

STATEMAP
Rosiclare-BG

Bedrock Geology of Rosiclare Quadrangle

Hardin County, Illinois

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Introduction

The Rosiclare 7.5-minute Quadrangle lies in the southern part of the Illinois Basin and near the western end of the Rough Creek Graben, a late Precambrian to Middle Cambrian failed rift structure (Soderberg and Keller 1981, Bertagne and Leising 1991). The Rosiclare quadrangle was included in previous geologic maps by Butts (1917, 1925), Weller et al. (1920 and 1952), Weller (1940), Baxter and Desborough (1965), and Amos (1965). Reports on the Illinois-Kentucky Fluorspar District and its mines and minerals have been completed by Bastin (1931), Heyl et al. (1961 and 1974), Hutcheson (1973), and Goldstein (1997). Original Mapping for this project was completed in 2010 and 2011. The geology of the Kentucky portion of the Rosiclare quadrangle was mapped by Amos (1965); a comprehensive map and report on the Kentucky part of the fluorspar district was published by Trace and Amos (1984).

Structure and Tectonics

The map area lies within the Fluorspar Area fault complex, one of the most intricately faulted areas in the North American interior. Although reverse, strike-slip, and oblique-slip faults are important, high-angle normal faults prevail. Seismic reflection profiles reveal that faults originate in Precambrian basement and bifurcate upward, so the fracture pattern becomes more complicated toward the surface (Bertagne and Leising 1991, Potter et al. 1995). As mapped from outcrop data, faults are clustered into zones, which outline horsts and grabens. Since the faults in this region are extensively mineralized with fluorite, short segments of these faults have been named. While this practice aids with mineral exploration, it complicates the tectonic nomenclature.

Maximum displacement in the Rosiclare Quadrangle is along the northwestern edge of the Rock Creek Graben, where the Middle Mississippian Salem Limestone is juxtaposed with the Lower Pennsylvanian Caseyville Formation, producing at least 2,000 feet of vertical offset. The fault segments here are extremely complex and in many

cases, rock units that occupy narrow fault slices cannot be identified with confidence. The authors have elected to show such areas as “Mississippian undifferentiated.” A prime example is the area where the Hogthief Creek, Interstate, Iron Furnace, and Goose Creek Fault Zones merge together in the northwestern part of the quadrangle.

Another major structural feature is Hicks Dome, which is centered about two miles north of the northwest corner of the Rosiclare quadrangle. The dome is approximately 10 miles in diameter and exhibits 4,000 feet of structural relief. Hicks Dome lies at the northwest end of a broad northwest-trending uplift that has been named the Tolu arch (Baxter et al. 1963). The regional area is underlain by magnetic anomalies thought to be a result of deep seated ultramafic igneous activity (Hildenbrand and Ravat 1997). Ultramafic dikes and sills occur in this quadrangle, along with igneous breccia (possibly diatremes), climaxing at Hicks Dome. The dome lies along the southwest flank of a large, northwest-trending positive magnetic anomaly, which is interpreted as a mafic intrusive body at a depth of 11,000 feet or greater (McGinnis and Bradbury 1964). A seismic reflection profile across Hicks Dome reveals that the entire Paleozoic section is domed (Potter et al. 1995). Doming is the result of a combination of intrusive and explosive igneous activity, combined with pervasive hydrothermal alteration and mineralization (Bradbury and Baxter 1992, Potter et al. 1995). Igneous activity has undoubtedly complicated the regional structural geology by selective structural uplift. The igneous activity first uplifted the bedrock which created extension of the strata. Subsequent normal faulting produces a very complex tectonic structure.

Hogthief Creek Fault Zone

The Hogthief Creek Fault Zone (Weller et al. 1920) defines the northwestern edge of the Rock Creek Graben. This fault zone is named for Hogthief Creek, which it parallels for several miles. The fault trends northeast-southwest and consists of steeply dipping normal faults, with overall displacement down to the southeast. Weller et al. (1952), Baxter et al. (1963), and Baxter and

Desborough (1965) all suggested that high-angle reverse faulting might be involved, but none of these authors provided any details. No evidence for compressional structure was observed during the present study; however, Potter et al. (1995) interpreted high-angle reverse faults in the Rock Creek Graben from a seismic reflection profile that passes through the Rosiclare quadrangle. The Hogthief Creek merges to the southwest into the Interstate Fault Zone.

Interstate Fault Zone

The Interstate Fault Zone (Baxter and Desborough, 1965) trends northeast-southwest and apparently is the southwestern extension of the Hogthief Creek Fault Zone. Several fluor spar mines were opened along this fault zone, primarily in sections 17 and 18 (T12S-R8E). The Interstate Fault Zone is difficult to trace to the southwest, but it probably intersects with the Pell and Wallace Branch Fault Zones (Weller et al. 1920).

Iron Furnace Fault

This fault can be observed south of the preserved 19th-century Illinois Iron Furnace (4-12S-R8E; 1600 ft. El, 300 ft. SL) along the gravel road that follows the southwest side of Big Creek. Here the fault trends N45°E and bears a gouge and breccia zone nearly 75 feet wide, which juxtaposes Salem Limestone with lower Chesterian formations, for a minimum throw of 600 feet. The fault cannot be traced with assurance south of this point, because it lies under the alluvial sediment along Hogthief Creek. The Iron Furnace Fault joins the Interstate Fault Zone to the southwest. Weller et al. (1952) suggested there is reverse faulting; we were unable to confirm such. This fault probably merges into the Goose Creek Fault Zone to the northeast.

Wolrab Mill Fault Zone

Mapped with difficulty, the Wolrab Mill Fault Zone (S. Weller et al. 1920) is located on the horst block between the Dixon Springs Graben and the Rock Creek Graben. Weller et al. stated that the Wolrab Mill Fault is the longest fault in Hardin County, and that the fault extends to the southwest into Pope County. The fault trends southwesterly

passing south of Hicks Dome and merging with the Stewart Fault Zone in the Shetlerville Quadrangle. Displacement is down to the southeast, a maximum of 200 feet. The throw decreases near Hicks Dome, where this zone merges into the Stewart Fault Zone in the Shetlerville Quadrangle (Denny and Counts 2009). The Stewart Fault in the adjacent Shetlerville Quadrangle is extensively mineralized.

Wallace Branch Fault Zone

The Wallace Branch Fault Zone crosses the Ohio River near the mouth of Wallace Branch in the adjacent Shetlerville Quadrangle and strikes north-northeast, merging into the Interstate Fault Zone described above. It also lies parallel with and is probably connected to the Three Mile Creek Fault Zone (Weller et al. 1920). Offset along the Wallace Branch is reported to be high-angle reverse with the southeast side being northwest side being up-thrown as much as 1000 feet (Nelson 1995).

Big Creek Fault

This is a high-angle normal fault with the north-western side downthrown. Near Rosiclare the Menard Limestone is faulted against Hardinsburg and Golconda Formations, creating over 350 feet of vertical offset. The zone is more complex than can be portrayed on this map. This fault apparently merges into the Hogthief Creek fault Zone to the north. The area between the Big Creek Fault and the Hillside Fault in the vicinity of Rosiclare is mineralized.

Rosiclare Fault Zone

The Rosiclare Fault Zone, as defined here, is composed of several faults near the town of Rosiclare. Portions of these faults are extensively mineralized. The Rosiclare Fault Zone represents the southeastern boundary fault of the Rock Creek Graben. Individual faults were named for the mine complexes that worked the mineralized veins. The Rosiclare Fault Zone is composed of the Rosiclare fault, Daisy Fault, Hillside Fault, Argo Fault, and the Blue Diggings Faults. These faults are all located along the southeast edge of the Rock Creek Graben.

Rosiclare Fault

The Rosiclare Fault is properly described as the master fault along the southeast side of the Rock Creek Graben near the community of Rosiclare. The fault is extensively mineralized in this location. The main fault trends just west of north at the southern end and to the north-east along the northern end. It curves in arc like fashion to the east. The fault plane is nearly vertical, with the west side downthrown 125 to 150 feet (fig 1). Parallel faults, such as the Blue Diggings, Hillside, and Argo Faults, (fig. 2) converge to the north into the Rosiclare Fault.

Hillside Fault

Situated along the southeast side of the Rock Creek Graben, the Hillside Fault was formerly exposed in the Hillside Mine, which started producing in the 1920s. Based on underground exposures, Bastin (1931) described the fault as trending north-south and dipping 65° - 70° to the west, with normal offset. Brecciated fluorite along the eastern footwall indicates movement occurred after mineralization. Bastin also described two sets of slickensides, one set vertical and the second set pitching south at 20° to 30° off horizontal. Thus, this fault has undergone at least two episodes of displacement.

Argo Fault

The Argo Fault hosts the Argo Vein (fig. 2) and strikes N 20° E, having the northwest side downthrown 75 to 100 feet (Bastin 1931). Weller et al. (1952) reported the fault plane is nearly vertical, whereas Bastin (1931) stated it dipped steeply to the northwest.

Daisy-Blue Diggings Fault

The Blue Diggings Fault is located between the Argo and Rosiclare Faults. It strikes N 30-50°E and dips 65° to 70° southeast, with the southeast side downthrown approximately 100 feet (Fig 2).

Daisy Fault

The Daisy Fault strikes N 20°E and dips 70° to 80° northwest, with up to 350 feet of normal displacement (Weller et al. 1920). Bastin (1931) reported

post-mineralization movement brecciated the ore, and plunge of striations varied from 10° north to 80° south. These observations again indicate multiple periods of movement, with an element of strike-slip.

Mineral Deposits

Although there is almost no active mining today, the Illinois-Kentucky district was formerly the leading source of fluorite in the United States and also produced significant quantities of lead, zinc, silver, and other commodities. The term fluorspar is commonly used as a synonym for fluorite.

Economic mineralization in the Illinois-Kentucky Fluorspar District (IKFD) is dominantly composed

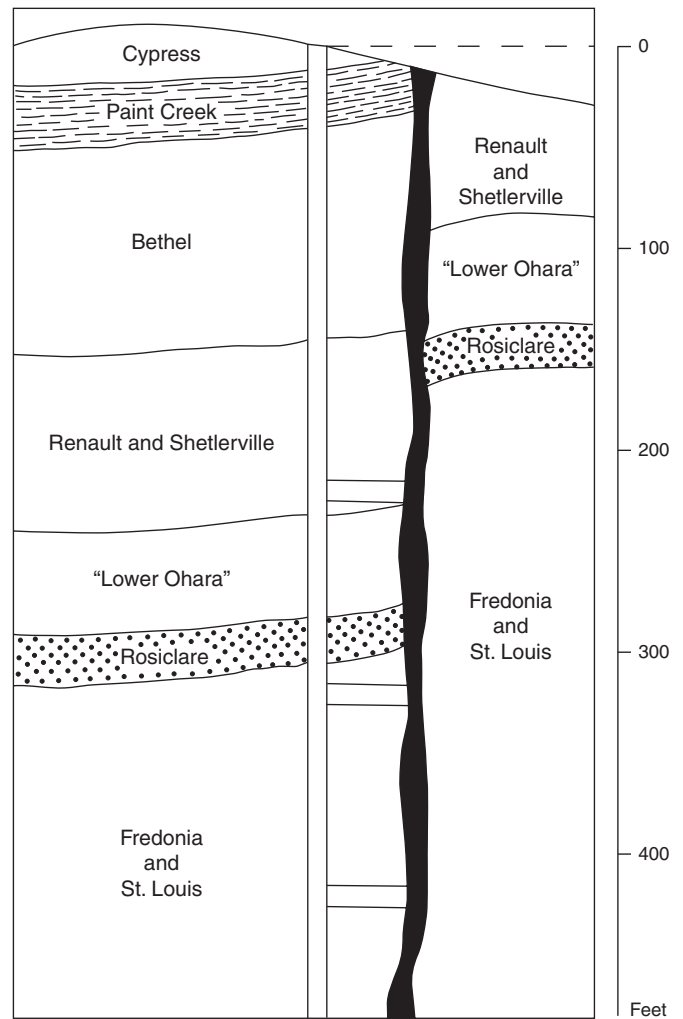


Figure 1 Cross section through the Rosiclare Vein at the Rosiclare Air Shaft showing working levels, looking north (Weller et al. 1920).

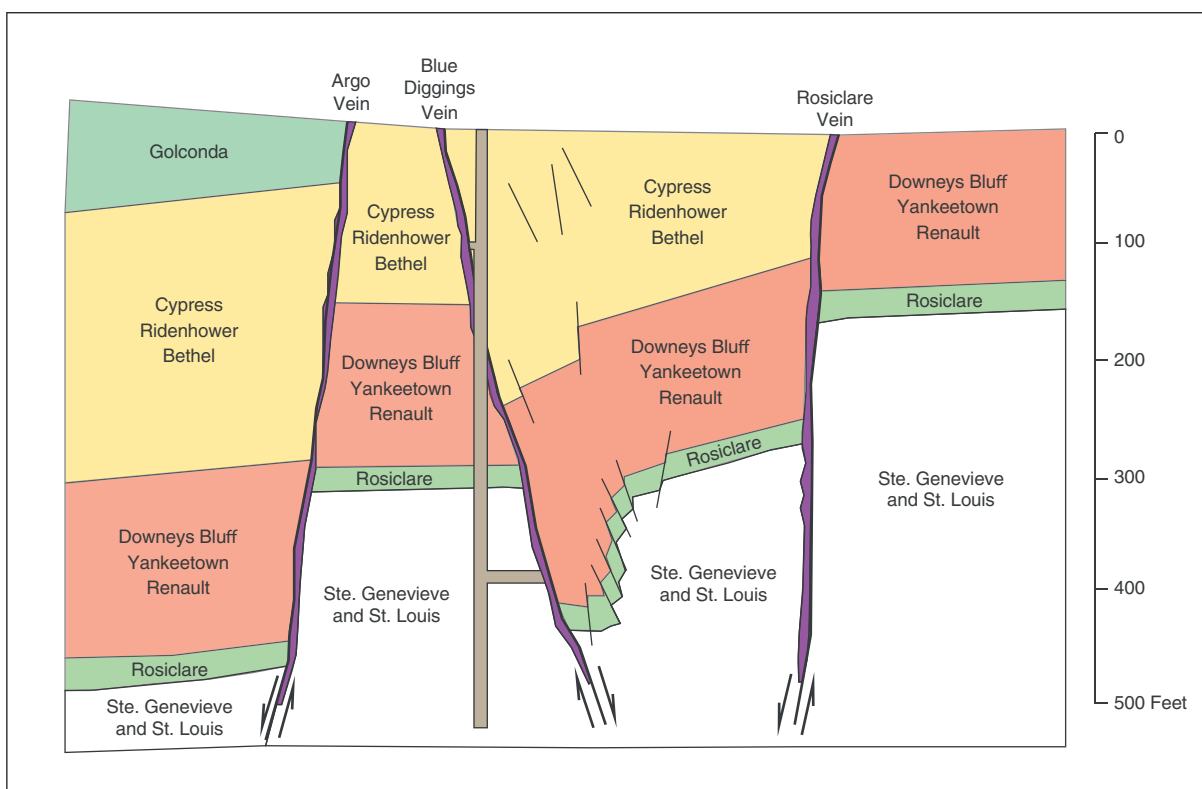


Figure 2 Idealized cross section across the Argo - Blue Diggings - Rosiclare Veins (adapted from Weller et al. 1920). Looking northeast.

of fluorite, with lesser amounts of sphalerite, barite, and galena. Other minerals identified in this district include pyrite, chalcopyrite, quartz, celestite, cerussite, greenockite, malachite, smithsonite, witherite, strontianite, benstonite, and alstonite (Goldstein 1997). Ore bodies are of three types: (1) bedded replacement deposits that formed by selective replacement of limestone strata, (2) vein deposits along faults and fractures, and (3) residual deposits derived from veins or beds. Deposits within the map area are mainly of the vein type, following faults of slight to moderate displacement. In some workings, however, a small amount of bedded replacement ore has been observed. The best indication of bedded replacement is remnant textures of limestone observed within fluorite crystals. These include fossils, stylonitic sutures, and primary bedding and other sedimentary structures. Mine-run ore commonly contained 30 to 40% fluorite, as much as 2 to 3% zinc, and small amounts of galena. Some deposits contained small values of silver in galena, along with recoverable cadmium and germanium in the sphalerite (Trace and Amos 1984). The amount of sphalerite in

some ore bodies within the IKFD is considerable. The ore at the Hutson Mine near Salem, Kentucky, was almost exclusively sphalerite associated with ultramafic igneous dikes (Osterling 1952).

Mineralization within the IKFD probably resulted from acidic basinal brines charged with fluorine and carbon dioxide, derived from Permian alkaline magma (Plumlee et al. 1995). These basinal brine-type fluids were funneled along northeast-trending fractures and fault zones concurrent with regional oblique extension, exemplified by multiple episodes of displacement. Disequilibria within the acidic fluids occurred when the fluids came into contact with the calcium-rich carbonate formations where the ore precipitated (Denny et al. 2008). The ore of the IKFD is almost always in contact within or adjacent to a carbonate host rock. Specifically, the upper part of the Ste. Genevieve Limestone and the Rosiclare, Levias, Shetlerville, and Downeys Bluff units of early Chesterian age. These rocks mark a transition from dominantly limestone below (Mammoth Cave Group) to alternating limestone and siliciclastic units above (Pope

Group). It is interesting that these same rock units also host petroleum traps in the Illinois Basin. The permeable rocks within the Ste. Genevieve to Downeys Bluff interval are the first permeable rocks overlying a thick succession of mostly "tight" carbonates.

Rosiclare District

The Rosiclare District comprised the Rosiclare, Argo, Daisy, and Blue Diggings veins, all of which trend from north-south to N 45° east. The mines within the Rosiclare District are discussed below.

Rosiclare Vein

The Rosiclare vein (also called the Good Hope and Fairview Veins) was one of the most prolific of any vein in the Illinois-Kentucky Fluorite District. The vein was first mined as part of the Pell property in 1842-1843 (Weller et al., 1920). The mine was opened to extract galena and the fluorite was dumped and considered worthless gangue. Small amounts of fluorspar from the old mine dumps were recovered and sold during and after the Civil War until around 1900 (Bastin 1931). In the early 1900's the mines of the Rosiclare started to ship fluorite in large quantities. Prior to World War I these early mines were competing with fluorite mines mainly in the English Derbyshire and Durham Districts (Weller et al., 1920). Manufacturing of steel was the primary use for fluorite and large steel mills were located in eastern part of the USA. During World War I the fluorite ore of the Illinois-Kentucky District became the primary supplier to the United States steel mills. The proximity of the Rosiclare Vein to the Ohio River was a key factor, allowing the ore to be transported up the Ohio River relatively inexpensively. From 1914-1915 the ores of the Illinois-Kentucky Fluorite District accounted for over 99 percent of the production for United States and the mines in Hardin County Illinois produced about 80 percent of the fluorite (Weller et al., 1920). The Rosiclare vein produced a substantial amount of the fluorite consumed in the USA during this early period. Several mines worked the Rosiclare Vein and each are described below.

Rosiclare Mine

This mine was operated by the Rosiclare Lead and Fluorspar Company and the Franklin Fluorspar Company (Bastin 1931). This vein was reported to be 30 to 35 feet wide near the Rosiclare Main and Plant Shafts. Weller et al. (1920) reported working levels were 235 (ft), 320 (ft), 420 (ft), and 520 (ft). Bastin (1931) reported several additional working levels and reported the main shaft was sunk to a depth of 720 feet. A diagram or cross section of this mine (Weller et al., 1920) shows that the displacement along the fault at the Rosiclare Air Shaft is approximately 125 (ft.) down on the west side (Fig 1).

Fairview Mine

The Fairview mine was operated by the Fairview Fluorspar and Lead Company. In 1862 this company sunk the Good Hope Shaft to a depth of 503 feet and worked the property until 1874 (Weller et al., 1920). From 1890 to 1895 this mine was leased by the owners of the Rosiclare Mine. More production occurred from 1905 to 1913 until the original Good Hope Shaft began to cave. The Good Hope Shaft was worked on at least 6 levels and the vein was reported to be 25 feet wide (Weller et al., 1920). In 1909 the Fairview Company re-opened an old shaft 1700 feet north of the Good Hope shaft and in 1911 the Annex and Extension Shafts were sunk (Weller et al., 1920). Mining ceased in these mines in about 1924 due to flooding when drifts apparently encountered water from the Ohio River. Just before the pumps were shut down over 3400 gallons per minute were being pumped from these mines (Bastin 1931).

Hillside Mine

The Hillside shaft was sunk in 1919 by Inland Steel (Weller et. al., 1920 and Bastin 1931). Working levels were 170 (ft), 250 (ft), 350 (ft), and 450 (ft). The mine complex consisted of the main plant shaft sunk to the (450 level), a south air shaft sunk to the (250 level), and north air shaft sunk to the (450 level). The vein was reported as nearly vertical, 5 to 35 feet wide, trending generally north-south (Bastin, 1931). The vein was mined continuously for over 1600 feet. Post mineralization

faulting was reported to be present and the faulting was described as normal with the west hanging wall being downthrown (See Hillside fault). The ore was primarily fluorite, but small amounts of galena were recovered and Bastin (1931) reports the Galena contained 5 ounces silver per ton.

Daisy Mine

The Daisy Mine was sunk by the Rosiclare Lead and Fluorspar Company prior to 1918 (Bastin 1931). The mine worked the 150 (ft), 180 (ft), 300 (ft), 412 (ft), and 500 (ft) levels. The vein strikes north 30° east and dips 70-80° west. The vein was approximately 8 (ft) wide, but in places swelled to over 20 (ft). The 412 (ft) Level extended south into the Blue Digging Vein (Bastin 1931). The vein shows post mineralization movement with the west side being down thrown (Bastin 1931).

Blue Diggings Mine

The Blue Diggings Mine was located southwest of the Daisy Mine and was operated by the Fairview Fluorspar and Lead Company from 1910 to 1920. The mine was named for the pure white to light blue color of the fluorite extracted from this vein (Weller et al, 1920). The mine worked 160 (ft), 200 (ft), 300 (ft), 400 (ft), and 500 (ft) levels. The vein was narrow between 3 and 8 feet wide. The main shaft was driven on the hanging wall and passed through the vein at the 200 (ft) level (Figure 2). Weller et al., (1920) reported this mine contained zones of intense fracturing and the strike and dip of the vein varied considerably. The offset along this vein is normal down to the east approximately 100 feet, and the dips are between 70-55° (Bastin 1931).

Argo Vein

The Argo Vein is about 450 feet northwest of the Blue Diggings Vein. It parallels the Blue Diggings Vein trending about north 25° east dipping steeply to the west (Bastin 1931). The Franklin Fluorspar Company sunk the shaft in 1922 and in 1923 a cross cut from the 500 (ft) level of the Blue Diggings Mine was driven into the vein. The vein was reported to have large “cavernous” openings sometimes lined with pyrite (Bastin 1931). The vein

was reported to be on a normal fault with the west hanging wall being downthrown over 100 feet.

Dimmick Prospects

Two shafts were sunk approximately 1400 feet north of the Daisy Vein. No mineralization was reported in either prospect.

Eureka Prospects

Several shafts and a few drifts were sunk west of Illinois Highway 34 and north of the Dimmick Prospects. These were called the Eureka prospects and the Eureka #2 was formerly called the Cowser Shaft (Bastin 1931).

Clement Mine

The Clement Mine also called the Clement-Dyspeck Prospects was operated by the Rosiclare Lead and Fluorspar Company. The vein trended north 45° - 50° east and was nearly vertical (Bastin 1931). These are northern prospects along the Hillside Vein. Weller et al (1920) suggested that the Rosiclare and Blue Diggings Vein comes together just south of this prospect.

Indiana Mine

The Indiana Mine was owned by the Indiana Fluorspar and Lead Company but was operated by the Hillside Fluorspar Mines. It was also called the Hillside Mine #2. The mine produced a small amount of fluorite from two parallel veins that trend north 18° east and dip very steep to the west (Bastin 1931).

Martin Mine and Interstate Prospect

The Martin mine was operated by Rosiclare Lead and Fluorspar Company and is a series of pits and one shaft. The pits are aligned in a north 20° east direction which (Weller et al, 1920) assumed was the trend of the vein. The general trend of the bedrock observed here was north 37° east dipping 80° northwest. The Austin Mine lies along the major northeast trending fault southwest of the Martin Mine. The Interstate Prospect shaft lies south of the Martin Mine. The Interstate Prospect Shaft is at least 30 feet deep and moderately fractured sandstone with clear fluorite veins were

observed. The major fractures appear to parallel the northeasterly major fault zone. These prospects are located in an extremely complicated tectonic zone where several fault zones converge. Several additional prospect pits were observed along this fault zone.

Unnamed Prospect

There is an unnamed prospect pits 17-12S-8E (3000 ft EL, 1500 SL). There are several pits here along a fault trending north 25° - 30° east. No additional historical information was available. These prospects are along the southeast side of a fault block of Caseyville Sandstone. The fault brings Caseyville down to be adjacent with the Clore Formation. Colorless fluorite was observed as small veinlets along fractured fine grained sandstone. The fault block dips at 50° northwest. The lack of roads into this site indicates that little production occurred at this location, although one pit was dug at least 10 feet deep along the trend of the fault. Numerous additional adits and prospect pits are marked on the geologic map, but no historical information concerning these operations could be obtained.

Limestone Resources

Large resources of limestone in the Rosiclare quadrangle are favorably located for barge transportation on the Ohio River. The St. Louis through Downeys Bluff interval currently is being quarried immediately west of the map area near Shetlerville and also east of the map area in the vicinity of Cave in Rock. These same formations are present in the Rosiclare quadrangle in a belt more than a mile wide adjacent to the Ohio River. Along with the older Salem Limestone, these formations also occur northwest of the major fault zones in the northwestern corner of the map area. Stone from these Mississippian formations is suitable for a wide variety of purposes, including concrete aggregate, agricultural lime, rock dust, and crushed stone for surfacing secondary roads. Although portions of the resources lie within the Shawnee National Forest, most of the potential quarry stone near the river is on privately owned land.

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