NEWSLETTER

NDGS

A publication of the
North Dakota Geological Survey,
University Station,
Grand Forks, North Dakota 58201
Phone: (701) 777-2231

CONTENTS

February, 1974

Editor's Note:

The staff at the North Dakota Geological Survey is attempting in this first issue of the NDGS Newsletter to supply information of interest to individuals and organizations with an active interest in geology and the mineral industry in North Dakota. We invite your suggestions, comments, criticism, etc. regarding what you would like to see in a newsletter of this type. Just write me at the North Dakota Geological Survey, University Station, Grand Forks, ND 58201, or call (701) 777-2231.

John P. Bluemle

ENERGY EXPERT ADDRESSES NORTH DAKOTA GEOLOGISTS--

Dr. M. King Hubbert recently addressed the North Dakota Geological Society in Bismarck. Dr. Hubbert is a research geophysicist for the U.S. Geological Survey and Distinguished Lecturer sponsored by the American Association of Petroleum Geologists. He spoke on "The World's Energy Economy." Before joining the USGS, he was associated with Stanford and Columbia Universities, Shell Development, Amerada Petroleum Corporation, and the Illinois State Geological Survey. Dr. Hubbert has made significant contributions to geology in the fields of ground-water movement and structural geology. As long ago as the 1950's, he warned of an impending petroleum shortage in the US. In 1968, this work was included in "Resources and Man," a report of the National Academy of Sciences--National Research Council.

An abstract of Dr. Hubbert's talk is reproduced below:

ABSTRACT

The earth is a virtually closed material system composed of the 92 naturally occurring chemcial elements, all but a minute radioactive fraction of which obey the laws of classical chemistry. Into and out of this system there occurs a continuous flux and degradation of energy. As a consequence, the materials of the earth's surface undergo either continuous or intermittent circulation. The principal energy influxes into the earth's surface environment are three: solar energy $174{,}000 \times 10^{12}$ thermal watts; geothermal energy, 32×10^{12}; and tidal energy 3×10^{12}. The outfluxes are low-temperature radiation into outer space.

During more than 3 billion years of geologic history a minute fraction of the materials of the earth's surface has been aggregated into the dynamical system of living organisms. By the process of photosynthesis, a small fraction of the incident solar radiation is captured by the green leaves of plants and is stored chemically in the organic molecules of carbohydrates and other more complex chemical compounds. This is the source of the physiological energy requirements for the entire plant and animal kingdoms. The rate of decay and of oxidation of organic materials is almost equal to their rate of formation, but a small fraction becomes buried in peat bogs or other oxygen-deficient environments of incomplete decay. Such accumulations during past geologic time have become buried under thick accumulations of sedimentary strata and have become transformed into the earth's present supply of fossil fuels.

By about 2 million years ago the ancestors of the present human species began to walk upright and to use stone tools. From that time to the present, this species has distinguished itself from all others in its cumulative inventiveness in means of capturing ever-larger quantities of the energy of its environment. A large increase in the consumption of energy per capita was not possible, however, until the exploitation of the large stores of energy of the fossil fuels was begun about 9 centuries ago. The rise of the world's present technological society, with its concurrent ecological disturbances, including that of the human species, has been an inexorable consequence.

The length of time during which this has occurred is deceptive unless account is also taken of the expotential growth in the rates of consumption. During the 9 centuries since the beginning of coal mining, approximately 142 billion metric tons had been mined by the end of 1972. Of this one half has been produced since about 1940. Eighty percent of the world's initial coal supply will be consumed within the next 2-3 centuries, and the middle 80 percent of the world's oil during the 65-year period from about 1967 to 2023.

As to the future, the fossil fuels are short-lived; nuclear power is potentially large but also hazardous; water power is large but inadequate; and geothermal and tidal power are inadequate. On the other hand, the largest source of energy available to the earth is that of solar radiation. Because the earth itself cannot tolerate more than a few tens of doublings of any biological or technological activity--and most of these have already occurred--it is now becoming evident that the present episode of expotential industrial growth can be only a transitory epoch of about 3 centuries duration in the totality of human history. It represents a brief transitional period between two very much longer periods, each characterized by rates of change so slow as to be regarded essentially as a period of nongrowth. Although the forthcoming period poses no insuperable physical or biological difficulties, it can hardly fail to force a major revision in those aspects of our current economic and social thinking which are based upon the premise that the growth rates which have characterized this temporary period can somehow be sustained indefinitely.

NORTH DAKOTA COAL BIBLIOGRAPHY--

North Dakota's vast coal resources have aroused nationwide interest. The North Dakota Geological Survey estimates that North Dakota has strippable lignite reserves totaling 16 billion tons. These reserves occur in seams at least 5 feet thick under overburden of 100 feet or less. The reserve estimate is based on calculations that indicate the state has total lignite resources in excess of 350 billion tons.

The North Dakota Geological Survey is active in answering the many requests for information on reserves and overburden depths for both in-state and out-of-state companies and individuals. John Ferguson, our coal geologist, has reviewed the extensive literature pertaining to lignite as an energy source in both conventional electric generation and future gasification and liquefaction plans. He has recently compiled estimated strippable reserves by counties to be used in the Northern Great Plains Resources Study.

John has also compiled a working bibliography of sources of information dealing with coal in this area and, as it has been in great demand, it is reproduced on the next two pages. To the best of our knowledge, it is fairly complete, but if you have any additions or other questions, give him a call at (701) 777-2231.

REPORT ON STRIP MINING NEARLY READY--

A collection of papers dealing with the environmental aspects of strip mining is in press by the North Dakota Geological Survey. This volume, edited by Mohan K. Wali of the UND Biology Department, is an outgrowth of a symposium that was held at UND in April of 1973. It includes papers that deal with the biology and geology of areas under consideration for strip mining as well as some of the economic, legal, and other problems of reclamation of mined areas. It is now in press as NDGS Educational Series #5, and will be available soon.

COAL BIBLIOGRAPHY

U.S.G.S. Bulletins:	
285-F p. 316-330	N. D. In General
341-A	Sentinel Butte Field
381-A	Washburn Field and Fort Berthold Field
471 p. 170-186	Fort Berthold Indian Reservation
471 p. 271-283	Glendive Lignite Field, Dawson Co., Montana
531-E p. 91-157	Williston Field
541-G	Morton, Adams and Hettinger Counties
575	Standing Rock and Cheyenne Indian Reservation
691 p. 211-217	Williams County
726-A	New Salem Lignite Field
726-D	Lignite Western Part of Fort Berthold Indian Reservation south of Missouri River
775	Marmarth Field
906-B	Minot Region
995-G	Wibaux Area
1015-E	Slope and Bowman Counties
1076	Square Buttes Field, Oliver and Mercer Counties
1322 p. 17-19	"Stripping-Coal Resources of the U. S." 1-1-70
Open File	Geology of the Knife River Area N.D.-1952
Water Supply and Irrigation Papers No. 117	N.D. In General
Circulars:	
78	Standing Rock and Cheyenne Indian Reservations
226	Lignite Resources of North Dakota
Coal Inventory Maps:	
38	Chalky Buttes Area, Slope County
C-52	Heart Butte N. W. Quadrangle, Parts of Morton and Grant Counties, 1970
C-53	Heart Butte Quadrangle, Parts of Morton and Grant Counties, 1970
Open File	Preliminary geologic map of the Glen Ullin quadrangle, Morton County, N.D.-1970
Open File	Preliminary geologic map of the Dengate quadrangle, Morton County, N.D.-1971
Open File	Preliminary description of cores, chemical analyses of lignite beds and map showing locations of holes drilled in Grant, Hettinger, Morton, and Stark Counties, N.D.-includes 19 drill holes-1970
Open File	Preliminary geologic map of the White Butte East quadrangle, Hettinger County, North Dakota. 1:24,000-scale geologic map and coal sections. 1972
Open File	Preliminary geologic map of the White Butte West quadrangle, Hettinger County, North Dakota. 1:24,000 scale geologic map and coal sections. 1972
Open File	Preliminary geologic map of the White Butte NE quadrangle, Stark and Hettinger Counties, North Dakota. 1:24,000 scale geologic map and coal sections. 1972

(Bibliography continued)

Open File	Preliminary geologic map of the White Butte NW quadrangle, Stark and Hettinger Counties, North Dakota. 1:24,000 scale geologic map and coal sections. 1972
Professional Paper 325	Geology of the Souris River Area North Dakota. R. W. Lemke. 1960 pp. 117-124
Corps of Engineers	Coal data sheets showing recoverable coal reserves in North and South Dakota, Considered for Synthetic liquid fuels manufacture-1951
U.S. Dept. of the Interior Office of Coal Research	"The Potential Market for Midwestern and Alaskan Coal and Lignite" pp.IV-47 thru IV-53. Paul R. Nathan Associates, 1966
Bureau of Mines:	
Information Circular 7158	Analysis of the Northern Great Plains Province Lignites and Their Ash: A Study of Variability, 1968
Information Circular 7691	Technology of Lignite Coals, 1954
Information Circular 8376	Technology and use of Lignite Coals, 1968
Information Circular 8535	Cost Analyses of Model Mines for Strip Mining of Coal in the United States. 1972, pp. 100-116
Information Circular 8537	Strippable Lignite Reserves of North Dakota. 1972
Preliminary Report 142	"Mineral Resources and Their Potential on Indian Land." 1961, Ft. Berthold Reservation
N. Dak. Geological Survey:	
Biennial Reports	1st, 2nd, 3rd, 5th, 6th
Bulletin No. 4	The Lignite Deposits of North Dakota. 1925
Miscellaneous Series No. 23	"Lignite in N. Dak.," 1964, Miller Hansen
North Dakota Water Commission	Logs on numerous water wells in coal area
N.D. State Engineer	Third Biennial Report, 1908 pp. 20-28
N.D. State Engineer	Fourth Biennial Report, 1909-1910 pp. 56-110
N.D. State Engineer	Fifth Biennial Report, 1911-1912 pp. 59-127
N.D. State Engineer	Sixth Biennial Report, 1913-1914 pp. 50-157
N.D. State Engineer	Seventh Biennial Report, 1915-1916 pp. 63-162
N.D. State Engineer	Eighth Biennial Report, 1917-1918 p. 31, pp. 48-174
UND College of Engineering, Bull.14	"North Dakota Lignite Analyses." 1960, Adelynne M. Magnuson
UND Department of Chemical Engineering	"Lignite Occurrence and Properties," Irvin Lavine, 1940
N. D. Research Foundation	Mineral Resources of N.D., Bull. 8, 1954, pp. 31-40
N.D. Economic Development Comm.	The Mineral Resources of N.D., 1964, pp. 1-13
Economic Geology, Vol. 45	"Geologic Features N.D. Lignites." 1950, Roe, W.B., pp. 434-440
Great Northern Railway Co. Mineral Research and Development Department	Report No. 1--Lignite Drilling Program Williston Basin, North Dakota and Montana, 1953-55
Great Northern R.R.	Logs of water wells drilled in lignite bearing areas
Northern Pacific R.R.	Logs of water wells drilled in lignite bearing areas
Coal Age	Mid-April 1973, "Western Coal," North Dakota pp. 136-142

HEATING VALUES OF VARIOUS FUELS COMPARED--

North Dakota lignite coal has a heat value of about 6800 Btu per pound; subbituminous coal yields about 9,000 Btu per pound; bituminous coal about 13,000 Btu per pound. By comparison, crude oils range from 5.8 to 6.3 million Btu per barrel; fuel oils from 5.5 to 6.8 million Btu per barrel; kerosene about 6.25 million Btu per barrel; and diesel fuel from 5.4 to 5.8 million Btu per barrel. (A barrel is 42 U.S. gallons.) Therefore a ton of lignite has a heating value roughly equal to two barrels of oil. Seven barrels of oil weigh about a ton, so on a weight basis oil is about three times as efficient as lignite in producing heat.

LIGNITE PRODUCTION OVER THE YEARS--

The table below may be of interest to some of you. It lists the lignite production in North Dakota for the years shown. C. A. Koch, U.S. Bureau of Mines Liaison Officer for North Dakota, and Professor Melvin Forthun, of the Mechanical Engineering Department at NDSU, cooperated in arriving at the estimated figures.

Year (Ending 6-30)	Produced	
1884 (First Reported)	35,000	
1890	30,000	
1895	38,997	
1900	129,883	
1905	317,542	
1910	416,580	
1915	528,078	
1920	878,969	
1925	1,357,408	
1930	1,849,144	
1935	1,828,213	
1940	2,165,181	
1945	2,485,469	
1950	3,212,534	
1955	2,979,725	
1960	2,522,691	
1965	2,758,112	
1970	5,001,828	
1973	6,798,607	
1975 (Estimated)	11,700,000	(Electric Generation)
1980	35,200,000	(Electric Generation + 1 Lurgi Gasification*)
1985	58,400,000	(Electric Generation + 2 Lurgi Gasification*)
1990	97,600,000	(Electric Generation + 6 Lignite Conversion Plants*)

The Total Lignite production to June 30, 1973 is reported as 152,000,000 tons.

* Total Units

NDGS INVOLVED IN ENVIRONMENTAL STUDIES--

Our resident waste disposal experts are Mike Arndt and Steve Moran. They are not really garbage men, but rather they evaluate specific sites for solid waste disposal, determining their suitability from a geologic and hydrologic standpoint. Mike and Steve aren't down in the dumps all the time, however, as they are involved in many other projects.

The North Dakota Geological Survey has published a report by Steve on the engineering and foundation conditions in Grand Forks. Entitled "Subsurface Geology and Foundation Conditions in Grand Forks, North Dakota," it is written for the non-geologist who is concerned with construction on or below the ground surface in Grand Forks. Its purpose is to describe the position, composition, origin, and engineering properties of the various layers of sediment that underlie the city. The report can be obtained by requesting Miscellaneous Series 44. It costs 75 cents.

Another report dealing with the geologic environment concerns the Langdon area. It was written by Mike Arndt in response to the ABM impact in that part of the state. The report is entitled "Report of Investigation 50, Geology for Planning at Langdon, North Dakota." The report can be obtained from the North Dakota Geological Survey for 25 cents.

A project currently underway near Langdon involves groundwater movement in and around a landfill. The object is to determine how much leachate is being produced in a landfill and where it is going. The geologic setting at this site is such that the results should have wide application over much of eastern North Dakota.

Fargo-Moorhead is a major urban area in the Upper Midwest, and continuing growth of such an area involves the need for regional planning. As part of the Survey's response to this, we are, in cooperation with the F-M Metropolitan Council of Governments, preparing some basic data input. Mike and Steve have nearly completed a series of maps, along with a text, dealing with the physical environment of Cass and Clay Counties. In addition to a surficial materials map, the report will include a series of maps dealing with solid waste disposal, septic tanks, sewage lagoons, construction conditions, groundwater resources, groundwater contamination hazards, drainage, and flooding.

APPRAISAL OF NORTH DAKOTA RESOURCES IS PUBLISHED--

A recent North Dakota Geological Survey publication that has been much in demand is Bulletin 63, "Mineral and Water Resources of North Dakota." It is intended to provide general information in regard to potential as well as previous development of the natural resources in a form that will be useful to citizens, professional people, and leaders who are interested in the conservation and development of the natural resources of North Dakota. Copies have already been distributed to certain state agencies and legislative committees. The report was written by staff members of the U. S. Geological Survey, North Dakota Geological Survey, Bureau of Reclamation, and University of North Dakota. The report was edited by E. R. Landis, U. S. Geological Survey.

Part I of Bulletin 63 describes the mineral resources of North Dakota, including the general geology of the area, the occurrence, distribution, and past and expected future development of each mineral resource. Part II describes the distribution, quantity, and quality of both surface and groundwater in the state. Part III describes the existing development of water resources and includes plans for future development.

The report consists of 252 pages of text and figures and is available from the North Dakota Geological Survey, Grand Forks, North Dakota. The Survey's Bismarck field office can forward orders or at times will have copies available. Price, including postage, is 50¢.

THESES DEALING WITH SUBSURFACE MAY BE USEFUL TO OILMEN--

People in the oil industry sometimes find the theses written by graduate students at UND valuable in their work. The list below includes most of the titles that deal with problems of interest to oilmen.

Harald C. Haraldson, 1953 (M.S.) Geomagnetic survey of parts of Pierce, Benson, Sheridan, and Wells Counties
Dan E. Hansen, 1955 (M.S.) Subsurface correlations of the Cretaceous Greenhorn-Lakota interval in North Dakota, a study in facies
Clarence G. Carlson, 1960 (M.S.) Stratigraphy of the Winnipeg and Deadwood Formations in North Dakota
Jack Kume, 1960 (M.S.) Investigation of the Bakken and Englewood Formations (Kinderhookian) of North Dakota and northwestern South Dakota.
Morris J. McCollum, 1962 (M.S.) Petrography of the Midale Subinterval in the Bottineau and Renville Counties area, North Dakota
Harold C. Ziebarth, 1962 (M.S.) Micropaleontology and stratigraphy of the subsurface "Heath" Formation (Mississippian--Pennsylvanian) of western North Dakota
Frederick V. Ballard, 1963 (M.A.) The structural and stratigraphic relationships in the Paleozoic rocks of eastern North Dakota
Wallace Dow, 1964 (M.S.) The Spearfish Formation in Williston Basin of western North Dakota
Albert D. Pernichele, 1964. (M.S.) Microfacies analysis of the Duperow Formation in the Beaver Lodge Field, Williams County, North Dakota
Richard A. Salisbury, 1966 (M.S.) Jurassic stratigraphy of the southern two-thirds of North Dakota
Mark Reishus, 1967 (M.S.) The Newcastle Formation (Lower Cretaceous) in the Williston Basin of North Dakota
Hussein Marafi, 1968 (M.S.) The geology of the Newburg-South Westhope oil fields, Bottineau County, North Dakota
Harlan Friestad, 1969 (M.S.) Upper Red River Formation (Ordovician) in western North Dakota
Kirth Erickson, 1970 (M.S.) Surficial lineaments and their structural implication in the Williston Basin
Kent A. Johnson, 1971 (M.S.) The petroleum geology of the Midale subinterval in north-central North Dakota
Harold C. Ziebarth 1972 (Ph.D.) The stratigraphy and economic potential of Permo-Pennsylvanian strata in southwestern North Dakota

ABOUT SNG--

Here are a few figures on Synthetic Natural Gas (SNG) production that we learned from Wayne Kube of the UND Chemical Engineering Department: 1. Each 250,000,000 Standard Cubic Feet per Day (scfd) coal-gasification plant would supply the total energy needs of 250,000 people (oil, gasoline, natural gas, electricity, etc.). 2. Each plant would supply 0.36% of present total U.S. natural gas use. 3. Each plant would supply about 0.5% of the total natural gas supply gap between 1985 and 1995. 4. Half the economically recoverable (strippable) lignite resources of North Dakota represents about 25% of the proved gas reserves in the USA.

DRILL STEM TEST CATALOG IN PREPARATION--

Our librarian, Mary Scott, has been compiling a catalog of drill stem tests that recovered oil from wells located a half mile or more from a producing well and, in most cases, outside a field boundary. A few of the wells were at one time producers, but they are now plugged. These were included because of their location away from currently producing areas. Only the results of the tests that recovered oil are reported.

The arrangement of the catalog is by county and then by township, range, and section. Updates of the catalog will be issued periodically and will be in the same format for easy interfiling. The first issue of the catalog is current through July 31, 1973 according to the records on file at the office of the State Geologist.

The test results were taken from the information submitted by each company with the completion or plugging report for the well. In cases where the reports in the files of the North Dakota Geological Survey were incomplete, the Ira Rinehart and Petroleum Information card files were consulted. The terminology and abbreviations of the original reports were used with no attempt to standardize or translate the information. The formation names that appear between quotation marks in this catalog are the names that the company reported along with the test results; otherwise the name was supplied by Sid Anderson of the North Dakota Geological Survey. Several of the half-scale logs used in the catalog were supplied by Harris, Brown, and Kiemer, of Bismarck, North Dakota.

Because of the intense interest shown by those who are aware of this catalog's preparation, we shall announce soon, by press release, conditions under which it can be ordered for immediate mailing upon publication. It will be dedicated, as they say in the oil patch, to all the "poor bastards" who drilled the holes!

RADIOCARBON DATE CATALOG READY--

Another "catalog" already published by the North Dakota Geological Survey is the Catalog of North Dakota Radiocarbon Dates. With an appropriate cover of carbon black, the catalog is a compilation of approximately 90 radiocarbon dates from North Dakota. For the user's convenience, the catalog has been arranged in two parts. Part I is a complete list of the geologic dates with all available information on them. Part II consists of a) geologic dates arranged by geological association, b) archaeological dates, and c) dates that are meaningless due to contamination or misidentification of materials dated.

The radiocarbon date catalog may be obtained for 75¢ from the North Dakota Geological Survey.

NORTH DAKOTA GEOLOGY BIBLIOGRAPHY IS AVAILABLE--

Anyone interested in North Dakota geology should find Mary Scott's Annotated Bibliography of the Geology of North Dakota-1806-1959, published in 1972, valuable. It includes all the known literature on North Dakota geology published between 1805 and 1960. The annotations were written to present the contents and coverage of the reports to aid the user in locating the desired information. The bibliography is followed by an index that contains both subject and geographical headings. If you are interested, contact the North Dakota Geological Survey and ask for Miscellaneous Series 49. Price is $1.00.

GUIDEBOOK SERIES UNDERWAY--

The North Dakota Geological Survey is cooperating with the Department of Public Instruction in publishing a series of six guidebooks to the geology of the state. The guidebooks are designed to present the geology of North Dakota in a generalized manner primarily for students and the general public. They can be used while traveling to explain the variation in rocks, soils, and landforms. A generalized geologic map in color is included, and each guidebook has several roadlogs that describe the geology along convenient routes.

The guidebooks for northeast and southeast North Dakota are now available and editions for the south-central and north-central parts of the state should be ready soon. They can be obtained from the Department of Public Instruction, Bismarck, or from the North Dakota Geological Survey.

GOLD IN NORTH DAKOTA--

Did you know that gold was once mined in North Dakota? A company with the unlikely name of "El Dorado Gold Mining Co." was formed in 1908 to mine gold in McHenry County. The project didn't last long and interest soon died, but in 1931, reports from Chicago told of gold being found in the crops of turkeys being processed in the Denbigh area. These reports started a "gold rush," and soon the area around Denbigh and Towner was covered by mining leases. Not much gold was taken. The gold is associated with the glacial outwash sands, gravels, and lake sediments of the Souris River basin. The gold was probably carried in from the Canadian Shield by Pleistocene glaciers. With the melting of the glacier, the free gold was concentrated and redeposited by the meltwater in the lake sediments and glacial outwash within and near the margins of ancient glacial Lake Souris.

A second gold mining operation existed about 60 years ago northwest of Lisbon, near Fort Ransom, North Dakota, in Ransom County. The mine operated for 2 years; however, the ore was low grade and it cost more to mine than the ore was worth. That deposit appears to be a cemented placer related to a stream that flowed on the Cretaceous Niobrara Formation in that area. The stream may have been a northeastward-flowing preglacial stream that derived sediment--and gold--from the Black Hills.

RECENT DRILLING PERMITS ISSUED BY THE NORTH DAKOTA GEOLOGICAL SURVEY--

Permit	Operator and lease	Well Type	Location	County
5396	Dallea Petroleum Corp. Hamlet Unit No. 3	Development NW McGregor	SENWSW Sec. 30-159-95	Williams
5399	Cardinal Pet. Co. & Patrick Pet. Corp.-Kesting-State #1	Extension Dickinson	C S/2 NW/4 Sec. 11-140-96	Stark
5400	Chandler & Associates, Inc.-Knox #14-33	Outpost Sherwood	SESW Sec. 33-164-85	Renville
5401	Don Bills and Clint St. Clair-J. H. Demaree #1	Extension South Lone Tree	NWNW Sec. 6-154-85	Ward
5402	Don Bills and Clint St. Clair-Dufner et. al. #1	Wildcat	SWNW Sec. 25-158-83	Renville
5403	Don Bills and Clint St. Clair-W. Erdman et. al. #1	Wildcat	NESW Sec. 22-158-75	McHenry
5404	Don Bills and Clint St. Clair-Butts Farming Assoc. et. al. #1	Wildcat	SENW Sec. 12-146-67	Foster