Karst Features and the Dissolution of Carbonate Rocks in Crawford County

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Over a long period of time limestone, and to a lesser extent dolomite, will gradually dissolve in the presence of ground water that was derived from precipitation. Carbon dioxide from the atmosphere and from the soil is incorporated into the precipitation as it changes from atmospheric moisture to ground water. Ground water containing dissolved carbon dioxide forms a mild acid, which can slowly dissolve alkaline materials. The alkaline carbonate bedrock units are affected by this process when the slightly acidic ground water moves through the units and is neutralized by the carbonate. A portion of the carbonate unit is dissolved in this neutralization process thus increasing the size of the fracture in which the water is flowing. As this process continues through time larger openings, solution features, form in the rock allowing for increased ground-water flow.

Many types of solution features can result from this process, some subtle and others quite large. The most common features develop along preexisting fractures, joints, and bedding planes, which represent the initial flow path of the water through the rock. Over time, a variety of larger features can develop leading to cave systems with sinkholes and deep valleys as surface expressions.

The near-surface bedrock aquifers in the Mississippian carbonates contain a highly variable fracture pattern, which greatly affects groundwater flow through the bedrock. Fractured rock represents one of the most complex types of hydrogeologic systems known. While regional ground-water flow can be very predictable, local flow can be highly varied in terms of both quantity and direction. Consequently, determining the local direction of ground-water flow in fractured bedrock at the scale of a specific site may require elaborate instrumentation, monitoring, and dye tracing.

The dissolution of carbonate rocks results in karst topography and other karst features. These include closed depressions on the land surface (e.g., sinkholes and sinking streams), caves, and underground drainage channels or conduits, some of which are several feet in height and width. Karst areas are extremely vulnerable to contamination from point sources (e.g., spills, leaking underground storage tanks, and individual household septic systems) and broad area contamination (e.g., road salts, vehicle emissions, pesticides, and fertilizers). The karst features of subterranean conduits or streams are in many cases connected for great distances. These connected conduits create a potential for widespread contamination downstream of a contaminant source. In places the flow rates can be similar to surface streams, with some contaminants flowing through the system rapidly (especially after a rain or snow-melt event), while in other parts of the system contaminants may be trapped in pools, sediments, or minor fractures for much longer periods of time.

Some of the larger karst features (sinkholes and sinking streams) in Crawford County are shown on the map. These features are based on digital coverages from the Indiana Geological Survey and the U. S. Geological Survey (hypsography, or land surface contours). The closed depressions based upon hypsography coverage came from 1:24,000 scale topographic maps. The overwhelming majority of these depressions are associated with karst development. The map also shows locations of wells in which the drillers reported caves, crevices, or mud-filled cavities.

The most extensive karst development in Crawford County occurs in the outcrop area of the Blue River Group. This group consists primarily of carbonates and some evaporite deposits. The majority of the sinkholes or depressions occur within one or two miles of the Blue River and its major tributaries. Additionally, water well records on file at the Division of Water indicate many caves or mud-filled cavities in this group. The height of the caves may be as much as 25 feet, but are typically two to five feet. Most of the water wells showing such cavities are also in the same general area as the sinkholes. However, a few are located in the Little Blue River watershed. Marengo Cave and Wyandotte Cave, two large caves accessible to the public in Indiana, occur in Crawford County. Both of these were formed in the Blue River Group.

The Stephensport Group, and to a lesser extent the West Baden Group, shows some karst development in Crawford County. These groups consist primarily of shale and sandstone, but have some limestone units. The Stephensport has a greater percentage of limestone than the West Baden. Many depressions (including sinkholes) tend to occur on broad upland plains in the upper portion of the Stephensport, probably in the Glen Dean Limestone. These depressions are located in central to southeast Crawford County and tend to occur in isolated clusters, mostly in southeast Crawford County. The karst features in the Stephensport and West Baden Groups are not as extensive or as connected as the features in the Blue River Group. The limestone formations are not as thick, and they are separated by shale or sandstones. Thus, fractures and joints are not as continuous. As in the Blue River Group outcrop area, several water well records show caves or mud-filled cavities in the subsurface. The caves and crevices are reported to be as much as 10 feet high, but are typically one to four feet high. Most such wells are located in central or east-central Crawford County on the broad upland plains between Little Blue River and Blue River. The cavities generally occur between 25 and 100 feet below the land surface, but one was reported at 325 feet. Elevations of these cavities vary widely. This is expected because several different limestone formations are involved, they occur over a large area, they dip to the southwest at roughly 30 feet per mile, and the local relief on the land surface is up to 400 feet.

The Stephensport and West Baden Groups are not as vulnerable to widespread contamination as the Blue River Group. This is because of the thinness of the limestones units, the units being separated by shale or sandstone, and the steep topography that would limit the size of areas contaminated.

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