

THE BLACK HAND FORMATION IN NORTH CENTRAL OHIO

RICHARD C. LORD,
Gambier, Ohio

The Mississippian series in central Ohio consists of a series of alternating sandstones and shales, the thin vein of the Maxville limestone being absent. These are more generally known as the Waverly. The epeiric basin in which they were deposited was unquestionably subject to variation in water currents and consequently a fine grained sandstone or a free-stone and a shale may be found in the same facies at no great distance apart horizontally. On this account the correlation of the various subdivisions into which the Mississippian series in this area may be divided is difficult.

Between the Berea grit, a persistent sandstone which is near the base of the Mississippian, and the Pennsylvanian, another sandstone which has been given the name of the Black Hand from the narrows of the Licking river, east of Newark, where there is an exposure two miles long in an east-west direction, persists from the Ohio River northward to some distance north of Mansfield. This sandstone has been traced from the Ohio river to the Licking river, in southern Ohio by Hyde.¹ The horizon of this sand is known to the oil driller as the Big Injun and the sandstone is found in most well records in eastern and southeastern Ohio.

North of Newark, where the surface has not only been subject to the erosion of two ice sheets, but is covered with glacial till to varying depths, the present outcrops are fewer and the former extent of this sandstone must be determined with the aid of well records, both water and oil.

The Black Hand is a coarse, sharp sandstone with varying binders. In some localities the sandstone is gray, comparatively free from iron, and easily crushed into a good grade of glass-sand; in other localities the color is a light buff and is quarried for building stone. The general characteristic is its coarseness, sharpness and the frequent presence at various levels of a quartz pebble conglomerate, the pebbles varying

¹Jour. Geol., Vol. XXIII, p. 665 seq.

in different localities from a maximum of one to one-quarter inch in diameter. The outcrops of the sandstone in this area vary from 20 to 70 feet in thickness, though some well records indicate a greater local thickness.

Another characteristic of the Black Hand, in which fossils have not been found, is the presence from five to thirty feet above its top, of a shale and fine sandstone strata that is fossiliferous. This is always found except in localities where erosion has removed the higher strata.

Fig. 1 is a map of the area from Licking to Richland and Ashland counties, on which are marked the outcrops, quarries and some well records of the Black Hand sandstone. The various locations are numbered on the map and the elevations of the top of the sandstone above sea level indicated. These outcrops are briefly described:

1. Black Hand Narrows of Licking river, Hanover twp., Licking county; forty foot exposure, ten feet containing quartz pebbles.
2. Pennsylvania railroad cut, one mile east of Hanover village, Hanover twp., Licking county; twenty-five foot section.
3. Rain Rock, Eden twp., Licking county. The Black Hand outcrops also on Rocky fork, west of Rain Rock.
4. Abandoned stone quarry on top of hill, one mile south of Utica, Washington twp., Licking county; twenty-five foot section exposed.
5. Along bank of Wakatomika creek, sec. 24, Jackson twp., Knox county; thirty foot section exposed, one-quarter to one inch conglomerate about the middle.
6. Rocky Hollow and Millwood Sand Co. quarry, along Kokosing river, two miles southeast of Millwood, Union and Butler twps., Knox county; 40 foot section exposed, quartz pebbles in three feet of section, western part of outcrop.
7. Water wells in glacial till, near Polk school and Weaver school, Liberty twp., Knox county; the drilling records show 30 and 130 feet, respectively, to rock, which places top of sandstone in both wells at 1,260 feet and indicates that strata above Black Hand had been eroded prior to or by glaciation.
8. Keller's Rock, southwestern part sec. 8, Pike twp., Knox county, along Little Schenck creek; 20-foot exposure, five feet of which contain one-quarter inch quartz pebbles.
9. Quarry, north of state road 97, sec. 13, Jefferson twp., Richland county; fifteen feet sandstone exposed.
10. Clear Fork, Mohican river, sec. 7, Hanover twp., Ashland county; Lyons Falls is an overhanging sandstone ledge fifty feet high, with concave under surface, similar to Ash Cave, Hocking county; sixty feet exposed, one-half inch quartz conglomerate near bottom. These exposures of the Black Hand are in the upper part of Mohican State Park.

county the interval is about 2,250 feet, the distance being about 22 miles.

If the facies from the top of the Black Hand to the Berea

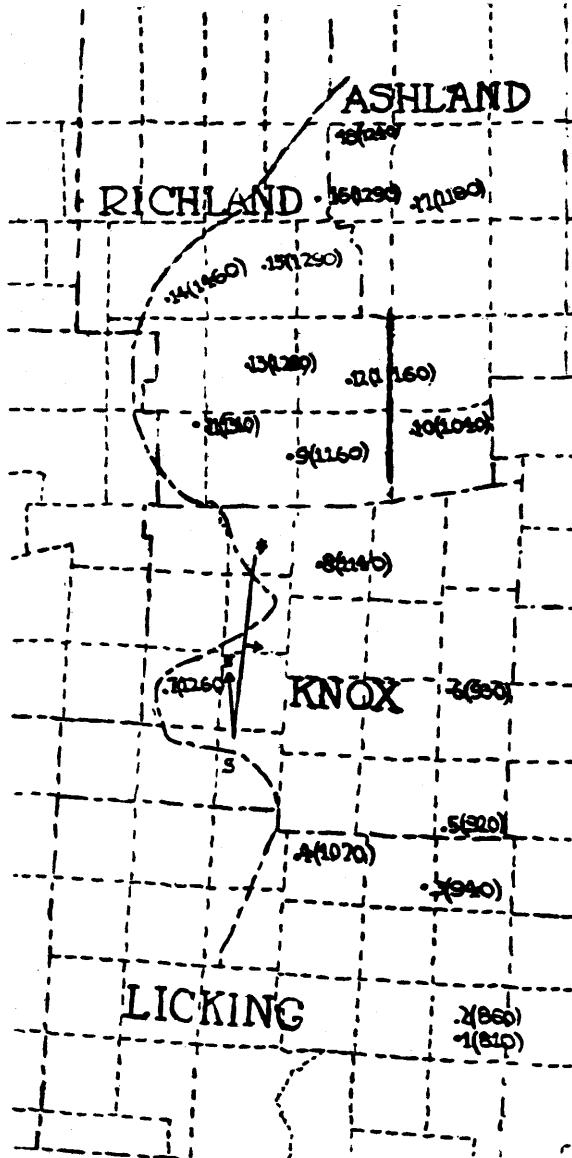


FIG. 1. Axis of the Dip of the Black Hand. Western Extent of the Black Hand.

11. Water well, west sec. 1, Perry twp., Richland county; elevation of well head 1,320 feet, 11 feet to sandstone, rock more than 160 feet thick.
12. Along Switzer creek, sec. 34, Monroe twp., Richland county; 25 feet exposed, one inch quartz pebbles at top, one-eighth inch conglomerate through entire section.
13. Opossum run, east sec. 16, Washington twp., Richland county; forty feet exposed, twenty-foot waterfall, concave "cave" behind fall.
14. Quarter mile northeast of elevation 1,500, sec. 34, Springfield twp., Richland county; coarse grey sandstone with quartz pebbles, fifteen feet exposed. This is the second highest area in Ohio.
15. Old stone quarries, sec. 15, Madison twp., Richland county, north of Mansfield, near state reformatory; sixty-foot section, no conglomerate.
16. Old stone quarry, north of Pavonia school, sec. 31, Weller twp., Richland county; fifty feet exposed quartz conglomerate in irregular vein, six inches thick, 30 to 40 feet from top.
17. Water well, northwest sec. 32, Montgomery twp., Ashland county; well drilled into soft grey sandstone.
18. Northwest sec. 16, Milton twp., Ashland county; sandstone within ten feet of surface of entire knob, thickness of sandstone eighty to ninety feet, water beneath rock.

A correlation of these sections and well records, as shown in Fig. 1, indicates that the Black Hand sandstone in this area is variable in thickness and that the general dip of the top of the sandstone is uniform and approximately nineteen feet to the mile in a direction south of east. The top of the Black Hand is more uniform as measured stratigraphically and the variation in thickness seems to occur at the base of the formation.

From well records in central Liberty township, Knox county, the top of the Black Hand is 1,260 feet above sea level, and the top of the Berea grit 600 feet; in sec. 15, Perry township, Coshocton county, the top of the Big Injun sand is 860 feet and that of the Berea grit 190 feet above sea level. In the twenty-two mile distance across Knox county from west to east the dip of the Black Hand and of the Berea is about nineteen feet to the mile for both and the interval between them is uniformly about 650 feet. Other well records confirm this uniform thickness of the lower Waverly strata in Knox county. In contrast the thickening of the strata between the Berea grit and the Clinton sand in an east-west section across Knox county is pronounced. In western Knox county the interval is slightly more than 1,600 feet and in eastern Knox

grit is designated the Cuyahogan and the facies above the Black Hand the Logan, the thickness of the Cuyahogan is uniform in the area under consideration. Such is not the case with the section of the Logan. In Pike township, Knox county, the Harrison ore, or basal conglomerate, of the Pennsylvanian is found on the surface a mile east and southeast of North Liberty, at a level 180 feet above the Black Hand, at Keller's Rock. On the Wakatomika creek, in sec. 24, Jackson township, Knox county, the basal conglomerate is 110 feet above the top of the Black Hand and 110 feet below the No. 2 or Quakertown coal. The lack of uniformity in thickness of the Logan is general in Knox county.

That the western extent of the Black Hand formed an escarpment prior to glaciation is definitely indicated by the variation in hilltop levels to the west and northwest of Knox county. A study of the topographic sheets shows that the uniform westerly rise of the resistant Black Hand causes the elevated area extending from the highlands around Olivesburg, Weller township, through Richland county to the west of Mansfield, where in sec. 34, Springfield township, the second highest area in Ohio has an elevation of over 1,500 feet, and a bedrock covering of less than 20 feet; thence southerly including Liberty township, Knox county, where the Black Hand is covered with glacial till to a depth varying up to 130 feet. The western extent of the Black Hand is indicated by the irregular line on Fig. 1. Several of the higher areas along the western limit of the Black Hand are outliers due to stream channels having been cut through the sandstone prior to glaciation. Also, in Liberty township, west of Mt. Vernon, the highest area in Knox county is covered with glacial till above the Black Hand, while in Pike township, northeast of Mt. Vernon, over 100 feet of Logan thin sandstones and shales overlie the Black Hand. The persistence, resistance to erosion and the stratigraphic plane of the top of the Black Hand sandstone, as described above, furnishes a definite horizon for the division of the Cuyahogan from the Logan.

In the exposure of the Black Hand, near Millwood, Knox county, where the Kokosing river has cut through the sandstone and weathered vertical sections along the stream show surface erosion indicating possible bedding planes with an inclination of from 15 to 20 degrees to the east.² Excavations

²Geol. Survey of Ohio, vol. III (1878) p. 337.

in the Millwood sand quarry show no bedding planes with a greater dip than the normal 19 feet to the mile. The cause of these possible bedding planes which incline such an angle may be due to a sloping basin or delta in which the sandstone was originally deposited. While there are indications in eastern Knox county of slight waves of minor anticlines and synclines with crests at intervals of about four miles, as determined by the occurrence of natural gas in the Berea, neither the location



FIG. 2. The face of the sandstone at Rocky Hollow.

of these crests nor the amplitude of the waves would account for the sloping bedding planes of the Rocky Hollow sandstone walls. Fig 2 is an illustration of the face of the sandstone at Rocky Hollow.

The fossils found in the shale-sandstone strata above the Black Hand are:

Crenipecten winchelli.

Conularia sp.

Syringothyris texta.

Camarotoechia sageriana (or sp.).

Productus sp.

Crinid stems.