
FROM THE STATE GEOLOGIST

by John P. Bluemle



Once in awhile it can be useful to provide an accounting of what we are doing, how we are contributing to the development of North Dakota's economy, and how we are helping to provide sound environmental stewardship. I'll comment on some of our current activities.

Geologic Mapping

Three of our geologists, Ed Murphy, Mark Gonzalez, and Lorraine Manz, are mapping the geology in various parts of the state as part of the National Cooperative Geologic Mapping Program's STATEMAP effort. In North Dakota, STATEMAP is funded mainly by the U.S. Geological Survey, and NDGS geologists do the mapping. Our recent mapping activities include: 1) completion of geologic maps of the North and South units of Theodore Roosevelt National Park (1:24,000 scale); 2) completion of a geologic map of the Cavalier, North Dakota, 1° x 30' sheet (1:100,000 scale)—with this we have now completed mapping the geology at this intermediate scale along the Minnesota border in the Red River Valley; 3) initiation of a new one-year project to map the geology in five 7.5-minute quadrangles in the Little Missouri Badlands of western North Dakota; 4) initiation of a geologic map of the Killdeer 1° x 30' sheet, a 1:100,000-scale map.

Our geologic mapping activities are particularly important because only about 2% of North Dakota is covered by detailed geologic maps at the 1:24,000 scale. A serious statewide need exists for accurate and complete geologic information to address such issues as growth in our urban areas, natural-hazard identification and mitigation, natural-resource identification, and environmental protection. Since 1992, we have completed fifty-one 7.5-minute geologic quadrangle maps and six maps at the 1:100,000 scale. In addition to providing new paper maps, we are creating digital maps and data sets. The digital geologic data are used by other state, federal, and local agencies to perform a variety of computer analyses utilizing various geographic information system (GIS) tools.

CO₂ Monitoring Project

The North Dakota Geological Survey is part of an international consortium of companies and agencies researching the International Energy Agency (IEA) Weyburn CO₂ Monitoring and Storage Project. NDGS geologists Randy Burke, Paul Diehl, Julie LeFever, and Tom Heck are mapping North Dakota subsurface units within 100 kilometers of Weyburn, Saskatchewan. Our work on the project, which is funded in part by the U.S. Department of Energy, is restricted to the U.S. side of the border and involves identifying the tops of selected subsurface intervals in North Dakota so that the various pertinent formations—oil-producing formations, trapping beds, aquifers, aquicludes, etc.—can be accurately mapped. Our data will be tied into the Saskatchewan database to provide subsurface coverage over the entire project area. We will be able to map groundwater flow paths and units to identify possible routes that leaking CO₂ might take. The data will also provide important geochemical models to determine how much and how effectively the CO₂—a greenhouse gas—will be sequestered (permanently stored in the ground). To do all of these things, we need to identify the various strata, and the chemical composition of the rocks with which the CO₂ will be in contact because, without that knowledge, it is impossible to predict accurately what will happen to the CO₂ after it is injected into the ground. In addition to being a major CO₂ enhanced-recovery project in strata that produce oil in North Dakota, this is one of the first studies designed to determine whether CO₂ can be safely and economically sequestered in geologic formations. Many North Dakota oil fields should be amenable to CO₂ enhanced oil recovery projects similar to the one at Weyburn.

Paleontology

Our paleontologist, John Hoganson, is involved in a variety of topics, including studies of the evidence for the extinction of cartilaginous fish at the end of the Cretaceous; the stratigraphy, age, and vertebrate fossil record of the marine Breien Member of the Hell Creek Formation; preparation of a report on the paleontology of Theodore Roosevelt National Park; and study of the vertebrate fossils of the Fox Hills Formation. John has recently completed several excavations and fossil-resource inventories. He has conducted public fossil excavations as part of North Dakota's Nature-Based Tourism Plan and he continues to provide fossil exhibits for local museums as part of the NDGS Outreach Program.

GPS

NDGS geologist Tom Heck chairs North Dakota's Global Positioning System (GPS) Steering Committee. In conjunction with Trimble Navigation, we recently converted the NDGS Community Base Station to a public-access site. We established the base station in 1993.

Geochemical Baseline Study

Lorraine Manz is collecting samples for a National Baseline Study of minerals near the ground surface. Her study, being done in cooperation with the United States Geological Survey, involves collecting about 700 samples statewide over the course of this fall and next summer. The samples will be analyzed to determine the composition of about 20 trace elements. The results of Lorraine's study will be incorporated in a national database from which detailed maps of the surface distribution of these elements across the entire United States will be constructed. These maps will ultimately be made available to interested agencies or individuals. Information of this kind is valuable because it helps us to evaluate the nation's energy and mineral resources and to understand better the relation between human health and the geologic environment. And, as the title of the study suggests, it also provides a base line of minerals in the soil against which future changes can be measured.

Additional Technical Projects

Our geologists are involved in a variety of other projects, and I'll comment only briefly on some of them. They include: 1) Mark Gonzalez's study of sedimentation of stock ponds on federal land of the Little Missouri National Grassland to determine the annual sediment yield in grassland and badlands environments. Mark's work will provide the first quantified data on sediment yield during historic times in the area; 2) Paul Diehl's study of the Red River B Cedar Hills Field in western Bowman County to characterize and understand production patterns and mechanisms in this giant oil field (estimated ultimate recovery > 155 million barrels of oil); 3) Julie LeFever's work on the Bakken and Lodgepole formations, collecting and compiling information into a large database to generate a series of isopach maps; 4) Randy Burke's investigation of the processes and impacts of salt dissolution on Williston Basin geology; 5) Ed Murphy and other's analysis and information about natural hazards to the State's Division of Emergency Management; our contributions relate primarily to flood and landslide matters; 6) and Mark's involvement with the Department of Public Instruction to establish new state science standards for grades K-12.

Earth Science Information Center

The NDGS maintains a complete collection of USGS topographic and land-management maps for sale to the

general public. We oversee the state's Digital Data Clearinghouse, which contains DEM, DRG, DLG, DOQQ files and other information on the web for access by other state and federal agencies and the general public.

Outreach

Our basic mission is to serve, inform, and educate North Dakotans about the important role of geology in everyday life. Our geologists lead tours and make presentations for visitors to the North Dakota Heritage Center, where the NDGS's fossil collection is housed. We give guest lectures at area colleges and universities, make presentations at youth summer camps, visit classrooms and make presentations with visual aids and hands-on displays, make presentations to civic groups, serve as science advisors and judges for science fairs, and provide teachers with visual aids, hand samples of rocks, fossils, minerals, topographic maps, and publications for their classrooms. John Hoganson and Ed Murphy have recently prepared a geology guide along the Missouri River corridor in North Dakota, tracing the route followed by Lewis & Clark. Their book will be released in May 2003 by Mountain Press Publishing Company as part of their Roadside Geology series.

In addition to the specific research and applied projects I've described, our geologists respond daily to specific requests for geologic information. These range from requests for information about mineral deposits to letters from school children wondering about the kinds of rocks found in North Dakota. Several of our geologists also have ongoing and periodic regulatory tasks as well, maintaining our core and sample collections in Grand Forks, issuing permits for geothermal, coal-exploration, subsurface mineral investigations, etc.

Conclusion

At times it may seem that our geologists ply their craft in esoteric fashion. But every project is undertaken within the spirit of our mission statement. We are the principal source of geologic information in the state and we investigate the geology of North Dakota on behalf of its people and industries, chief among them agriculture, energy production from fossil fuels, and tourism. From farmers who need to know the properties of soils to best manage their lands, to tourists who gaze in curiosity into the mesmerizing landscape of the Little Missouri Badlands, we study the state from the surface to its depths to improve continually our knowledge of geology and how it affects our daily lives and commerce.

Our technical studies provide a huge return, both in revenue to the state in increased oil and gas production and in technical and quality-of-life knowledge about our state, which also enhances our tourism industry. The North Dakota Geological Survey definitely delivers.