A NEW STATE GEOLOGIC MAP FOR MISSISSIPPI: A TOOL FOR UPDATING NOMENCLATURE AND DEFINITIONS OF THE STATE'S AQUIFERS AND AQUITARDS

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Introduction

The delineation of Mississippi's aquifers and aquitards can only be as accurate as surface geologic maps and shallow subsurface cross sections allow. Insufficient surface and near-surface geologic data can result in erroneous ground-water models. In such cases, the computer adage "garbage in, garbage out" well applies. Detailed county geologic maps are available for only a half of Mississippi's 82 counties, and some of the older county maps are in need of revision. The state geologic map is often used for areas where a county geologic bulletin is not available. This map, published in 1969, is only a minor revision of a 1945 edition and is itself in need of revision. Four major problem areas of the 1969 map need to be reexamined and remapped. These include: (1) the Naheola outcrop belt, (2) subdivision of the Wilcox Group into formations, (3) the Winona-Kosciusko sequence in northwestern Mississippi, and (4) the Neogene (Miocene-Pliocene) sequence in southern Mississippi. Resolution of each of these problem areas will provide a much improved framework for the resolution of aquifers and for ground-water models.

The previously defined problem areas of the present state geologic map are not the result of poor mapping in the past but are related to the state's geologic setting. Problem areas numbered one through three are related to changes in sedimentary facies within the Midway, Wilcox, and Claiborne groups as they grade from alternating marine and deltaic sediments in the south to largely deltaic and fluvial sediments in the north. Where fluvial-deltaic sands and clays overlie other such sediments of a different time and deposition sequence, the boundary between these sequences is difficult to determine and marine fossils, which give the geologic age, are missing. In this region, careful and detailed surface geologic mapping is required in conjunction with test hole drilling and the running of geophysical logs.

Aquifer resolution of the Wilcox Group in Mississippi is coarser than that of the actual geologic sequence. The lower Wilcox aquifer (Hosman et al. 1968) consists of the first well developed sand sequence above the Porters Creek Clay. Included in this sequence are sands of the Naheola Formation of the upper Midway Group as well as those of the Nanafalia Formation of the basal Wilcox Group. Hosman et al. (1968, pl. 1) in a regional study of Mississippi's Tertiary aquifers placed the Midway-Wilcox boundary at the Naheola-Porters Creek contact, a practice commonly followed by the oil industry in southwestern Mississippi. Even if the Naheola and Nanafalia aquifers are interconnected in part, their classification as the lower Wilcox aquifer is a nomenclatural problem that obscures the recognition of the aquifer's outcrop belt and recharge areas. Where facies relationships are complex, as in the Wilcox Group of northern Mississippi, geophysical logs by themselves are not adequate for determining formational boundaries and for defining aquifers. Here a combination of detailed surface mapping, test hole drilling, and geophysical log runs are needed. The fourth problem area mentioned for the present geologic map of Mississippi is in the Neogene sequence of southern Mississippi. Here, the formational boundaries between the Catahoula, Hattiesburg, Pascagoula, and Graham Ferry formations are undefined, leading some workers to abandon these terms (Bowen, in press) and others to designate the whole sequence as Neogene undifferentiated (Otvos, in press). Also, the upland sands and gravels mapped as the Citronelle Formation are now believed by several workers to be a mosaic of the updip graveliferous facies of several Neogene units. The Neogene problem of southern Mississippi, like the Paleogene problems in northern Mississippi, is due to the presence of repetitive fluvial-deltaic sequences which lack intervening fossiliferous transgressive shelf units. However, before the formal nomenclature is abandoned, detailed geologic mapping is needed to search for mappable horizons within this thick sequence. Paleontological data from coastal and offshore wells is also needed to place this sequence adequately within the framework of geologic time.

Present Mississippi Bureau Of Geology Mapping Programs

The Mississippi Bureau of Geology has had a classic

role in mapping the geology of the state, county by county, as part of its county geology and mineral resources reports. To date, county reports have been made for 40 of the state's 82 counties, all but one of which contain a geologic map (Bograd, in press). The latest county bulletin, Tishomingo County (Merrill 1988), has a county geologic map printed in two sheets at one mile to the inch. This mapping program is continuing with the mapping of Neshoba County.

A new mapping program was initiated in 1989 with the addition of two new field geologists (which doubled the staff of the Surface Geology Section) to remap the problem areas of the state geologic map. The first order of business for this program was to remap the Naheola Formation within Mississippi. This problem has been complicated by the introduction of local formational names which have never been adequately correlated with the type sequence in Alabama (Weathersby and Stover 1990). The Lauderdale County geologic map by Foster (1940) has the upper Naheola Formation mapped as the Fearn Springs Formation and the Nanafalia Formation mapped as the Ackerman Formation, the latter terms of each pair being of local (Mississippi) origin. This mapping practice has produced an artificial state-line fault at the Mississippi-Alabama line where the Midway-Wilcox boundary changes from the Naheola-Nanafalia contact in Alabama to the Naheola-Fearn Springs (upper Naheola) contact in Mississippi (Dockery, in press). Recent field mapping along with two test holes have shown the Naheola Formation to maintain a thickness of about two hundred feet across the Alabama-Mississippi state line into Lauderdale County, Mississippi, and to include coarse sand units similar to that at the base of the Nanafalia Formation (Gravel Creek Sand Member). Mapping of the Naheola Formation is being continued into Kemper and Winston counties, where it includes important commercial clay deposits.

A New Emphasis on Geologic Mapping

Geologic mapping and mineral resource exploration were the major (and perhaps even the only) tasks of the Mississippi Bureau of Geology in its early days when it was a department of the state under the title Mississippi Geological Survey. These early days were very productive as a small staff on a low budget produced a number of county geologic bulletins and maps. Of special note was the work of Frederic F. Mellen on the geology of Yazoo County (1940) and his discovery of the Tinsley Oil Field structure. This oil field is the largest east of the Mississippi River and was the first economically successful field in Mississippi. It has produced 219 million barrels of oil and 6.7 billion cubic feet of gas (Mississippi Bureau of Geology, Pamphlet 2, 1989) and is still producing today. As the nation and the state became more environmentally conscientious, the Mississippi Geological Survey redirected its emphasis toward the fields of environmental geology, mine reclamation, and ground water. This new emphasis was intensified when the Survey became the Bureau of Geology in the Department of Natural Resources, now the Department of Environmental Quality. In 1988, the Bureau's staff included nineteen geologists, only two of which were in the Surface Geology Section.

Surface geologic mapping is now being reemphasized at both the state and federal levels as environmental and water resource management needs face a lack of regional and site-specific geologic data. Also, both state and federal governments are interested in the surficial mineral resources present on state and federal lands. Local communities need site-specific geologic data for planning their waste management and the siting of landfills. The state has recently conducted major geologic studies concerning the possible placement of both a national high-level radioactive waste repository and a regional low-level radioactive waste repository (both of which were unwanted) and the placement of a superconducting super collider nuclear accelerator (which was wanted). Surficial geology was a major consideration in the siting decisions for each of these, and the placement of these items stood to have a major impact upon the state. The next environmentally sensitive item may be the placement of a toxic waste disposal site within the state to handle the state's own production of toxic waste.

The increasing demand and dwindling supply of the state's surficial and groundwater resources has prompted the regulation of these supplies. State management of groundwater resources requires accurate groundwater models. Such models are only as good as the surface and shallow subsurface geological data on which they depend. Improvement in groundwater models will require additional detailed geologic maps.

A conference on geologic mapping, the MISGEOMAP Conference, was held in Jackson, Mississippi, on February 21, 1989, to bring together those mapping the state's surficial deposits with those who use these maps. The conference program included geologists from the Mississippi Bureau of Geology as well as from the U. S. Geological Survey, U. S. Waterways Experiment Station, Mississippi Mineral Resources Institute, and state universities who were involved in geologic mapping. A number of both state and

federal agencies who utilize data obtained from geologic maps were also represented. The proceedings and papers of this conference are in press to be published as Mississippi Bureau of Geology Circular 3 (Bograd and Dockery, editors, in press). This document outlines recent and ongoing mapping projects, problems with the present map resources, and summarizes the needs of the map users. The consensus of the conferees was that the most useful geologic map is at the scale of a 7 minute quadrangle. Such maps will probably be done digitally on computers in the future. Also, it was determined that a new state geologic map was needed. Work is now under way toward revising the 1969 state geologic map.

Summary

The Mississippi Bureau of Geology has increased its staff of geologic mappers and is undertaking work toward the production of a new state geologic map. Problem areas of the 1969 map are being remapped on 7 minute quadrangles. These quadrangle maps can be digitized and made available to the public. A new state geologic map along with quadrangle maps and the continuing county bulletin series will provide the detailed surface geologic data needed for groundwater and environmental management decisions as well as to document the state's surficial mineral resources. These maps may also serve as legal documents for defining formations and their boundaries and for providing the correct stratigraphic nomenclature for aquifers and aquitards.

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