DISCUSSION

PROPOSED TECTONIC MAP OF THE UNITED STATES

FOR several years there has been serious discussion of a plan to make a tectonic map of the United States, on which will be represented all that is known about the major structural units. The committee on tectonics, Division of Geology and Geography, National Research Council, has kept such a plan on its list of desirable projects. Last year one of the guidebooks for the sixteenth International Geological Congress, which met in this country, contained a tectonic map on the scale 1: 10,560,000, with descriptive text.[1] This first attempt has much merit, and has led many geologists to express a wish for a similar map on a larger scale, with correspondingly more detail. In particular it has been suggested that a tectonic map be prepared on the scale 1:2,500,000, which is the scale of the new geologic map of the United States, published in 1933 by the U. S. Geological Survey. The writer, sympathizing strongly with this suggestion, recently accepted the chairmanship of the committee on tectonics in the hope that preparation of such a map may become an immediate project of the committee.

The task of preparing the map will not be an easy one. Cooperation of a large number of geologists in all parts of the country will be a first essential. No small group using only what is now published in geologic literature can hope to produce a tectonic map that is even approximately correct or complete. Knowledge of geologic structure has been growing at a rapid rate within the past few years. A large store of information that has accumulated is not yet published; and many important facts that have been announced can be represented usefully on a map only by those who have first-hand knowledge of the latest field developments in particular areas. Even with the maximum cooperation it will not be possible to make the map nearly complete, because the structure in large areas is little known and will remain so for some time. Probably it will be necessary to leave some blank spaces, and to query some of the relationships that are shown. Inability to make the map perfect, however, is not a good argument for delaying the project. Every map is a report of progress, inviting corrections and additions. By setting down all that is known, we focus attention on the gaps in knowledge and thus give direction and stimulus to further effort.

The need of a good tectonic map, accompanied by explanatory text, is generally acknowledged. At present it is extremely difficult to form an adequate picture of the general structural relations, even in limited areas. Necessary information, if it is available at all, generally is fragmentary and scattered in the literature. For many districts there are contradictory accounts, which can be evaluated only by time-consuming study. A map that shows the principal structural facts in each district, and at the same time gives the most probable interpretation of the facts in their regional setting, not only is a convenient source of information but also serves as a basis for further investigation work. Such a map would be welcomed by scientific and educational institutions, and also by men engaged in exploratory work for petroleum and mining companies.

Opinions differ considerably as to what a tectonic map should attempt to show and as to the most effective technique for expressing particular facts and relationships. The chief purpose of the present article is to state tentative specifications for the proposed map, and to invite all who are interested to offer frank criticisms and constructive suggestions.

There is obvious advantage in having the scale of the map 1: 2,500,000, as this scale makes it possible to show considerable detail, and to make direct comparison with the geologic formations shown on the new map mentioned above. Comparison will be most effective if the tectonic map is printed on transparent paper, to allow direct superposition, like the tectonic map of Europe made to accompany the small geologic map by Beyschlag and Schriel. However, there is much to be said also for printing the map in more durable form on heavy opaque paper, to permit mounting for wall use, or to make an effective worksheet on which geologic units and additional symbols may be entered at will. If both of these forms seem to be popular, it may be possible to print the map in both ways.

It is suggested that the map represent the following features: trend-lines in folded belts, with axes of individual major folds so far as the scale of the map permits; direction and degree of important overturning of folds; cross folds or important changes in pitch of major fold axes; direction and degree of regional dips; all important faults, with appropriate symbols and figures showing, so far as known, direction and degree of dip, amount of throw and nature of displacement—whether normal, reverse or strike-slip; major thrusts (with a special convention or color to designate overthrust masses); belts of *en échelon* faults; important areas of metamorphic rock, with strike and attitude of the cleavage, so far as it can be shown; areas of pre-Cambrian rocks related to orogenic zones, as discussed recently

[1] "An Outline of the Structural Geology of the United States," by Philip B. King. Guidebook 28, XVI International Geological Congress. Government Printing Office, Washington, D. C., 1932.

by Bucher[2]; all major igneous masses; swells and basins in areas of unfolded rocks (possibly by structure contours); salt domes and anticlines; monoclinal folds.

Time relationships should be indicated, so far as practicable, by conventional patterns or colors. If conventions are chosen judiciously, they may be superposed in areas that have experienced repeated diastrophism. It may even be feasible to indicate important vertical movements in folded belts, such as the late uplift of the Appalachian region. Considerable ingenuity will be required to represent all the complex disturbances in some western areas, even where adequate information is available. It does not seem practicable to show the geologic dates of individual faults. However, faults that are recognized as "active" can be distinguished from those supposedly "dead"; and it may be desirable to indicate that faults in an important group are essentially contemporaneous. Thrust faults in a belt of folding involve no special problem.

Considering the scale of the map, there is danger of attempting to show too much detail in areas of complicated structure. It is better to present limited information clearly than to have parts of the map overloaded to the point of confusion. The degree of complexity beyond which the law of diminishing returns begins to operate can be determined for each part of the map only by careful experiment. Rigid rules should not be strictly applied to all areas; for example, structure contours may be used with profit in areas that have simple structure, but not in belts of complex folding.

The function of a memoir to accompany the map requires little explanation. Many facts and relationships that can not be represented adequately on the map should nevertheless be made available. Reasons for interpretations given by the map should be stated, and discussion of possible alternatives will be helpful. Numerous cross-sections to show critical structural relations will be invaluable to users of the map. Diagrams and large-scale maps can be used to elucidate the structure in limited key areas. If the memoir is prepared adequately, it will be fully as useful as the tectonic map itself; and the two will be indispensable parts of a unit treatise.

It was suggested recently by R. D. Reed that a tectonic map should be accompanied by a series of paleogeographic maps of a rather special kind, to represent the evolution of major tectonic units. Such maps would show not only the outlines of subsiding and rising areas in various geologic periods, but also thicknesses and important facies of deposits in basins of sedimentation. Symbols could be used to represent facies, and either contours or actual figures or both to indicate thicknesses. Maps of this kind for limited areas have been published. A comprehensive series for each of the major tectonic units in the United States would form a proper and valuable part of the memoir to go with a tectonic map.

The efforts of the committee will be justified only if the result is equipment that can be used to advantage by numerous students of tectonics. Exactly what kind of map do these students require? Specific suggestions offered at an early date, while plans are in the formative stage, will be most useful in furthering the project.

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[2] "The Deformation of the Earth's Crust," by Walter H. Bucher. Princeton University Press, 1933.

"THE" SOUTH AND "THE" NORTH

IN a recent number of SCIENCE (September 28, 1934), under Science News, subtitle "Air Conditioning of Hospitals," there is an abstract of a paper from which the public learns that "in acute appendicitis the fatality rate is almost three times as high in the South as in the North"; further, that acute nephritis shows a "high death rate in the South and low death rate in the more stormy North." These assertions are attributed to Professor C. A. Mills, of the University of Cincinnati. They struck me because I am somewhat familiar with living in two places, central Missouri and the southern tip of Florida. I need not point out which is more south and more north by 800 miles.

During the summer just ended, in the "tropical" climatic region of the United States, the temperature rose on three days as high as 93°, confining itself on other summer days to the customary maximum of 90°. To tell the whole truth, however, on one day it reached the terrific (?) climax of 96°. Yet no death from "heat stroke" was reported in the papers, although many aged people live here. During the same weeks and months I received letters from my friends and relatives in Missouri, saying that they were sweltering under afternoon temperatures between 105° and 110°, and that on days when it rose only to 100°, they felt blest. Further, all the year around, it is nothing undreamed of in Missouri to have to stand an average of one day thirty degrees above or below that of the directly preceding day. Eight hundred miles south looking in the records for an analogous event amounting to only ten degrees difference meets with success but rarely.

"Patients should be protected from the heat waves of summer—and the year around from sudden changes in weather." True! But the truth is stultified by translating it into "The South." I assert