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Geothermal Resources of North Dakota

Since 1979, the North Dakota Geological Survey has been involved in a cooperative study with the U.S. Department of Energy (FC07-79ID12030) to evaluate the hydrothermal resources of North Dakota. Intially, emphasis was placed on using existing data on file with state and federal agencies. Oil and gas well data from the North Dakota Geological Survey and water well data from the U.S. Geological Survey, Water Resources Division, and North Dakota State Water Commission have been compiled into two computer library systems, WELLFILE and WATERCAT. In addition to summarizing existing information, temperature profiles have been measured in available ground-water observation wells throughout the state. We have installed casing in available test holes in selected areas for terrestrial heat-flow determinations.

The information contained in WELLFILE and WATERCAT is being assembled into a catalog of user-oriented aquifer summaries. Depth, thickness, water quality, and temperature data have been summarized for the Madison Group (Mississippian) and the Inyan Kara Formation (Cretaceous) in North Dakota. Work continues on similar data summaries for other Mesozoic and Cenozoic aquifers.

The data from temperature logs run in ground-water observation wells have been incorporated in WATERCAT. This information can be displayed as temperature profiles for individual wells, as "shallow" geothermal gradient maps, and as "slice" maps of expected temperatures at various depths.

Interest in geothermal energy, particularly residential heat pump applications, is increasing in North Dakota. User-oriented data summaries of the information collected during our study are available through the North Dakota Geological Survey.

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Reefs of Smackover Formation, An Upper Jurassic Carbonate Shelf Sequence Rimming U.S. Gulf Coast

The occurrence of reefs and oolitic sands in the Smackover Formation, an Upper Jurassic (Oxfordian) sequence that has been recognized in the subsurface of the U.S. Gulf Coast, adds significantly to our knowledge of depositional models for Jurassic carbonate shelf deposits. Models for the upper Smackover Formation have been based exclusively on subsurface data gathered from non-skeletal carbonate reservoirs. The widespread occurrence of buildups within the upper Smackover requires a revision of the existing models. These reefal buildups are 3 to 40 m thick, commonly elongate, and several square kilometers in plan. They developed seaward of oolite shoals on paleostructures that created subtle topographic highs on an otherwise ramp-like sea floor. Reef-rubble zones have reservoir-quality porosity throughout the Smackover trend, but reef framework is a target only where diagenesis has been favorable.

The biota forming Smackover reefs are similar to those described for sponge-algal buildups and patch reefs from the Upper Jurassic of Europe. Reef framework is constructed by digitate and branching "stromatolitic" blue-green algae and to a lesser extent by agglutinated worm tubes, *Tubiphytes morronensis,* and marine cements. The biota varies throughout the Smackover trend. Reefs in southern Arkansas and northern Louisiana are more diverse. In these reefs, encrusters and binders produce constructional microframework cavities on and between corals (primarily *Actinastrea*), skeletal algae (*Parachaetetes* sp. and *Cayeuxia* sp.), lithistid and hexatinellid sponges, bryozoans, and hydrozoans. The cavities are commonly filled with marine cements or geopetal sediments. The reefs are commonly underlain and overlain by subtidal peloidal lime packstones containing oncolites and scattered fossils and they can develop in close proximity to subtidal quartz sands.

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AAPG Presidential Address

No abstract.

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Geological Setting and Production History, Grosmont Pilot Project, Northern Alberta

Enormous quantities of bitumen are contained along the eastern margin of the Upper Devonian Grosmont Formation in northern Alberta. This formation can be readily subdivided into four informal stratigraphic units which represent, along with several smaller scale internal depositional cycles, successive stages in the evolution of a hugh carbonate complex: argillaceous slope sequences pass upward to a spectrum of shallow-platform facies and these then are capped by shoreline deposits and horizons of exposure and erosion. Although almost exclusively secondary in nature, the type and distribution of pore fabrics appear to have been at least initially controlled by original depositional facies.

In 1975, Union Oil Co. of Canada initiated a single well steam stimulation program to evaluate the potential for recovering bitumen from the upper Grosmont Formation. In 1977, the Alberta Oil Sands Technology and Research Authority (AOSTRA) and Canadian Superior Oil joined the project and further tests (steam stimulation, steam drive, combustion) were undertaken at a new site with Union continuing as operator. The 1980-81 "huff and puff" stimulation program consisted of one injection/production well and four closely spaced observation wells. Four production cycles have been completed to date, yielding attractively high production rates. An expanded evaluation program is currently under way and will utilize a five-spot scheme of injection/production wells augmented by four or more observation wells.

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Late Pleistocene Deposits of Florida Keys

The sedimentology and diagenesis of the late Pleistocene carbonates of the Florida Keys have been studied in a series of shallow cores from Key Largo and Big Pine Key. On Key Largo three stratigraphic units—defined by paleo-exposure surfaces—were wholly or partly penetrated. Skeletal grainstones and packstones are the dominant lithofacies and enclose abundant massive corals, especially in the upper parts of the two