

OHIO ACADEMY OF SCIENCE FIELD TRIP
Sunday, April 28, 1991

Cores and Crops: Hands-on Lithologic Data

by

Mike Angle, E. Mac Swinford and C. Scott Brockman

with contributions by

Mike Caudill, Ken Coats, Glenn Larsen, Ron Reily, Greg Schumacher,
Doug Shrake, Ernie Slucher, Jim Wooten and Garry Yates

ABSTRACT: This year's field trip will introduce, especially to the non-professional geologist, the two main sources of hands-on lithologic data used in geologic studies: cores and outcrops. **STOP 1** will be the Ohio Division of Geological Survey's (DGS) core library to examine cores that span most of Ohio's geologic section. Stops 2 and 3 will illustrate the utility and limitations of cores by viewing large exposures of some of the same intervals seen in core at the library. **STOP 2** will be a large natural exposure of drift. **STOP 3** will be in one of the largest quarries in the state to view drift and Devonian-age limestones.

**STOP 1: OHIO DIVISION OF GEOLOGICAL SURVEY CORE LIBRARY,
810 PHILLIPI ROAD, COLUMBUS, OHIO 43228**

The stop at the core library of the Ohio Department of Natural Resources, Division of Geological Survey has two main aspects. The first is to introduce the core library and describe its purpose and function. The second is to show selected intervals of core that have been drilled by the Survey's drill and auger rigs; these have been chosen to show a range of ages and rock types as well as to illustrate their use in geologic mapping and unravelling difficult geologic relationships.

The cores on display will illustrate some of the more interesting intervals of strata that have been drilled for various surface and subsurface investigations. A brief verbal explanation of the important information concerning each core will be given to the entire group by project geologists. Participants may then return to particular displays to examine and discuss the core in more detail with project geologists and each other.

Some of the cored intervals on display include:

The Middle Run Formation, the oldest known sedimentary unit in the State of Ohio;

The Rose Run Sandstone of Cambrian-Ordovician age, an oil and gas bearing unit in the upper portion of the Knox Dolomite; Ordovician-age bentonitic shale beds from the Point Pleasant Formation of southwestern Ohio;

Silurian and Devonian-age carbonates recently cored on The Ohio State University campus which contain the same limestone units we will see later at STOP 3;

A variety of Pennsylvanian-age lithofacies as well as the Mississippian-Pennsylvanian contact;

Two cores of Pleistocene-age material showing Wisconsinan-age till and lacustrine deposits from central and northern Ohio. Materials seen in these cores will be discussed at STOP 2.

The Survey has been actively involved in a core-drilling program since 1981 and has drilled, to date, 235 core holes yielding approximately 87,800 feet of core. These cores provide valuable geologic and mineral-resource information which is vital in order to meet future energy, mineral, and water resources needs of the state. Recently, much of the core drilled is in support of the Survey's mapping efforts in northeast, southwest, and most recently west-central Ohio. Core drilling has added essential data to the bedrock-mapping effort by allowing geologists to study long, continuous stratigraphic sections available in core rather than the short, scattered stratigraphic sections available from limited natural and man-made surface exposures.

The Survey moved into the present core warehouse facility in 1983. The core library has 27,000 square feet of floor space in which the Survey has stored 215,000 feet (more than 40 miles) of bedrock and glacial core, sample cuttings from 4500 oil and gas wells, and hundreds of samples of Pleistocene material. The cores and samples are available for public viewing from 8AM to 4PM Monday through Friday. A few days notice is requested in order that a staff member can be present to insure access to the building and to assist the user in finding the core and setting up an adequate place to work. The facility has binocular microscopes for viewing core and samples, a core splitter, a lighted and heated/air conditioned office in which to work, two lighted core examination tables (one with a built-in trim saw), an oil saw for cutting large rock samples, a trim saw for cutting small rock samples, a sample-cutting washer, and several halogen lamps for added light in some of the darker parts of the facility.

The Survey has recently adjusted the core-use policy to make core samples more accessible for scientific research by individuals and organizations. The Survey will still permanently preserve a portion (half split) of all the core. Destructive analysis or

viewing of the core off site requires a letter to Tom Berg, Division Chief and State Geologist, describing the details of the project. The proposal will be reviewed by Survey staff most familiar with the area of study. Upon approval, arrangements can be made to fulfill the request. Geologists, professional or student, are encouraged to take advantage of the massive collection of geologic information at the Survey core library.

STOP 2: Graessle Road Till Exposure of Battelle-Darby Metropark

SETTING: The main focus of southwestern Franklin County's Battelle-Darby Metropark is Big Darby Creek, a state scenic river and proposed national scenic river. Within its watershed are no major industrial sites, save for the new Honda plant near Marysville, thus keeping the creek relatively unpolluted and a safe haven for a rich fauna, especially bivalves (possibly the most diverse in the midwest). The Big Darby area is also the easternmost limit of the prairies that extend from the central midwest.

The till section near Graessle Road is within the park and has been maintained by active slumping and stream erosion at its base by an unnamed tributary to Big Darby Creek. Bedrock is 50 - 100 feet below stream level. Small remnant prairies of only 0.25 to 2 acres dot adjacent terraces and hill tops.

THE CUT: The Graessle Road till cut is so large as to thwart attempts to understand it fully. Our purpose today is to become acquainted with the range of vertical and lateral variability common in a large cut and by analogy, the unexposed drift throughout the region. A single core, or even several taken from the bluffs would give an incomplete picture of the range of properties of the drift.

There are several notable properties of the till:

MATRIX - silt loam to loam; texture varies from thin (<1mm) con-torted sand layers to sandy and gravelly zones. Some variation in color may be due to the water-holding ability of more or less sandy areas.

CLASTS -

Lithology - pebbles to boulders of variable lithologies, mostly limestone (local Silurian and Devonian). A particular type of erratic, Gowganda Tillite, is easily identifiable and comes from a source area in Ontario 450 miles due north of this site; the provenance of most other erratics can only be called "northish".

Shape - clasts that are faceted and bullet-shaped, often with visible striations, are diagnostic or originally iso-dimensional clasts that have spent some time in the erosive debris-rich base of the glacier.

JOINTS - are easy to identify in gray unoxidized till as roughly horizontal and vertical areas of oxidized (brown) till. The joint surfaces here may be coated with clay, silt or sand and may also have an icing of secondary calcite or gypsum. Most water movement through till occurs along these joints.

FACIES - The presence of a particular facies or depositional mode of till is often conjectural. There are three general till facies which differ in geologic and hydrologic properties; basal melt-out till is the most common till facies.

Basal melt-out till - deposited by melting stagnant ice from its base upward; considered massive with sand and gravel lenses, drape features and clasts from more distant derivations.

Lodgment till - deposited by active basal ice through smearing. Striated, faceted and bullet-shaped clasts have fabric and striations parallel to local ice movement; contains more local clasts.

Surface melt-out till - deposited by melting surface ice as debris flows; texture as found in other till facies but more variable due to the washout of fines; fabric locally consistent, but not over larger areas.

INTERCALATED UNITS AND STRUCTURES - sand and gravel units are thin (<1m) suggesting they represent periods of short ice-margin fluctuations and not larger-scale retreats and advances. Significant lithologic differences above and below a clastic unit are often interpreted as a major readvance, especially when a till overriding a sand and gravel deposit is clayier than the till under it (usually a till overriding sand and gravel will have a sandier texture simply from incorporation). Folding, faulting and glacio-tectonic pinch-outs in these clastic units most likely indicate post-depositional activity by ice.

Modern geologic processes are also richly illustrated in this area including erosion, slumping, fan formation, alluviation, and floodplain and terrace formation.

LUNCH: We will caravan to Stringtown Road where there are many fast food restaurants. Lunch is on your own.

STOP 3: AMERICAN AGGREGATES QUARRY, FRANK ROAD.

NOTE: Our host, American Aggregates, has been very gracious in letting us into their quarry. The quarry is not in operation today, however, hard hats are required and can be obtained from field trip leaders. To travel in the quarry we will consolidate into as few cars as possible. Stay close when driving so as not to get lost. Please avoid standing directly underneath rock overhangs and getting too close to the edge of highwalls. Be careful climbing around and enjoy!

PLEISTOCENE MATERIALS AT THE AMERICAN AGGREGATES QUARRY

We will be stopping at a couple of different vantage points to view the glacial deposits. Stratigraphic correlations at this stop are difficult because of the complex, highly variable nature of these deposits and the fact that the upper portion of the section has been removed in most areas. This stop is ideal for viewing facies changes and depositional environments. Imagine how different "representative" auger corings taken a few hundred yards apart would look!

The site roughly lies on the western margin of a large buried valley system which underlies the modern Scioto River and Big Walnut Creek. American Aggregates has removed from 50 to 150 feet of drift in order to quarry the underlying limestone in this area. The abundance of relatively clean sand and gravel deposits at the site has made the stripping process economically feasible.

In the upper portion of the section exposed in the western end of the quarry, a relatively persistent till is readily visible. The till unit is approximately 15 feet thick and is underlain and overlain by sand and gravel outwash. The till is dense, hard, dark gray, silty, calcareous and contains abundant pebbles and cobbles. Superficially, the till at this site resembles the till at Graessle Road. The coarser outwash deposits provide an excellent example of a braided-stream environment. Well-developed cross-beds, trough and point bars are present and excellent examples of the truncation of beds can be found. Fine sand, silt and even clay deposits mark times of more sluggish drainage and ponding as ice or sediment choked the drainageways. Examples of clay-filled oxbow cut-offs have previously been viewed within the site. It is interesting to speculate on the rapidly changing energy levels and bed loads of these streams. Try speculating on the relative proximity of the ice sheet margin while examining these deposits.

It is interesting to note the spectacular bands of iron-staining visible within the outwash. Highly-stained zones are commonly adjacent to very similar looking layers which lack the brilliant oxidation. "Micro" changes in coarseness, porosity, and sorting locally increase the permeability and have allowed water

to circulate more freely in these zones. The coarse outwash deposits in general provide excellent pathways for groundwater movement as is obvious from the abundance of well-developed seeps visible throughout the quarry. Interestingly, dewatering efforts by American Aggregates has had the beneficial effect of lowering the local water table sufficiently below the base of some nearby abandoned landfills.

BEDROCK AT THE AMERICAN AGGREGATES QUARRY.

The Devonian-age Columbus Limestone is the bedrock interval quarried at this operation although several feet of Delaware Limestone are reported to be present in the uppermost portions of the quarry. According to the 1990 Report on Ohio Mineral Industries (in prep) 1,121,120 tons of limestone were produced from this quarry in 1990, when the price of limestone was \$3.60/ton. This quarry is one of the largest in the state and produced about 2% of Ohio's limestone last year. The stone is used for making cement and asphalt and as road construction material and building stone. Core data indicates that the Columbus Limestone is approximately 95 feet thick within the quarry. The lowermost 10 to 15 feet lie below the quarry floor. The Columbus Limestone, described in a measured section taken within the quarry, is gray, fine- to coarse-grained, medium to massive bedded, and fossiliferous in the upper two-thirds becoming light- to dark-brown to brownish gray, dolomitic, cherty in the lower one-third (22 feet). Fossils include brachiopods, corals, crinoids, and gastropods.

Well-developed solution features occur on the upper surface of the bedrock in parts of the quarry. The linearity of these features suggests they are joint controlled. According to Ken Coates of American Aggregate Inc., these solution features can transect the entire quarried interval at this operation. Clay, sand, and gravel fill these solution features and make quality control difficult for limestone removed near these features.

A trip to the quarry floor will be arranged for those wishing to get a better look at the lower portion of the Columbus Limestone exposed in the highwall.

THANK YOU FOR YOUR PARTICIPATION!

