

The implication is that a change in sampling method may produce results that are representative of the groundwater geochemistry, but the data will lead to interpretations that unimpacted wells have statistically significant increases in metals concentrations, i.e. false positives, whereas impacted wells will not have statistically significant increases, i.e. false negatives.

No. 6919

# CONODONT BIOSTRATIGRAPHY AND FACIES RELATIONS OF THE MIDDLE ORDOVICIAN TRENTON LIMESTONE IN NORTHWEST OHIO AND INDIANA

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The Trenton Limestone is one of the most well-known and widely distributed Ordovician stratigraphic units in North America, however its regional subsurface relations in the United States Mid-continent have not been completely understood. The Trenton Limestone in the research area represents a transition from a cratonic inner-shelf carbonate platform environment to a carbonate platform, a transgressive sequence. This transgression can be identified in the subsurface by lithologic evidence and the change from a shallower-water to a deeper-water conodont fauna. The conodont elements are representative of the *Phragmodius undatus*, *Plectodina tenuis*, and *Belodina confluens* Conodont Zones. Sequence stratigraphic concepts were applied to the strata in the study area, and the parts of three sequences are believed to be represented in the Trenton Limestone. Three transects using geophysical logs from Ohio, Michigan, Indiana, Illinois, and Kentucky were constructed. Geophysical data were compared with conodont biostratigraphic information and sequence stratigraphic concepts were applied to cores from five key localities in an attempt to gain a more detailed understanding of the regional subsurface geology, depositional environments, and conodont biofacies changes of the Middle Ordovician Trenton Limestone.

No. 60152

# USING LITHOLOGIC DISCONTINUITIES IN SOILS OF A MICHIGAN DRUMLIN FIELD AS AN INDICATOR OF PALEOENVIRONMENTAL CONDITIONS.

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Although often masked or blurred by pedogenic processes, near-surface lithologic discontinuities in soils can provide a window to paleoenvironmental conditions, past sedimentary environments, and landscape evolution. Discontinuities that exist within two meters of the surface are often reported and mapped in standard, county-wide soils maps. Fieldwork can be used to verify other discontinuities, where they are so subtle that they have been 'missed' by soil mappers. This study sought to determine if lithologic discontinuities were present in a drumlin field located in northwestern lower Michigan. Soils here are rarely mapped as having such discontinuities. The research also attempted to describe these discontinuities and suggest some hypotheses related to their origins. Soil samples were collected from both pit faces and by bucket augering along catenary sequences roughly perpendicular to the long axes of drumlins. Particle size, particle size indices, sorting, estimates of coarse fragments, and clay mineralogy were employed to determine the presence of discontinuities. Abrupt increases in gravel content within the profiles were the strongest indicators of discontinuities in upland profiles. The texture of the materials both above and below these discontinuities was typically sandy loam or loamy sand, however the mean gravel content of the uppermost material was lower (<10% volumetric estimate) than that of the material (~15-25%) found below the discontinuities. A number of hypotheses were developed and tested to determine the most likely origin of the discontinuities in these soils which, prior to this study, were thought to have developed entirely in till. Bioturbation, weathering processes, glacial phenomena, and subaqueous processes were all studied as possible causes of the discontinuities. The hypothesis of subaqueous erosion and deposition, most likely beneath the surface of a proglacial lake, seemed to fit best with the data. This hypothesis is supported by similarities to other glacial features suspected of having been submerged, and by evidence suggesting that water may have been ponded between two waning lobes of ice in the region.

No. 60042

# USE OF BOREHOLE AND SURFACE GEOPHYSICS TO INVESTIGATE GROUND-WATER QUALITY NEAR A ROAD-DEICING SALT-STORAGE FACILITY

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Borehole and surface geophysical techniques were used to investigate groundwater quality affected by road-deicing salt. Historical water-quality data indicated a salt-water plume in the glacial sand aquifer beneath a former salt-storage facility located near a public-water-supply well field. Geophysical techniques were applied when conventional water-sample collection from a monitoring-well network was unable to provide complete information about the vertical and horizontal extent of the salt-water plume. Borehole geophysical logs of electromagnetic conductivity and natural-gamma activity were used to infer ground-water quality above the screened intervals of the wells. The borehole-geophysical data and water-quality

data from the screened intervals of monitoring wells in the salt-water plume were used to determine a relation between the concentration of dissolved solids and the geophysical property, electromagnetic conductivity. With this relation, a conceptual, multi-layer model was made to show the vertical distribution of saline and brackish ground water in the vicinity of the monitoring wells. Surface geophysical surveys of terrain electromagnetic conductivity were used to obtain information about ground-water quality at locations where monitoring wells were not, or could not, be installed. Background terrain electromagnetic conductivity was measured in an area where water-quality and borehole geophysical data did not indicate saline or brackish ground water. The horizontal extent of the salt-water plume was mapped where terrain electromagnetic conductivity was greater than background.

No. 60144

# ANALYSIS OF AN UNCOMMON (LATE-ILLINOIAN THROUGH WISCONSINAN) SEQUENCE OF GLACIGENIC UNITS, YELLOW MEDICINE BLUFF, SOUTH-CENTRAL MINNESOTA

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Yellow Medicine Bluff exposes a 30.5m high section of glacial units along a cut bank of the Yellow Medicine River at Upper Sioux Agency State Park in south-central Minnesota. The goal of this study was to describe and sample the section to provide insight into the history of glaciation as well as differences in glacial processes from one glaciation to the next. In order to determine the number of distinct units preserved at the site, the provenance of these units, and depositional mechanisms, we described and sampled the different sedimentary facies. Analyses performed on samples included: point counts of sand-sized grains; anhydrite remnant magnetism; natural magnetic remanence; magnetic susceptibility; and x-ray fluorescence.

Results indicate that five tills are preserved, and that each unit represents a separate glacial advance. The provenance of the tills indicates the youngest two units (one and two) are of predominantly northwesterly provenance; unit four is of a more northerly provenance; and units three and unit five (the oldest) are of north-eastern provenance. This is consistent with what is known about glaciation in Minnesota. Till units one and two are separated by a clean, well-sorted sand and have higher percentages of sand than the other tills in this outcrop, suggesting that there has been considerable mixing and reworking of the underlying unit.

Natural Remnant Magnetism indicates the oldest till unit may have been deposited during an episode of reversed magnetic polarity, possibly during the Matuyama reversal event. If so, this would suggest an age of approximately 0.7ma or deposition during the Illinoian glaciation for the oldest unit. The preservation of a sequence of glacial units representing much of the history of late-Illinoian through Wisconsinan glaciation is uncommon and is deserving of more study.

Research for this study was funded by a grant from the N.F.S.- R.E.U. Program (NSR-EAR 9820249).

No. 60163

# LATE PALEOZOIC GLACIAL HISTORY OF THE RIO GRANDE DO SUL ARCH, SOUTHERN BRAZIL

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During the Gondwana glaciation the Rio Grande do Sul arch was the center of an ice mass that flowed radially toward the marine Paraná Basin. The paleogeographic evolution of the ice mass has been reconstructed on the basis of regional stratigraphic, sedimentological and paleontological data, as well as orientation of glacial abrasion features and facies of glaciogenic deposits (Itararé Subgroup).

At its maximum expansion (Middle/Late Carboniferous-Early Permian), the northern termination of the terrestrially based ice mass extended as far as the southern margin of the basin, where it stabilized as a marine margin. During this stage, the glacier may have been of ice sheet dimensions and 2-3 km or more thick.

The change in the basin configuration starting in the Early Permian resulted from subsidence to the south and uplift of its northwest flank. The consequent southward displacement of the basin margin led to gradual marine encroachment and stratigraphic onlapping upon the Rio Grande do Sul arch, as represented mostly by glaciogenic sediments remobilized and redeposited in a glacial-marine environment. The rise in sea level may have affected the disintegration of the ice mass by decoupling it from its base. Concomitantly, the ice sheet receded, eventually becoming restricted to the area of the present Rio Grande do Sul shield. During this time, radial flow of ice from the shield was mostly funneled through pre-glacial valleys. Itararé Subgroup strata preserved in the valleys comprise glacial-estuarine facies associations grading to terrestrial associations on the shield. The ice sheet collapsed and terminated in the late Early Permian.

No. 60012

# PALEOENVIRONMENTAL ANALYSIS OF PLEISTOCENE SHALLOW-WATER DEPOSITS ON SAN SALVADOR ISLAND, BAHAMAS

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The focus of this study is to determine the depositional environments of a 10.2 m rock core (97-2) taken on the western side of San Salvador Island, Bahamas.