The Status of Topographic Mapping in Oklahoma

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A topographic map is one which portrays the relief or configuration of the land, as well as the horizontal extent and vertical position of such surface features as streams, lakes, swamps, rural and urban settlements, roads, and railroads. Depending upon the care and completeness with which it is prepared, it may or may not distinguish such features as woodlands, individual farmsteads and fields, specialized buildings and other types of land use. This paper is a brief report on the history and present status of topographic mapping in Oklahoma.

The scientific surveys of western United States conducted between 1865 and 1880 by parties under the direction of Clarence S. King, F. V. Hayden, Lt. G. M. Wheeler, and Major John Wesley Powell did not extend east as far as the territory of Oklahoma. They did, however, lay the groundwork for the organization of the United States Geological Survey in 1879, which undertook as one of its major programs the preparation of an adequate topographic map of the country. While several of the European countries were well along with programs of topographic mapping by 1880, the vast size of the United States, the seemingly unlimited extent of farm land, and the constitutional delegation of most political authority to the states had retarded the beginning of a national mapping program in our country.

No topographic map of the United States, prepared by uniform standards with uniform horizontal and vertical scales, has as yet been completed. In view of existing contrasts in local relief and slope, a national map with uniform vertical scale would perhaps be impractical, but a systematized topographic map of the nation on several different scales, for a wide variety of chorologic and planning purposes, is still urgently needed. The largest scale map of the entire country prepared on anything like a uniform basis is the United States Coast and Geodetic Survey's Sectional Charts, prepared for aeronautical use, of which 87 sheets cover the country at a scale of 1:500,000, or approximately eight miles to the inch. The World Aeronautical Chart Series of the Coast and Geodetic Survey covers the United States with 43 sheets, on a 1:1,000,000 scale, by reducing somewhat the number of physical and cultural landmarks included. The first national map coverage on a uniform scale at 1:250,000 will be a United States Army Map Service series, begun after World War II, now being published and distributed for civilian use by the Geological Survey. Since even in the more level areas of the country the contour interval used on this 1:250,000 map is no less than 50 feet, the amount of relief detail which can be shown on it is strictly limited. Even so, it will be an impressive improvement over the first Geological Survey topographic map of the nation, published on a scale of 1: 2,500,000, in 1893, with contour lines at 100, 500, 1,000, 1,500, and 2,000 feet, and from 2,000 to 12,000 feet at 1,000-foot intervals. (1)

Rather interestingly, the 1:250,000 map now in rapid production represents a return to the same horizontal scale, and often the same vertical scale, used on some of the early reconnaissance sheets of the Geological Survey published in the last two decades of the 19th century. By 1900 small scale reconnaissance maps had been made available for about one-third of the nation, but by that time it was apparent that scales of 1:125,000 or smaller were inadequate for many desired purposes, and pressures were strong for the remapping with greater detail of the older settled parts of the country. About 1900 the decision was made to establish a standard horizontal scale of 1:62,500, or approximately one mile to the inch, and to proceed to the mapping or remapping of the country on that basis. Even this scale proved inadequate for certain purposes, and in the 1930's new series at 1:31,680 and 1:24,000 were begun in such areas as southern New England, the Tennessee Valley, and major military reservations. Some of the states,

especially in the East, have entered into cooperative arrangements with the United States Geological Survey and, by paying part of the cost involved, have greatly speeded up their topographic mapping programs.

By 1950 the Director of the Geological Survey was able to report that map coverage was complete on approximately one-half of the total area of the United States. Because of changing requirements and higher standards of accuracy, however, only one-fourth of the country could be regarded as adequately charted, and, among the states, only Massachusetts and Rhode Island were completely covered on a scale of at least two inches to the mile. About 85 per cent of the area in which the TVA is active had been mapped by 1950 on a scale of 1:24,000.(2) Early in 1956 it was announced that Kentucky had completed a $6,360,000 cooperative mapping program with the Geological Survey and was entirely mapped on that scale.(3)

Where are we with regard to topographic mapping in Oklahoma? How well is Oklahoma mapped? In order to answer these questions the writer has examined existing maps and map indexes, as well as a considerable amount of literature concerning the progress and problems of mapping this 46th state, now getting ready to celebrate the 50th anniversary of its admission to the union.

The topographic mapping of what is now eastern Oklahoma proceeded rapidly during the closing years of the 19th century after the federal government decided to survey and subdivide all the lands in Indian Territory. Between March, 1895, and January, 1898, the Congress appropriated $671,500 for the purpose of surveying standard, township, and subdivision lines, and preparing a 1:125,000 topographic map of the lands of the Cherokees, Creeks, Choctaws, Seminoles, and Chickasaws. At one time as many as 300 men were engaged in the project. Within a little more than three years Geological Survey parties completed a topographic map of 30,885 square miles, using 133 different triangulation stations and establishing 920 permanent bench marks. The base for the triangulation of Indian Territory was a line nearly 25,000 feet long measured generally southward from a point three-fourths of a mile north of Savanna station some seven miles south of South McAlester. Talcott's method for determining latitude was employed at the Savanna station, and longitude was established after astronomic readings were taken on five different nights simultaneously with the Washington Observatory at St. Louis.

At most of the triangulation stations the theodolite had to be placed on a tripod, raised by a timber platform some 25 to 60 feet above the ground, so the instrument man could see over the trees. Minor corrections had to be made when the Indian Territory triangulation was tied in at Wasson in the northern portion of the Cherokee Nation by primary traverse to the Oswego, Kansas, astronomic station of the Geological Survey, and when Marlow in the western part of the Chickasaw Nation was tied to the Arkansas triangulation of 1887, which had been based on the United States Coast and Geodetic Survey astronomic stations at Fort Smith and Little Rock. The elevation of most of the Indian Territory was determined with relation to a Coast and Geodetic Survey benchmark on the end of a copper bolt in the west wall of the United States jail in Fort Smith. Insofar as possible, spirit leveling operations followed the lines of the newly built railroads, which afforded long, unobstructed station intervals.(4) The survey of Indian Territory proceeded rapidly. By 1901 twenty sheets had appeared, and by 1905 Henry Gannett was able to report that the 1:125,000 map covered all except a small section in the extreme northeastern corner of the Territory.(5)

In Oklahoma Territory, to the west of Indian Territory, the progress of topographic mapping was much slower. By the time of admission to statehood in 1907, only a few quadrangles had been mapped—Kingfisher and Chickasha, the latter partly in Indian Territory, at 1:125,000, advance

sheets of Guthrie and Hennessey at 1:62,500, and little else. Indeed, much of the rest of what constituted Oklahoma Territory remains topographically unmapped today except at scales of 1:500,000 and smaller. (Note: Shortly before this delayed number of the Proceedings went to press, in early 1959, it was announced that the 1:250,000 map of the Geological Survey was complete for the state of Oklahoma.)

During the decade 1905 to 1915 ten or a dozen 1:62,500 sheets appeared, covering a small section of central Oklahoma, mostly in Lincoln and Pottawatomie counties. The last of the 1:125,000 quadrangles, the Hominy area, was surveyed in 1916, following which mapping in Oklahoma seems to have come to a complete halt for more than a decade. Surveying was resumed in 1928, and within three years work was completed on ten more 1:62,500 quadrangles covering the area northward from Chandler and Stroud to the Kansas border in western Osage and eastern Kay county.

The decade of the 1930's brought mapping to only seven additional 1:62,500 quadrangles and a narrow strip along the North Canadian River above Oklahoma City. The Anadarko and Lawton quadrangles were surveyed on the same scale during the war years. Since 1948 the pace of mapping has been stepped up, and more than a dozen new 1:62,500 sheets have been published, mostly of quadrangles in the vicinity of Muskogee and Lawton. The new 1:24,000 scale, which the Geological Survey is using for metropolitan and other intensively utilized areas, has been adopted for revised maps of the Oklahoma City, Tulsa, Fort Smith, and Fort Sill areas, as well as a section of Red River bottomlands below Hugo, in Choctaw County. The military services converted the new Fort Sill area map to a scale of 1:25,000 in conformance with scale usages on detailed military maps not only of the United States but of many foreign countries. The 1:31,680, or two miles to the inch, scale which has been used rather widely in some parts of the country has not been employed in Oklahoma except for two small areas along the Red River in Tillman and Cotton counties which were mapped in 1916 with quadrangles centered on the Burkburnett, Texas oil field.(6)

According to an index map of the United States issued by the Geological Survey, showing the status of topographic mapping in the nation as of June 30, 1956, the following maps are in process for Oklahoma: (a) five 1:62,500 quadrangles in the Enid area to cover parts of Major, Garfield, and northern Kingfisher counties; (b) four 1:62,500 quadrangles in Washita and Custer counties, and half a dozen more in the Ouachita Mountains of McCurtain and LeFlore counties, for which the aerial photography has been flown; (c) a few quadrangles on the same scale along the Red River above Waurika; (d) some additional 1:24,000 sheets in the metropolitan areas of Oklahoma City and Tulsa; and, (e) twelve 1:24,000 sheets in the hills of Atoka, Coal, and western Pushmataha counties, where the construction of several large water supply reservoirs is anticipated.(7)

At the time of writing, late November, 1956, there are no published topographic maps of southwestern Oklahoma south of Duncan and west of Waurika, and there is essentially no topographic coverage better than that of the 1:500,000 Sectional Aeronautical Charts for the entire northwestern part of the state, northwest of a line through Altus, Hobart, Watonga, Perry, Ponca City, and Newkirk. There are, of course, street maps of a few of the larger towns, county road maps at two miles to the inch, a few county soil survey maps, and property maps, often very out of date, at the county courthouses. Of maps that show the relief of the land, other than in the most highly generalized fashion, there are none for approximately the northwestern one-third of the state.

Most persons with any competence in such areas as civil engineering, land- and water-use planning, geological exploration, and urban zoning are fully aware of the value of good topographic maps. They are a basic tool for countless academic and practical pursuits, and one can only regret that the federal government has not pursued its program of topographic mapping with greater vigor and with more generous financial support. The cost of mapping has gone up sharply. Some of the 1:250,000 reconnaissance map-

ping conducted by the Geological Survey in the 1880's cost as little as $1.75 per square mile, and in 1904 the Survey reported that 1:62,500 mapping was being done for $12.00 to $30.00 per square mile.(8) Fifty years later, in 1954, with the old plane table largely replaced by photogrammetric techniques employing air photos taken by trimetrogon cameras, the Geological Survey reported the cost of mapping one square mile to be from $85.00 to $300.00, depending upon terrain conditions and whether the scale is 1:62,500 or 1:24,000.(9)

During the first twenty-five years of its existence the United States Geological Survey spent $6,672,000 on its topographic program, or an average of about $267,000 per year.(8) Several attempts have been made to speed up the mapping operations, perhaps the most hopeful one the passage of the Temple Act by Congress in 1925. The Temple Act, which included an initial appropriation of approximately $1,000,000 for topographic mapping, was to provide for an annual increase in mapping funds until the national survey was completed. The great depression of the 1930's intervened, and in 1935 the direct federal appropriation for topographic mapping was down to less than $200,000, or about the same sum as had been provided in 1885.(10)

Since World War II the mapping of foreign areas seems to have had a higher priority than the domestic mapping program, although the annual spending rate on the national topographic map by all federal agencies since 1950 has been about $20,000,000. The Geological Survey hopes that by about 1970, or perhaps 1975, it can complete its topographic mapping program, using the two standard scales now employed. The total cost of completing this twenty-year program has been estimated at $480,000,000.

This is a lot of money, but the values which can be derived from such an expenditure would appear to make the completion of the national topographic map eminently worthwhile.

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