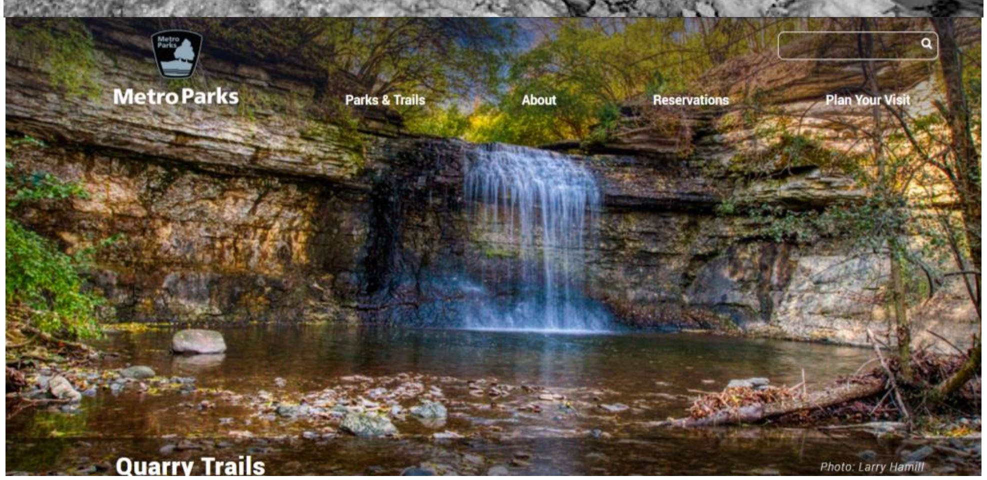
Geology Tourbook
Quarry Trails MetroPark and Marble Cliff Quarry

The Ohio Geological Society

Based on: Guidebook for the Marble Cliff Quarry by **Mac Swinford**
for *The 2004 American Association of Petroleum Geologists Eastern Section Meeting*



Geology Tourbook for Quarry Trails MetroPark & Marble Cliff Quarry

Based on guidebook prepared by Mac Swinford (2004)

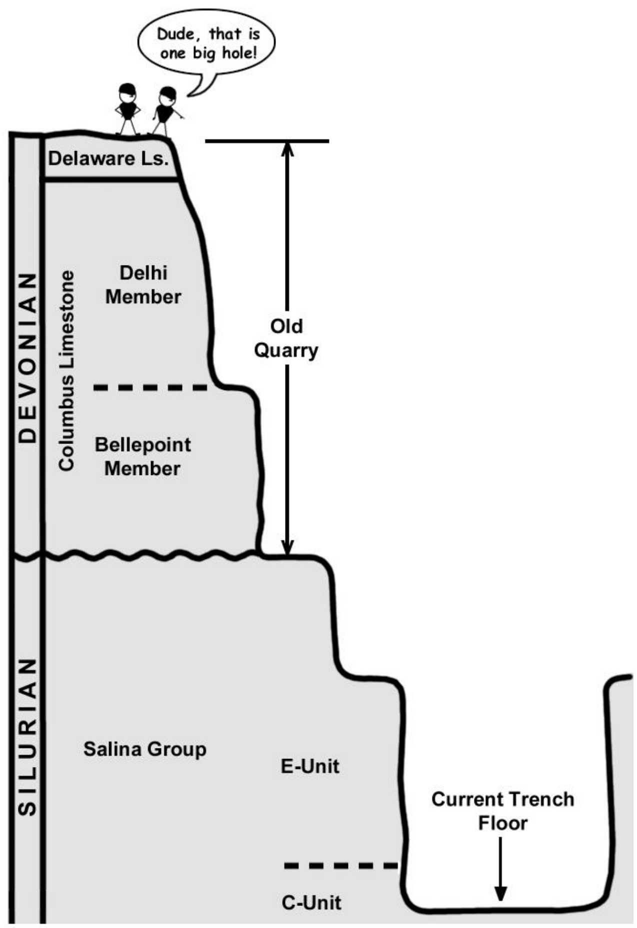
The Marble Cliff Quarry is operated by Shelly Materials, Inc. and is located in western Franklin County, Ohio, in Norwich Township. The quarry has been operating since the 1850's and at one time employed approximately 400 people, who used hand tools to produce dimension stone and lesser amounts of agricultural lime. Even with the large work force, only a few thousand tons of stone could be extracted per year from this operation. Many foundations and windowsills in Columbus' older homes are made of dimension stone from the Marble Cliff Quarry. Other historic uses of the stone include ballast, roads, concrete lime, fertilizer, and the manufacture of glass and soda ash.

"In 2021, Metro Parks has turned an abandoned quarry into a recreation destination for Franklin County residents and beyond. Quarry Trails, the 20th Metro Park, is located within 5 miles of 350,000 residents, fulfilling a need for access to a park in this area and having a Metro Park within 5 miles of every Franklin County resident. Current amenities include trails, observations areas, a single-track mountain bike trail, a picturesque 25-foot waterfall and lakes.

Located on the site of the Marble Cliff Quarry which was once the largest contiguous quarry in the United States it provided limestone for over a century that was used to build the Ohio Statehouse, roads, buildings and many other places in Central Ohio. Funding for the park is a result of the generosity of Franklin County residents through their support of our tax levy and grants." (Source: https://www.metroparks.net/parks-and-trails/quarry-trails/)

The Marble Cliff Quarry has produced up to 1.6 million tons per year of crushed stone. The quarry uses controlled explosions to initially break the wall of rock, large machinery to extract and crush the stone, and automated conveyor systems to move the stone efficiently. The machinery can be viewed adjacent to the Quarry Trails MetroPark. Limestone quarries are an essential part of the local economy. Local sources of limestone are an important component to the health of the central Ohio construction industry by keeping the cost of aggregate low. Aggregate extracted at this quarry is used for riprap, road construction, road resurfacing, and building foundations.

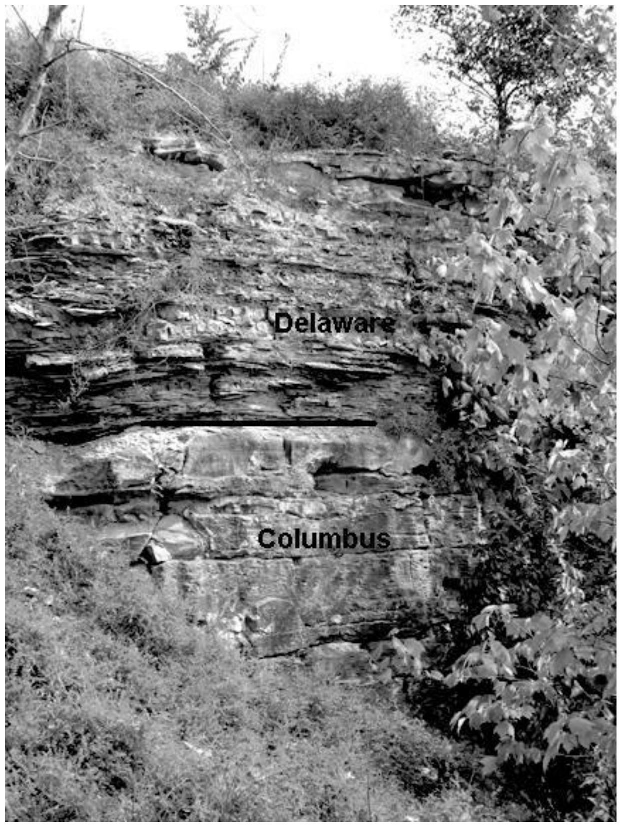
The Marble Cliff Quarry today covers over 600 acres and exposes approximately 250 feet of Silurian-and Devonian-age limestone and dolomite. Glacial cover above the uppermost bedrock surface is less than 10 feet thick where exposed at the north edge of the site. Glacial deposits consist of Wisconsinan-age (11,000-75,000 years ago) till in the uplands and outwash in the lowlands closer to the Scioto River. Bedrock units exposed in the highwalls consist of, in descending order, the Delaware Limestone, the Columbus Limestone, both of Devonian age (438 to 408 millions of years before present) and the Salina Group of Silurian age (408 to 360 millions of years before present). A major unconformity separates the Devonian-age rocks from the Silurian-age rocks and represents the boundary between the Tippecanoe and the overlying Kaskaskia sequence of Sloss (1963).



Stylized drawing of the rock units, their ages, and the current configuration of the quarry. Not to scale.

Below is a brief description of each rock unit exposed in the quarry in descending order. The descriptions are taken from Janssens (1969, 1970) and Swinford and Slucher (1995).

Delaware Limestone (Middle Devonian)—limestone (23.5 feet thick), medium-gray to brownish-gray, finely to coarsely crystalline, fossiliferous in part; nodular chert; bedding 4 to 8 inches thick; some weathered zones have shaly appearance (Figure 4). Upper contact with the Olentangy Shale is not present in the quarry.



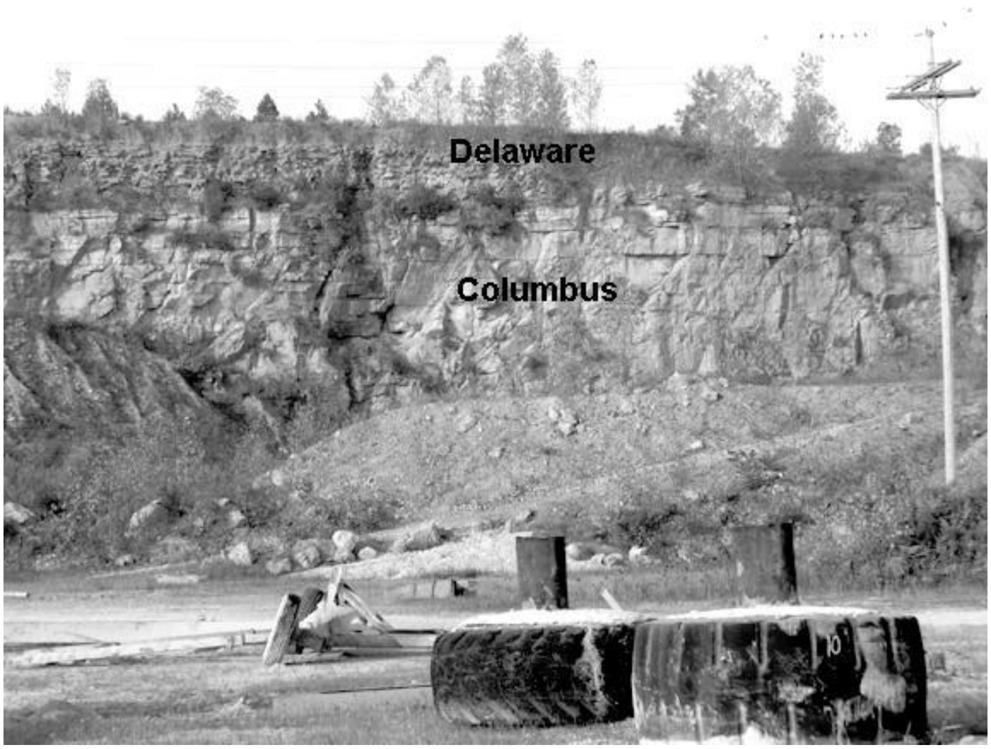
Contact between the Delaware Limestone and the underlying Columbus Limestone at north end of the quarry (exposure approximately 10 feet high). A thin layer of shale at the top of the Columbus Limestone (black horizontal line) is a bone bed with abundant phosphatic fish plates or teeth.

Columbus Limestone (Middle Devonian)—limestone and dolomite (91 feet thick total). Limestone (upper 41 feet of unit; Delhi Member), light-gray, finely to coarsely crystalline, slightly argillaceous; zones of abundant white to gray chert; abundant fossil fragments including brachiopods, coral, and echinoderms; massive bedded with intervals of irregular to nodular bedding with ripple marks; 80 to 92 percent calcium carbonate. Dolomite (lower 50 feet of unit; Bellepoint Member, yellowish-brown, finely crystalline, calcareous in part, slightly argillaceous; white to gray chert nodules; some hydrocarbon staining; poorly preserved fossil molds; massive bedded; intercrystalline and moldic porosity. Lowermost 5 feet of unit commonly contains medium- to fine-grained, well-rounded to subangular quartz sand and basal conglomerate containing rounded pebble- to cobble-sized clasts of underlying Salina Group and chert. Upper contact of the Columbus Limestone is marked by a 3-inch-thick shale or shaly limestone containing phosphatic fish remains, called a bone bed, but this lithology may be locally replaced by 1 inch of chert. This bed has been suggested to mark the position of the Tioga bentonite (volcanic ash bed) (Janssens, 1969).

The Devonian-age Columbus Limestone and Delaware Limestone have been extracted at this quarry over most of its 150-year history. The Delaware Limestone, present at the top of the quarry in the northern and western highwalls, is a thin interval and the rock contains argillaceous material. The Columbus Limestone, the main unit quarried at this site, has two distinct facies, the upper Delhi Member, and the lower Bellepoint Member.

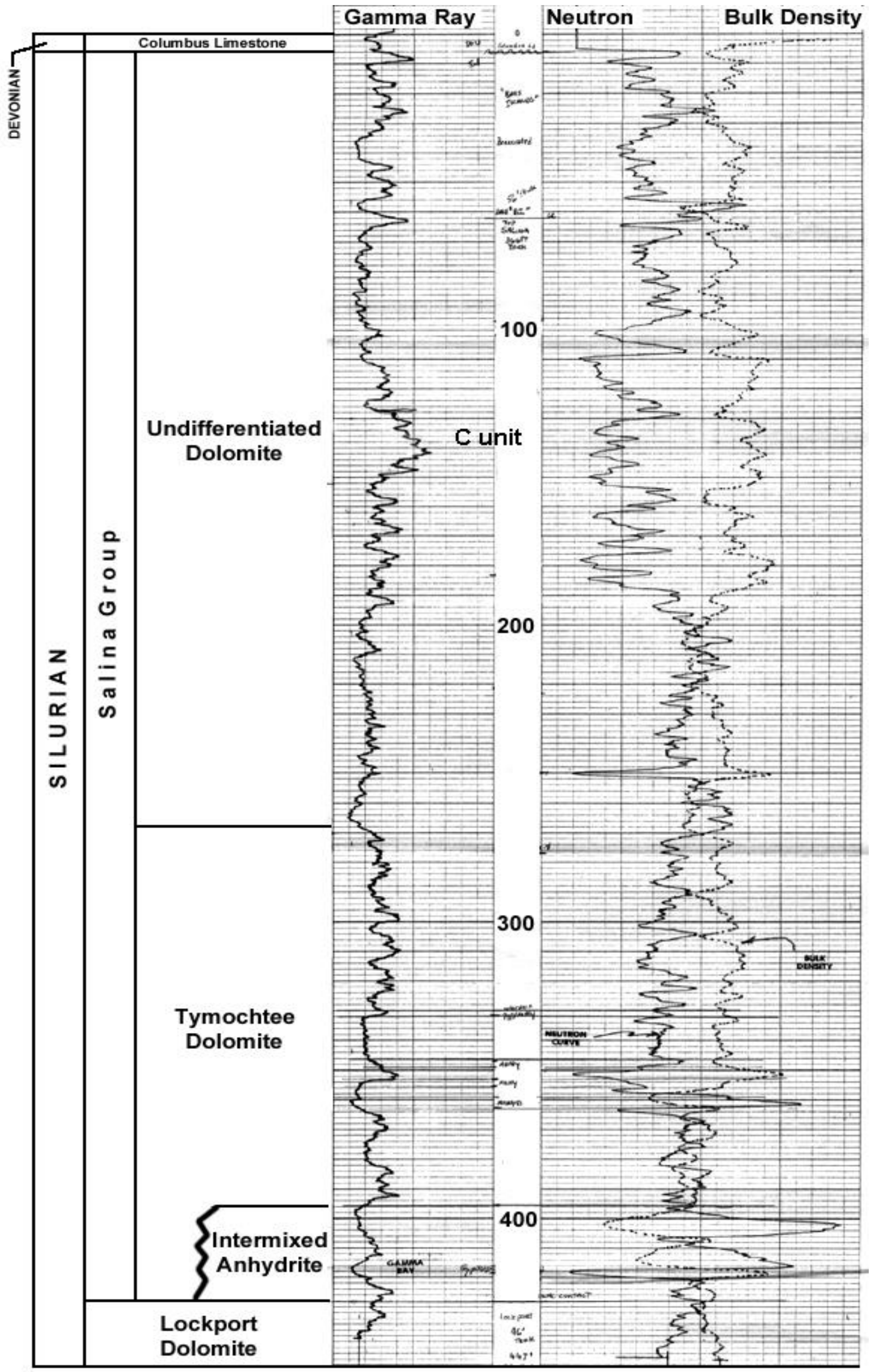
The Delhi Member is light in color, low in argillaceous material, and has a high calcium carbonate content, ranging from 80 to 92 percent. These characteristics make this interval a desirable source of aggregate and some of the highest quality stone in central Ohio. This rock also is the most highly fossiliferous rock in central Ohio and a favorite target of fossil hunters. Most of the mineable Delhi Member has been quarried out. Joints or karst features have compromised the quality of the Delhi that remains.

The Bellepoint Member is a dolomite or dolomitic limestone that is distinctly brown in color, slightly argillaceous, and lower in calcium carbonate than the Delhi Member. The Bellepoint Member is a less desirable stone because of the lower calcium carbonate content and the high amounts of intercrystalline and moldic porosity; both characteristics affect the aggregate quality, strength, and durability. Reserves of the Bellepoint Member also are nearly exhausted.



West highwall of Marble Cliff Quarry exposing Delaware Limestone (dark colored, thin bedded unit) and Columbus Limestone (light colored, massive bedded unit).

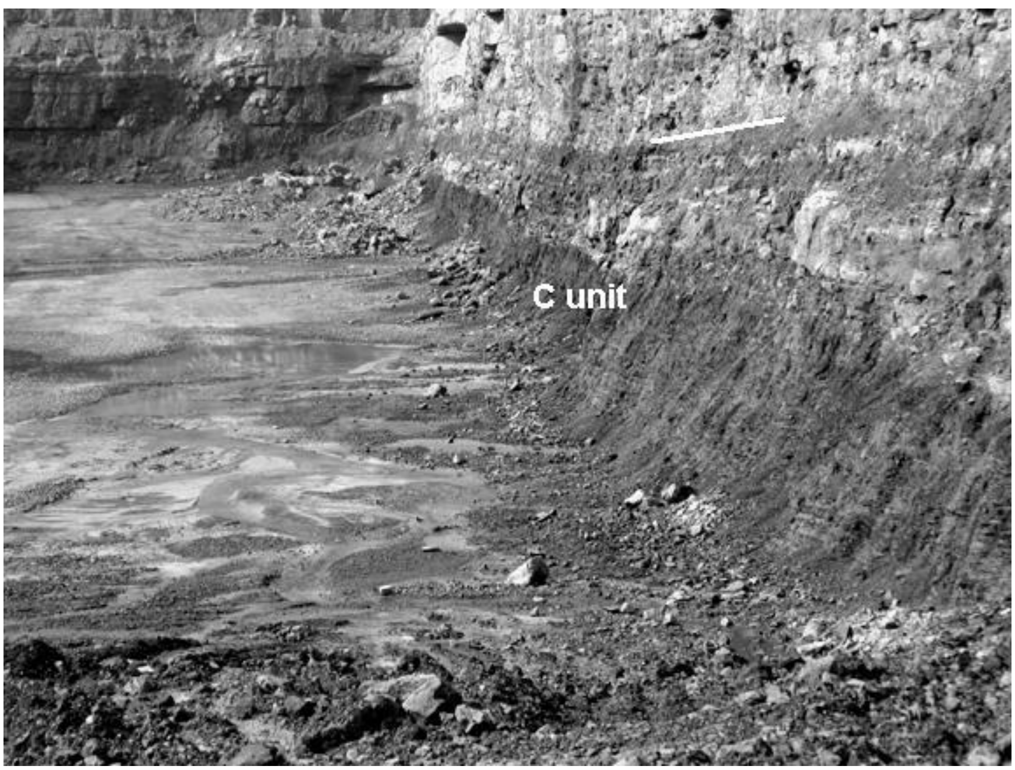
Salina Group (Upper Silurian)**—**dolomite (270 feet thick as determined from core and borehole geophysical logs), yellowish-gray, pale-yellowish-brown, microcrystalline to finely crystalline, slightly to moderately argillaceous; thins beds to laminae of dolomitic to calcareous shale; thin bedded to massive; abundant faint to distinct laminae; stromatolites; birdseye structures. Interval of gray to dark-gray shaly dolomite (37 feet thick) present in middle portion of the formation and is regionally known as the C unit of Janssens (1977). A portion of the C unit is exposed in the lowermost portions of the trench.



Geophysical log of a core hole drilled at the base of the quarry floor showing the stratigraphic units exposed in the trench and below the trench floor. The target zone of the underground mine lies below 220 feet and above approximately 300 feet. Note the gammaray signature of the C unit.

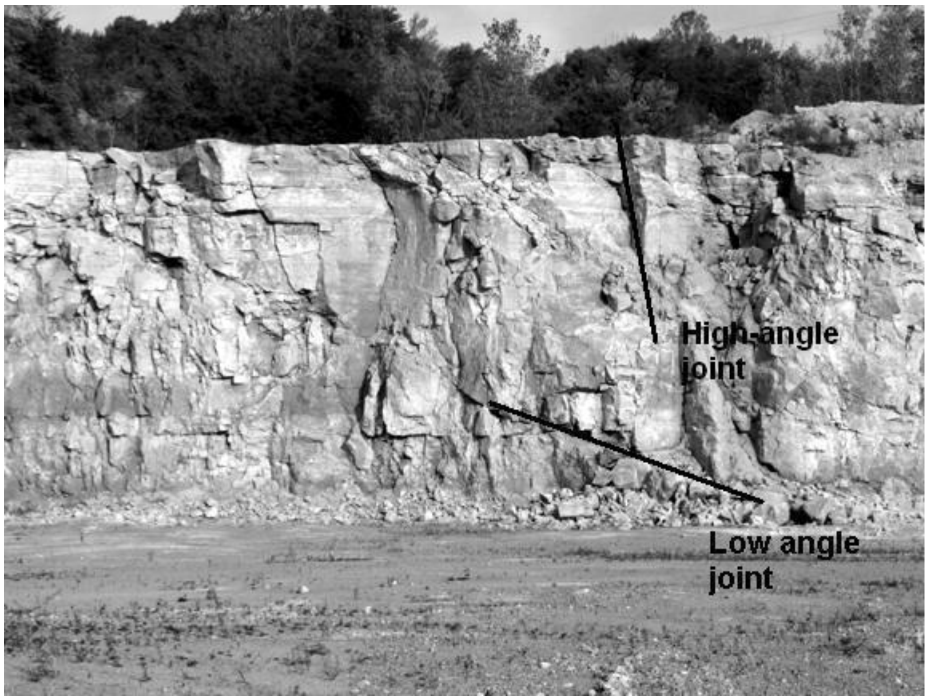
Current Quarry Activity- Today, reserves of the Columbus Limestone at the Marble Cliff Quarry have been removed, and cultural growth and the Scioto River preclude lateral expansion. Shelly Materials, Inc. has explored the rocks of the Salina Group beneath the current quarry floor in search of an interval of stone with suitable chemistry and thickness to extend the life of the operation. Exploratory core drilling in the quarry floor has revealed an interval of high-quality stone approximately 75 feet thick beginning approximately 220 feet beneath the old quarry floor. The target stone is a calcium-rich, clean interval at the base of the upper undifferentiated dolomite of the Salina Group and the upper portion of the underlying Tymochtee Dolomite. Rocks of the Salina Group that lie between the quarry floor and the zone of high- quality rock are of poorer quality than the Columbus Limestone. Dolomite and argillaceous content degrade the rock quality, making this interval useful only as aggregate fill material.

The current trench highwall is composed of undifferentiated dolomite of the Salina Group. Rocks in the upper portion of the trench are medium gray, finely crystalline to microcrystalline dolomite. Near the base of the trench, the lithology changes from medium gray to greenish gray in appearance and has an increased amount of shale. This interval is believed to be the C unit of Janssens (1977), which he described as an anhydritic silty greenish-gray dolomite. Excluding the anhydrite, these characteristics adequately describe the interval exposed at the base of the trench.



The C unit of the Salina Group is exposed in the basal 20 ft of the trench. The C unit, a shaly dolomite, is a marker bed in the Salina Group traceable over much of western Ohio on oil & gas well logs.

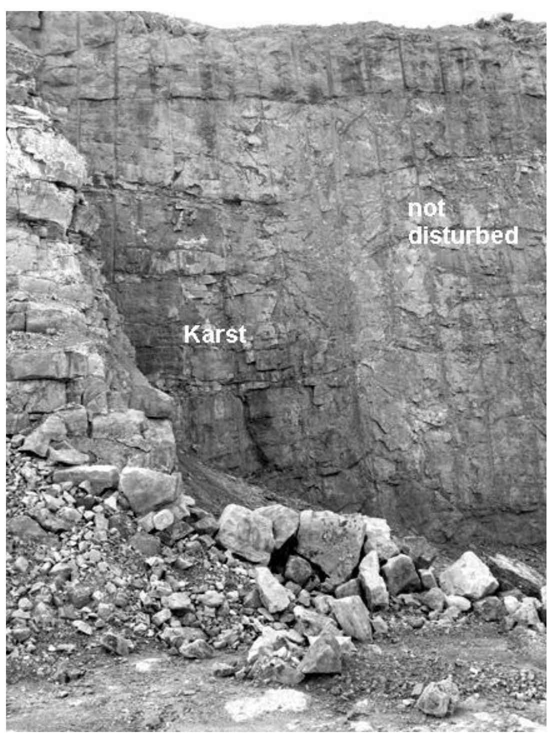
The existing highwall and the C unit present challenges to mine engineers designing safe and stable mine highwalls. The C unit is highly fractured and broken, which reduces highwall strength. The placement and height of the highwall benchs will accommodate the broken interval. Other problems to consider are joints in the rock. Several joint sets are present in the quarry face; high-angle northwest-southeast- and northeast-southwest- oriented joints create vertical faces and low-angle joints, particularly on the east end of the south wall. Regional tectonic events associated with mountain building (Taconic, Acadian, and Alleghany orogenies) are likely sources of the compressional and tensional forces that caused the high-angle joints. Vertical or near-vertical joints with a northwest-southeast and northeast-southwest orientation are common in central and western Ohio. The low-angle joints, best developed in the Columbus Limestone, may have resulted from the onset and release of vertical pressure created by the weight of glacial ice. Glacial ice is believed to have been up to 3,000 feet thick in central Ohio during the last glacial event. The presence of the Scioto River Valley adjacent to the quarry may also be a factor in joint development.



This highwall exposes the Bellepoint Member of the Columbus Limestone. Low-angle & high-angle joints in the rock are important factors in quarry blasting patterns used to detach the rock from the highwall and for highwall stability. Caves and sinkholes, collectively referred to as karst, also create problems with blasting in the quarry. A portion of the northwest corner of the quarry has not been quarried because of open caves or sediment-filled caves, which make blasting expensive and results erratic.

The trench highwall, particularly on the south side, displays disrupted bedding planes interpreted as paleokarst. The upper surface of the Salina Group was exposed for a considerable length of time at the end of Silurian time and the beginning of Devonian time. No Lower Devonian-age rocks are present at this site, and north to south across Ohio, Devonian rocks unconformably overlie increasingly older Silurian strata. During this lengthy exposure and erosion of the carbonates, karst developed in the upper portion of the Salina Group. The karst features collapsed and were filled in with surrounding rock. These possible examples of paleokarst features are spectacularly preserved in the highwall and can be identified as areas of disruption to the even bedding present along the trench highwall surface.

The south highwall of the trench exposes paleokarst features formed during exposure of the Silurian surface prior to the onset of the Middle Devonian transgressive seas. Thick vertical lines show the position of selected collapsed features.



This close-up view of the east end of the south trench highwall shows a good example of paleokarst in the upper portion of the Salina Group and the adjacent beds that are not disturbed beds.

Acknowledgments

Thanks to Mac Swinford for preparing this guidebook. Special thanks to Shelly Materials, Inc. for providing support for the guide. Glenn E. Larsen of the Ohio Geological Survey produced all photographs and artwork in this guidebook, excluding figures 1 and 2. Merrianne Hackathorn, Greg Schumacher, and Glenn Larsen provided helpful comments to this guidebook.

References and further reading

Janssens, Adriaan, 1977, Silurian rocks in the subsurface of northwestern Ohio: Ohio Division of Geological Survey Report of Investigations 100, 96 p., 26 figures.

______________, 1970, Guidebook to the Middle Devonian rocks of north-central Ohio: Ohio Geological Society, 30 p., 7 figures.

______________, 1969, Devonian outcrops in Columbus, Ohio, and vicinity: Field trip guidebook, 3rd annual meeting of the North-Central Section of the Geological Society of America, Ohio Geological Survey, p. 1-1 to 1-22, 13 figures.

Ohio Division of Geological Survey, 2002, 2001 Report on Ohio Mineral Industries; Annual Report of the Ohio Division of Geological Survey, 155 p., 21 figures, 30 tables.

Sloss, L. L., 1963, Sequences in the Cratonic Interior of North America: Geological Society of America Bulletin, v. 74, p. 93-114.

Stauffer, C. R., 1909, The Middle Devonian of Ohio: Ohio Division of Geological Survey Bulletin 10, 204 p., 17 plates.

Stauffer, C. R., Hubbard, G. D., and Bownocker J. A., 1911, Geology of the Columbus Quadrangle: Ohio Division of Geological Survey Bulletin 14, 133 p., 16 figures, 28 plates, 3 maps.

Stout, Wilber, 1941, Dolomites and limestones of western Ohio: Ohio Division of Geological Survey Bulletin 42, 468 p.

Swinford, E. M., and Slucher E. R., 1995, Regional bedrock geology of the Bellefontaine, Ohio, 30 x 60 minute quadrangle: Ohio Division of Geological Survey Map 8, scale 1:100,000.