a multitude of points above a common datum plane, and will show the relation of the mean level of the Atlantic and Pacific oceans. From a purely scientific stand-point, these would be reasons enough for completing the transcontinental survey as originally outlined; but let us see what some of the practical advantages of the work are. To begin with, this already well-advanced scheme of a national survey, from ocean to ocean, provides every subsidiary state survey with an accurate base-line. How important this is will appear if one attempts to conjoin the hitherto existing surveys of adjacent states. Discrepancies of many miles are frequent; for example, "The best maps of the states of Ohio, Indiana, and Kentucky, constructed upon independent data, when put together, leave no delineation of the Ohio River. Between the land-survey maps of Illinois and Missouri, the Mississippi River presents in places wide lakes, while in others it entirely disappears." The transcontinental link also adjusts the lines and points of the public land surveys, and furnishes the necessary data

for the compilation of town, county, and state maps of the utmost precision. Nor is the fact lost sight of that in time it will become necessary to have an absolutely correct map of the entire area of the United States. Work of this character has been for years in progress, and in its continuance rests the only possibility of bringing harmony into what is now utter confusion.

All who have taken even the least cognizance of the scientific methods systematically pursued by the coast survey will experience no difficulty in seeing that the uninterrupted exertions of scores of trained observers and calculators are demanded in completing the thorough survey of so extended a field as that of the Atlantic and Gulf coast. Very few outside of those actually engaged in such work take occasion to know the degree of precision sought and attained in these investigations; nor is it a matter of common information that the work has so far advanced that the survey of the Atlantic and Gulf coast is about nine-tenths completed. The slightest knowledge of the necessary conditions is sufficient to show that, even when the entire extent of the coast has once been charted, a large amount of work must continually be done, in order to maintain the correctness of the charts, and 'Coast pilots' or sailing-directions. Professor Hilgard estimates, that, in order to keep up this work, a force of two parties will be required—one ashore and one afloat—in each of five districts between Passamaquoddy Bay and the Rio Grande.

The entrance of the important harbor of New York is kept under annual examination, in order to keep track of the changes, and to control, if possible, their causes. A complete re-survey of the great thoroughfare of Long Island Sound is in progress, as in time great changes have taken place, and many localities have very much grown in importance. Also thorough re-surveys are progressing in other waters as rapidly as the limited appropriations for this work will allow.

The survey of the Pacific coast, between San Diego (the Mexican boundary) and Fuca Straits, with Puget Sound, is about three-fifths completed; and the publication of charts, sailing-directions, and tide-tables is proportionally advanced. The same considerations in regard to future re-surveys hold here equally with the Atlantic coast: one re-survey of San Francisco Bay was made about twelve years ago, and a new one is now strongly urged. In the territory of Alaska, no minute or exact surveys have yet been undertaken, as the condition of the country does not yet call for them; but a good deal has been done in the way of geographical exploration and hydrographic reconnaissance, while many charts of

approximate correctness have been published, as well as a volume of sailing-directions. Mention must be made, in this connection, of the explorations of the Gulf Stream, having for their object the discovery of the laws which govern it, with the view of taking due account of it in navigation as an indication of the approach to our shores; as also of the practical researches into the distribution and laws of change of the earth's magnetism, by which we have been enabled to ascertain the variation of the compass along the coasts, as well as over the whole country,—a knowledge equally important to the mariner and to the land-surveyor.

In no department of its coast operations is the practical usefulness of the survey more apparent than in its systematic researches and publications relating to the safety of navigation. Foremost among these are the thorough series of observations of the tides. In addition to this, advantage is taken in the most practical way of all discoveries and developments affecting the safety of navigation by the printing and wide circulation of the series of 'notices to mariners.' During the year 1883-84, for example, twelve such notices were published as warnings to navigators against newly discovered or newly developed dangers. Also the studies of officers of the survey in the department of physical hydrography have led to results of the highest practical importance in our commerce and navigation.

In his late message to congress, the President of the United States alludes once more to the threadbare subject of transfer of the coast and geodetic survey to the navy department. Three years ago the superintendent of the survey, in a letter to the secretary of the treasury, reviewed the whole ground in the most thorough and impartial manner, concluding with the following points in opposition to this proposed transfer. They may be advantageously cited here:—

"1°. The present system, perfected nearly forty years ago, has proved thoroughly efficient, economical, and satisfactory to the country. It is wise to hold fast to that which has been proved to be good.

"2°. It affords to the navy all the advantages that can legitimately be claimed. It employs as many of its officers in service afloat as can be advantageously used in hydrography. The employment of a larger number, in the event of a transfer, would result in training naval officers to be geodesists, topographers, chiefs of technical bureaus, and in withdrawing their interests and habits from the naval service proper.

"3°. The efficiency of the service would suffer by the loss of ambition and emulation, which exist at present in a high degree, but which find no stimu-

lus in a service where no positions of responsibility and direction are open to civil experts, however great their attainments and devotion to the public service."

Some months subsequently, in a letter to the committee of the National academy of sciences, the superintendent added the important considerations that the naval officers detailed by their department for coast-survey duty are almost without exception well pleased with their service in this capacity, although, in reality, more arduous than the regular routine of the naval service in time of peace. They are at all times, however, perfectly under the control of the navy department, and subject to being detached and ordered upon other duty. No officer of the navy above the rank of commander is attached to the survey, and most of the officers are of the grades between ensign and lieutenant. In this survey work they obtain a most valuable experience, which stands them in great stead on foreign stations.

The alleged duplication of work by the coast survey and the hydrographic office of the navy department is often urged as a reason for the transfer of the survey to the navy; but in reality there is no clashing. The special work of the hydrographic office consists in publishing charts of foreign coasts for the use of the navy and our commercial marine, as also of directing surveys on foreign coasts by our naval vessels when their opportunities permit. The functions of the two offices are thus entirely different.

The hydrographic work conducted by the coast survey along our own shores is not a nautical survey, but, properly speaking, a trigonometrical survey, in which the positions of the depths observed, and of rocks and shoals, are determined by the observation of angles upon objects on shore, which are known by the triangulation and topography. The hydrography is closely co-ordinated with these, and cannot be separated from them without losing much of its present excellence.

DAVID P. TODD.

#### RECENT CHANGES IN CORNELL UNIVERSITY.

THE growth and prosperity of Cornell university are shown in the measures which its trustees are taking to enlarge and strengthen its faculty. The value of a university lies in its teaching force. Cornell university has been put by its benefactors on a firm financial basis, and the trustees are wisely preparing to employ its increased revenue in adding to its facilities for instruction. The most important of these new measures is the re-organization of the Sibley college of mechanical engineering, with Dr. R. H. Thurston as its direc-

tor. Following this are the measures just consummated and announced, providing for other changes in the faculty. Dr. Wilson, the distinguished and venerable professor of moral and intellectual philosophy, and Professor Schackford, the professor of rhetoric and general literature, are retired at the end of the present year with liberal allowances. A professorship of pedagogy has been established; and Prof. S. G. Williams, now occupying the chair of geology, is appointed to the new professorship. As this is a new feature in our New York colleges, the results of the experiment are looked to with great interest. Professor Williams has had an unusual training for such a professorship. As a teacher in preparatory schools, as a superintendent of schools, and a professor in Cornell university, he has enjoyed an experience which will enable him to put himself in sympathy with those who are preparing themselves for teaching, and to give them whatever aid is possible.

The retirement of Professor Williams from the chair of geology enables the trustees to consolidate the now separate departments of geology and paleontology in one, and to promote Prof. H. S. Williams, who has occupied the latter chair, to the professorship of geology and paleontology. Other changes are either made or contemplated which will still further re-enforce the board of instruction. Not the least important of these changes is the increase in the salaries paid to all the principal professors. The inadequate compensation heretofore allowed has cost the university in several instances the loss of men whom it would have been glad to retain. Two of the professors are to receive \$3,200 each; eleven others, \$3,000 each; and in other cases the stipends have been proportionately increased. S.

#### THE ABBOTT COLLECTION AT THE PEABODY MUSEUM.

THE collection of stone implements made at Trenton, N.J., by Dr. C. C. Abbott, now on exhibition in one of the recently opened rooms of the Peabody museum of archeology at Cambridge, is one of the most important series of the kind ever brought together, and one which archeologists will consult for all time to come. It contains more than twenty thousand stone implements and several hundred associated objects, made of bone, clay, and copper, with several pipes and numerous ornaments and carved stones.

There are several considerations which give the collection exceptional importance. First, it was brought together from a very limited area by a single archeologist; all the specimens having been found by Dr. Abbott upon his own farm and its