tions for peneplains older than late Tertiary is an arduous task. To correlate without them should be classed by law as among the dangerous occupations.

It is no reflection on the cycle to point out that its records are subject to complication with those of another process. Rather, it should be apparent that, when the complicating factor has been properly evaluated and allowed for, the record of cycles will be less confused and more trustworthy. It seems appropriate to speak of this other factor as essentially non-cyclic. It matters little whether the terminology here used be liked or accepted. It matters much that the facts be recognized. For want of such recognition the cycle is burdened with so many complexities and inconsistencies as to impair its usefulness or even at times to expose it to unfriendly criticism.

THE NATIONAL MAPPING PLAN OF THE NATIONAL RESOURCES BOARD

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FOR many years scientific men, including engineers, have realized the importance to a country of having a complete knowledge of its terrain and all physical data relating to the earth's surface. Without basic facts good plans can not be made, and they surely can not be carried out with any degree of effectiveness.

It is recognized that the topographic map shows graphically essential data regarding the area covered. It would take years of traveling or of reading in order to obtain a knowledge of an extensive region, while with a topographic map much more comprehensive and accurate knowledge can be gotten in a few hours.

Not only is the topographic map of value in planning the industrial and commercial activities of our people, but it is essential in many lines of scientific research. The configuration of an area has a bearing on plant and animal life. Without a knowledge of the terrain geological and geophysical investigations can not be carried on with efficiency and accuracy.

In spite of the need for maps, very little has been done. Only about 47 per cent. of the area of the United States, about three million square miles, has been covered by topographic maps and more than half of those maps are so out of date or so sketchy in character that they do not meet present-day needs. We thus see that only about 25 per cent. of the area of the country is adequately mapped; in fact, many of the otherwise satisfactory maps must be revised to show changed cultural features.

The National Resources Board, an agency set up by President Roosevelt to advise on the conservation and utilization of our resources, requested the Federal Board of Surveys and Maps to prepare a plan for completing the mapping of our country. This was done late in 1934. This plan was endorsed by the National Resources Board and was forwarded to the President in one of its reports. The opening paragraph of this report is significant:

> Most of the land planning and land use agencies of the Federal Government, as well as many other Federal and State organizations whose activities are concerned with land, have asked the Board of Surveys and Maps to prepare a program for the completion at an early date of the mapping of the United States. The Board has made an exhaustive investigation and finds much evidence that the actual loss of money due to lack of adequate maps is greater than the estimated cost of completion of the standard map of the United States. Moreover, most of the land use agencies have testified that the absence of adequate map data makes it almost impossible to carry out any plan of readjustment in land use until the areas affected are adequately mapped.

This report in turn has been commented on favorably and given endorsement by the Science Advisory Board of the National Academy of Sciences.

The national mapping plan was considered of such interest by the American Society of Civil Engineers that it was printed in full in the February, 1935, issue of *Civil Engineering,* a journal of that society.

Many engineers, geologists, biologists and others have expressed great interest in the national mapping plan and have expressed the hope that it might be put into effect immediately and carried on vigorously. It calls for the completion of the topographic mapping of the country within ten years at an estimated cost of $117,531,000 or less than $12,000,000 per year. Congress had already authorized the mapping of the country as a federal project in the so-called Temple Act, which became a law on February 27, 1925. That act authorized the appropriation of funds with which to complete the map of the country within twenty years. Ten years have passed and little topographic mapping has been done during that time. Forty-three per cent. of the country had been mapped before 1921, while to-day only 47 per cent. has been mapped. This is at the rate of 0.3 of one per cent. per year. One can see that the mapping will not be completed within a hundred years at this rate of progress, and besides,

a map should be revised at frequent intervals, say of five to ten years, in order that it may show new conditions as to cultural features.

The Temple Act authorized the acceptance by federal bureaus charged with mapping the country of funds from states or subdivisions thereof, which might wish to have the mapping of their areas expedited. It was not mandatory that the states should make contributions towards the mapping.

Under the present national mapping plan, provision is made whereby funds may be received for expediting the mapping in any particular area or in making larger scale or more detailed maps than what are ordinarily called the standard maps.

Topographic maps must be based upon geodetic or control surveys which furnish the latitudes, longitudes and elevations of great numbers of monumented points on the earth's surface, together with distances and azimuths between adjacent points. With emergency funds the Coast and Geodetic Survey has during the past three years added much to the control survey nets of the country. There are now in the United States about 261,000 miles of lines of levels, and 67,000 miles of arcs of triangulation. The plan that has been followed is to have the lines of levels and arcs of triangulation spaced at intervals of approximately 25 miles. So far as the leveling is concerned, the 25-mile spacing has been completed to the east of the 102° meridian. To the west of that meridian some additional leveling must be done to secure the 25-mile spacing. There remains approximately 47,000 miles of arcs of triangulation to finish the 25-mile spacing of the net.

Much more control surveying will be needed to furnish the basis for topographic mapping. Within the 25-mile meshes of the nets will be needed horizontal and vertical control survey stations placed at intervals of from 5 to 7 miles in order to supply the topographic engineer with a sufficient number of control stations.

Airplane photography will no doubt be used to a great extent in the mapping of the country. The data shown on the photographs taken from the air can be fitted into the control stations that may be plotted on the map, and thus topographic features, such as roads, railroads, shore lines, rivers, streams, forests, settlements and even individual houses, can be placed on the map in their true geographic positions. The so-called planimetric map made from airplane pictures can be taken to the field and the topographic engineers can draw on them the contours representing elevations and slopes. There are also now in use a number of instruments with which contours can be plotted from airplane pictures, using optical methods. This is a new and as yet very limited development in topographic mapping.

Undoubtedly the mapping plan will be put into effect, but just how soon no one knows. When we consider the cost of completing the mapping of the country in terms of human energy or man-years, we find that the cost to our people is almost insignificant. Measured in dollars we may think it is high. However, ten million dollars per year for each of ten years would be the equivalent of the cost of only 2,000 miles of modern highways or 200 miles per year. We are spending hundreds of millions of dollars per year on highways and I feel confident that if we had good maps from which to select the routes for the highways, great economies would be effected in the highway work. The best routes could be selected and the maintenance charges for the roads based upon the maps would be less than for those highways constructed in unmapped areas.

Elevation and slope bear a definite relationship to animal and plant life. Maps would more than justify their cost by their use in the plant and animal industries of the country alone. With the maps there could be far better control of those organisms that influence favorably or unfavorably plant and animal life.

I suppose that the real reason that the mapping of the country has not been carried on more vigorously in the past is that there has been no concerted action on the part of those whom the maps would benefit. Individual action does not carry as much weight as does united effort based on unified opinion. Whether there will be a concentration of effort on the part of map users to have the plan put into effect, no one knows, but it is reasonably certain that we are becoming map-minded. It is unfortunate that we have so few maps in a map-minded age.

SCIENTIFIC EVENTS

PLANS FOR THE DEVELOPMENT OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

A DEVELOPMENT program which will make the Academy of Natural Sciences an active part of Philadelphia's educational system was announced by its president, Effingham B. Morris, at the formal opening on January 16 of the new East African water-hole habitat group in the Free Museum of the academy. Dr. James Bryant Conant, president of Harvard University, and Dr. William Berryman Scott, emeritus professor of geology at Princeton University, who