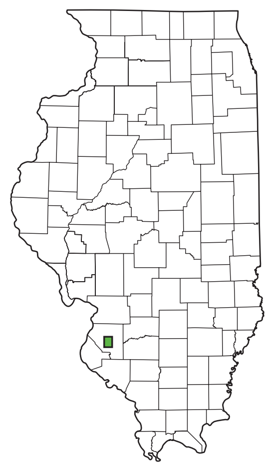
Illinois Preliminary Geologic Map
IPGM Freeburg-BG

Bedrock Geology of Freeburg Quadrangle

St. Clair County, Illinois

W. John Nelson

2005



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Subsurface Stratigraphy

The deepest well in the Freeburg Quadrangle is the Eason Oil #1 Thomas in Sec. 4, T1S, R8W, which cored 10 feet into the St. Peter Sandstone. The Mississippi River Fuel Corp. #1 Vale in Sec. 8, T2S, R8W, less than 1 mile west of the map area, drilled entirely through the St. Peter.

Ordovician

St. Peter Sandstone The St. Peter Sandstone is 76 feet thick in the Vale well, mentioned above. It is decribed as white (light green near the top), medium to coarse-grained, friable, slightly calcareous sandstone composed of rounded and frosted quartz grains.

Joachim Dolomite(?) The Joachim is about 120 feet thick in the Thomas well and 125 feet thick in the Vale well. Cuttings and core samples are logged as dolomite, buff to greenish gray and "tight", with streaks and parting of green, dark gray, and black shale. The unit also includes interbeds of dark gray, calcreous shale as thick as 5 feet. The ragged resistivity profile on electric logs confirms that this is a shaly carbonate rock.

Plattin Limestone The Thomas and Vale wells both penetrated approximately 280 feet of Plattin Limestone; several other wells drilled into the upper Plattin. Well cuttings are described as dolomite and dolomitic limestone that is light to medium brown and brownish gray, dense and very fine to fine, and slightly cherty. Asphalt or "dead oil" was encountered. Oolitic limestone in the lower part of the Plattin in the Thomas well probably represents the thin but widespread Brickeys Member. Characteristic lithology of the Plattin in southwestern Illinois and southeastern Missouri is microgranular limestone and dolomite that is strongly mottled and displays burrowed or "fucoidal" structure.

Decorah Formation The Decorah is 15 to 37 feet thick and is composed of shaly, dolomitic limestone that is medium to dark brown and micritic, with interbedded gray calcareous shale. The lower contact is sharp.

Kimmswick (Trenton) Limestone The Kimmswick is 85 to 96 feet thick in the map area and consists of limestone that is white to yellowish and brownish gray, occasionally tinted pink. It is described as very fine to very coarsely crystalline but commonly coarse; much of it is probably crinoidal grainstone. Features observed in cores include stylolites and a variety of fossils, including crinoids, bryozoans, and the colonial coral *Receptaculites.* The lower part is more dense, finer grained, and partly dolomitic. Also a dark brown, dense "cap rock" is reported in several wells. Oil shows or stains and asphaltic residue are common, but porosity is meager (less than 5%) and porous zones too thin for oil production. The Kimmswick provides the reservoir rock in the Waterloo-Dupo oil field, west of the report area. The lower contact is sharp.

Maquoketa Shale This unit is 125 to 150 feet thick and consists of medium to dark greenish and brownish gray, silty shale with laminae of siltstone to very fine sandstone. Wireline logs and samples indicate the upper 60 to 80 feet is shale and siltstone that coarsens upward. This overlies the Thebes Sandstone Member, 5 to 20 feet thick and composed of dark brownish gray, very fine sandstone that commonly yields shows of oil. Below the Thebes is 40 to 50 feet of calcareous siltstone grading to silty and argillaceous dolomite. The lower contact is sharp.

Leemon Formation The sample log of Mason #1 Funk oil-test hole in Sec. 14, T1S, R7W (Mascoutah quadrangle) records about 5 feet of buff to dark gray, oolitic and coarsely granular limestone overlying the Maquoketa Shale. Such limestone is characteristic of the Leemon Formation, a thin and lenticular, yet widely distributed unit of Hirnantian (latest Ordovician) age (Thompson 1991).

Silurian

Sexton Creek Limestone The Sexton Creek, 35 to 60 feet thick, is white to light gray and buff limestone and dolomite that is sublithographic to very fine-grained and contains plentiful chert. The lower part becomes more dolomitic and less cherty; the lower contact is sharp.

St. Clair Limestone Limestone that is white to light yellowish gray and marked with small pink to maroon spots is diagnostic for the St. Clair. As seen in well cuttings, the limestone is largely sublithographic and slightly dolomitic. Scattered fossil fragments include echinoderm fragments and the foram *Ammodiscus.* Thickness is 30 to 50 feet; the lower contact is not clearly marked on well logs.

Moccasin Springs Formation This unit ranges from 95 to 290 feet thick in the map area, and comprises two distinct units. The lower unit, 90 to 135 feet thick, consists of limestone and dolomite mottled in reddish and greenish gray, the red hue increasing downward. This rock has sublithographic to very fine texture and a high silt content, grading in part to calcareous siltstone. The upper unit comprises up to 180 feet of dolomite and dolomitic limestone that is white, light gray, buff, and light greenish gray. Like the lower unit, the upper is sublithographic to very fine grained, argillaceous, and silty. The texture commonly is described as “chalky”. Partings and streaks of green shale were noted in cores; dark greenish gray clay-shale occurs at the base of the upper unit. As indicated by electric logs, the lower contact of the Moccasin Springs is sharp and the upper contact erosional. The formation thins toward the west, where the upper gray unit is largely, if not entirely eroded beneath the New Albany Shale.

Devonian

New Albany Shale The dark brown to black, hard shale is 3 to 12 feet thick, thinning southward. It is finely micaceous, fissile, and contains the algal(?) fossil *Sporangites.* Fine to coarse, rounded quartz sand grains occur at the base. Both contacts are sharp, the lower being a major unconformity.

Mississippian

Chouteau Limestone Seventeen to 27 feet thick, the Chouteau is a unit of white to light greenish-gray, sublithographic to very fine-grained limestone. It is dolomitic, argillaceous, and contains a few scattered fossil fragments. Both contacts are sharp.

Fern Glen Limestone The Fern Glen is about 28 to 75 feet thick and has red shale at the base, overlain by greenish gray, calcareous and silty shale. This in turn grades upward to cherty, argillaceous limestone and dolomite similar to the overlying Burlington-Keokuk Limestones. The lower contact is sharp, the upper one gradational and difficult to identify consistently. The Fern Glen thins eastward.

Burlington-Keokuk Limestones As in much of Illinois, the Burlington and Keokuk Limestones cannot be readily distinguished in the Freeburg area. The limestone is largely white to light gray, coarsely crinoidal, and very cherty. The lower part is finer grained, dolomitic, glauconitic, and contains increasing proportions of silt and clay, grading to the Fern Glen. Chert in the lower part is bluish to greenish gray and translucent, that in the upper part is white to gray and opaque. A little red and green shale is reported near the top.

The Burlington-Keokuk is confined to the western half of the Freeburg quadrangle where it is as thick as 265 feet and overlain by the Warsaw Formation. In the eastern part of the quadrangle, the Borden Siltstone takes the place of both the Burlington-Keokuk and the Warsaw. As Lineback (1966) proposed, the Burlington-Keokuk represents a shallow-water carbonate bank that had a steep east-facing margin.

Borden Siltstone The Borden thickens eastward across the map area from a feather-edge to 375 feet in a well one mile east of the quadrangle border. The siltstone (or silty shale) is medium to light brownish gray, becoming darker downward. It is calcareous or dolomitic, containing scattered fossils such as ostracods and in the upper part, the foram *Endothyra.* Interbeds of finely to coarsely fossiliferous, silty and argillaceous, cherty limestone are common and probably represent intertonguing of the Borden with Burlington-Keokuk Limestones on the margins of the carbonate bank postulated by Lineback (1966). Near the base the Borden grades to greenish gray shale than contains abundant glauconite and phosphate nodules. The Borden is the deposit of a large delta that entered Illinois from the northeast and lapped against the edge of the Burlington-Keokuk carbonate bank (Lineback 1966).

Warsaw Formation The Warsaw is a unit of impure limestone and dolomite interbedded with calcareous siltstone and silty shale similar to that of the Borden. Carbonate rocks are micritic to finely granular and contain plentiful crinoid and bryozoan fragments, as do siltstone and shale of the Warsaw. Geode quartz is common in the upper Warsaw, a little glauconite and pyrite are found in the lower part. The resistivity log signature is ragged. The Warsaw ranges from 74 to 210 feet thick, generally thickening eastward. Where it overlies the Burlington-Keokuk the lower contact is abrupt, but the Warsaw-Borden contact is gradational and arbitrary. The Warsaw may be regarded as a tongue of Borden–like deltaic sediment that extended over the top of the Burlington-Keokuk carbonate bank (Lineback 1966).

Salem Limestone The Salem is 165 to 310 feet thick and consists of limestone along with minor dolomite. Limestone is very light gray or buff to medium brownish gray and has fine to coarse bioclastic texture. Echinoderm and bryozoan fragments are abundant; the foram *Endothyra baileyi* is common and distinctive to the Salem. Some light-colored crinoidal and oolitic grainstone occurs in the Salem. Dolomite is mostly sublithographic or microsucrosic. A little anhydrite is logged near the top. Chert is present, but not plentiful. On gamma-ray and electric logs, the lower 100 feet of the Salem has the signature of pure carbonate rock (very low clay content). The lower contact is sharp or rapidly gradational.

St. Louis Limestone The St. Louis is 80 to 185 feet thick in the study area, increasing toward the northwest. The formation is mostly limestone, with beds of dolomite. Limestone is mostly microgranular to finely granular, light to medium gray and brownish gray, and cherty. Dolomite is microsucrosic and slightly vuggy. Some beds are silty or argillaceous. Medium to coarse-grained, crinoidal and oolitic packstone and grainstone occur rarely in the St. Louis. The St. Louis thins toward the southwest, where the upper part is eroded beneath the Aux Vases Sandstone. The lower contact is gradational, and intertongues with the Salem Limestone. Lineback (1972) showed that the St. Louis thickens toward the northwest at the expense of the Salem. The line of most rapid change passes through the Freeburg Quadrangle.

Structural Geology

The Freeburg Quadrangle is situated on the Western Shelf of the Illinois Basin, a broad terrace-like feature that separates the Illinois Basin on the east from the Ozark Dome on the west. Regionally, rock strata on the Western Shelf dip very gently eastward. At the level of the New Albany Shale (Upper Devonian), the average dip is approximately 50 feet per mile, which is equivalent to less than half a degree of dip (Cluff et al. 1981). Regional dip on the Herrin Coal (Pennsylvanian) is even less, only about 15 feet per mile.

Mississippian and Pennsylvanian rocks on the Western Shelf are separated by an angular unconformity. The eastward dip is greater on Mississippian than on Pennsylvanian strata. Thus, the Tradewater Formation (basal Pennsylvanian) rests on the Glen Dean Limestone in the eastern part of the Freeburg Quadrangle and on the older Cypress and Paint Creek Formations in the western part of the quadrangle. The angular relationship resulted from uplift and erosion that took place during Early Pennsylvanian time.

Richland Creek Fault A fault runs north-south through the western part of the Freeburg Quadrangle. It is here named the Richland Creek Fault because Richland Creek closely follows its trend. Although the Richland Creek Fault has indirect surface expression, it is not exposed in outcrop and apparently was not recognized by any previous geologist. Mapping the subsurface configuration of Mississippian formations from water-well and other borehole records discloses its presence.

As shown by the geologic map and cross section, rocks east of the Richland Creek Fault are downthrown. The Cypress and Paint Creek Formations west of the fault are juxtaposed with Golconda and Hardinsburg Formations on the east. Structure contours on the base of the Beech Creek (Barlow) Limestone depict the offset more precisely. Directly east of Smithton, the throw is about 200 feet. Three miles north of Smithton, the offset is roughly 150 feet. Its northward continuation is poorly known due to a lack of information. Well records in the New Athens West Quadrangle (south of Freeburg) show that the fault continues at least several miles south of the quadrangle border.

An oil test hole, Morris #1 Munier in SE 1/4 Sec. 27, T1S, R8W, apparently penetrated a branch of the Richland Creek Fault. The log of this well indicates that the Beech Creek Limestone rests directly on sandstone of the lower Cypress Formation, the shale and mudstone that ordinarily comprise the upper Cypress being faulted out of the well bore. Such missing section, amounting to 30 or 40 feet, signifies that this is a normal fault, i.e. the fault surface dips toward the east and the eastern hanging wall moved downward.

Displacement of Pennsylvanian rocks across the Richland Creek Fault is markedly smaller than offset of Mississippian rocks. This is best illustrated by the cross section, which shows Pennsylvanian formation contacts at nearly the same altitude east and west of the fault. Notice in particular that the Pennsylvanian Tradewater Formation rests on older Mississippian units west of the fault than to the east. Some down-to-the-east movement of Pennsylvanian rocks is indicated southeast of Smithton, where a well apparently encountered Colchester Coal downthrown east of the fault. Also, in the northwestern part of the quadrangle, the Herrin Coal and associated layers seem to be about 50 feet lower in elevation on the eastern side of the fault. There are no reports of indications that faults were met in any of the underground coal mines that lie close to the fault line in Belleville. However, these records are incomplete, and in the area where the fault likely passes the Herrin Coal is missing due to pre-glacial erosion.

Differential displacement of Mississippian and Pennsylvanian rocks signifies that fault movement took place during latest Mississippian to Early Pennsylvanian time. Later fault movements, during and after Middle Pennsylvanian time, were considerably smaller.

The Richland Creek Fault was also active prior to Late Mississippian time. The Moccasin Springs Formation (Silurian) thins markedly westward across the quadrangle, and is truncated with an angular unconformity beneath the Upper Devonian New Albany Shale. The eastern edge of the Burlington-Keokuk carbonate bank (Mississippian), as mapped by Lineback (1966), strikes north-south and closely coincides with the Richland Creek Fault. Deltaic sediments of the Borden Siltstone accumulated east of the carbonate bank. The western, upthrown side of the fault created a favorable environment for shallow-marine organisms whose skeletons made up the Burlington-Keokuk Limestone.

Modern Richland Creek coincides closely, but not exactly with a pre-glacial valley. Contouring the bedrock surface shows that the pre-glacial valley averages 100 feet deep and one to two miles wide. The valley is slightly sinuous and has relatively steep walls and a level or gently sloping bottom. The west side of the pre-glacial valley is close to the Richland Creek Fault. Streams commonly follow faults because fractured rock along faults erodes more easily than intact rock. Also, the Richland Creek Fault juxtaposes relatively resistant sandstone of the Cypress and Tradewater Formations (on the west) with more readily eroded shale and limestone on the east. Glacial deposits incompletely buried the ancestral valley of Richland Creek, allowing the stream to reoccupy its course after the glaciers receded.

Economic Geology

Coal

Coal mining was the principal industry in the Freeburg area for more than a century. No mines are currently active; abandoned underground and surface mines occupy many square miles. Mines in the quadrangle have been catalogued and mapped at 1:24,000 scale by Chenoweth et al. (2004). Records are derived from mine maps (paper and microfilm), annual Coal Reports published by the Illinois Office of Mines and Minerals, field notes made by ISGS geologists who visited active mines, and other sources. By far the most detailed source of information on coal geology was acquired by ISGS geologists through several months of detailed mapping studies in Peabody Coal Company's River King Underground Mine between 1978 and 1982. This unpublished mapping was carried out principally by W. John Nelson, H.-F. Krausse, John T. Popp, and Stephen K. Danner.

The only coal seam that has been mined commercially in the map area is the Herrin. Except in small areas, the coal maintains a thickness of 5 ½ to 7 ½ feet throughout the quadrangle. It is a bright-banded, bituminous coal having blocky fracture. Several claystone bands are typically present, of which the "blue band" is almost universal (as throughout the Illinois basin). The "blue band" is generally ½ to 2 inches thick and occurs 18 to 28 inches above the base of the Herrin. Above the "blue band", as many as three additional claystone layers are widely present, whereas others are local. The coal has a high sulfur content (3 to 5%) and contains plentiful pyrite in the form of laminae or stringers, cleat facings, and lenses or "sulfur balls". The latter typically occur near the top of the coal.

Coal thicker than 10 feet was reported in parts of the Mulberry Hill (Sec. 12, T1S, R8W), Richland (Sec. 2, T1S, R8W) and Star (Sec. 30, T1S, R7W) Mines. Geologist G.H. Cady (ISGS Mine Notes,

1918) reported that coal 9 to 11 feet thick occupied a structural depression in the Star Mine. The "blue band" was more than 4 feet above the base of the coal in the trough. On its western(?) margin, the coal dipped as steeply as 30°. Thick coal was overlain by an abnormally thick (8 to 10 feet) Anna Shale. Unfortunately Cady did not map the area of thick coal or specify its dimensions. Occurrence of thick coal in depressions strongly suggests that low areas existed during peat formation, allowing thicker accumulation there.

Unusually thin coal was encountered in northern workings of the River King Underground Mine in Sec. 4, T1S, R7W. The Herrin Coal thinned to less than 3 feet along several sinuous, branching or dendritic belts generally 50 to 100 feet wide. Thinning clearly resulted from partial erosion of the upper part of the peat deposit. The "blue band" is in its usual position and unaffected. Where thinned, the upper part of the coal became dull and hard, with absent or distorted cleat and banding and more clay stringers than normal. This disturbed coal was partially silicified or replaced by large nodular masses of dark brownish-gray to black chert. As Danner and Nelson (1982) proposed, the thin coal probably resulted from erosion of peat in shallow stream or tidal channels shortly after deposition. Within the channels, peat was partially oxidized, reworked, and silicified. Mining this coal entailed (1) loss of reserves, (2) excessive wear on continuous mining machines, and (3) mining large amounts of waste rock.

The floor of the Herrin Coal is generally claystone (underclay) ranging from 2 to 8 feet thick. This rock is dark gray to olive-gray, massive, partly silty and calcareous; it contains pervasive slickensides and root traces. Underlying the claystone is limestone that is light gray to buff, microgranular, and massive to nodular. This grades laterally to isolated limestone nodules within claystone matrix. Claystone floor is relatively incompetent, turning to mud when wet. Several mines reported problems with floor heave or squeeze. At the River King Underground Mine, most squeezes took place where the roof was competent limestone. Evidently, the strong limestone functioned as a beam pressing the coal pillars into the soft floor.

Detailed geologic mapping at River King Underground provides an intimate look at variations in roof strata. The gray Energy Shale occurred as pods or lenses that covered approximately 15% of the areas mapped. Lenses were circular, ovoid, or irregular in map view and varied from less than 20 feet to 500 feet wide, most being 100 to 300 feet across. Energy Shale commonly was found at low places in the coal. Beneath Energy Shale, the topmost layer of the Herrin was commonly canneloid (hard, dull, non-banded coal the breaks with a conchoidal fracture), and the shale interfingered with the coal. Anna Shale overlies Energy Shale with an erosional contact, truncating bedding at an angle as steep as 20°.

Energy Shale is interpreted as a deposit of fresh to brackish, quiet water that flooded the swamp, ending peat deposition. Energy Shale originally may have covered the entire Herrin peat deposit in St. Clair County, but most of it was eroded, remaining only in low areas.

The black, fissile Anna Shale formed the immediate roof in about 60% of the areas mapped in River King. At its base were lenses of dark gray to black, fossiliferous, impure limestone called "bastard limestone" by miners and drillers. As mapped, "bastard" limestone occurs along the margins of Energy Shale lenses, in some cases completely encircling them. The limestone interfingers with both the upper Herrin Coal and the Energy Shale. "Bastard limestone" probably is a lag deposit that accumulated in low areas as sea level rose. Anna Shale was deposited in very quiet marine water that became strongly depleted in oxygen. As Zangerl and Richardson (1960) proposed for similar Pennsylvanian black shales, the Anna probably was deposited in shallow water. A floating mat of algae (as found in some modern swamps) may have prevented circulation and led to oxygen depletion.

The Brereton Limestone is by far the most competent unit above the coal, and is the key to roof stability. Roof failure is rare where the limestone forms immediate roof and is thicker than about 2 feet. This is the case in about 15% of the areas mapped at River King. Where thick Brereton overlies shale, roof bolts can be securely anchored in the limestone, minimizing falls of the shale. Like other roof-rock units, the Brereton is highly lenticular in the Freeburg area. It is generally thin or absent above lenses of Energy Shale.

The Jamestown Coal directly overlay the Herrin in about 10% of the mine area. It was a harbinger of unstable roof, because Brereton Limestone is absent where Jamestown is immediate roof. The Conant Limestone, overlying the Jamestown, is generally too thin to form competent mine roof. The Jamestown reflects a drop in relative sea level and partial emergence following deposition of the marine Brereton Limestone. Land plants temporarily became established, but little peat accumulated.

The Lawson Shale, as seen in the mine, varied from about 5 to 10 feet thick. The lower part was dark gray and silty shale, weakly fissile and commonly calcareous, containing marine fossils and limestone nodules. The upper Lawson was a highly mottled, weak and incompetent mudstone. Color mottles outlined a checkerboard or patchwork pattern, with streaks of green extending downward into lower dark gray shale. Evidently, at least the lower part of the Lawson is marine. Mottled coloration and veining of the upper part indicates alteration, likely by subaerial exposure.

The Bankston Fork Limestone was normally visible only in roof falls, where it had a flat or knobby base. Commonly a thin lower bench of limestone, about ½ foot thick, was separated from the main body by a few inches of shale or claystone. Miners anchored roof bolts in the Bankston Fork where the Brereton Limestone was thin or missing.

Clay dikes and small faults were abundant in the River King Mine and are reported in several other mines in the Freeburg area. Clay dikes are vertical or inclined intrusions of claystone into the Herrin Coal and associated strata. They range in width from a film of clay to several feet. Their boundaries are jagged and irregular; commonly they zig-zag through the coal. The filling is hard gray to yellowish-brown claystone containing angular fragments of coal and roof rocks. Most clay dikes penetrate only the upper part of the coal. Only large ones reach the floor. Above the coal, some penetrate the Bankston Fork Limestone. Some dikes are funnel-shaped. They contain fragments of roof shale and limestone, indicating that the dikes were filled from above.

Clay dikes are accompanied by small normal faults and commonly change into faults along strike. Faults dip at moderate angles, typically 35° to 55°. Displacement is typically one to three feet; the largest observed is 5 feet. Fault surfaces are slickensided with vertical striations. Coal banding along faults typically converges or diverges, and is folded opposite the direction of slip (false drag). Vertical clay dikes may not be faulted; gently inclined ones have the largest fault offsets.

In map view, dikes and faults form parallel sets or swarms that follow curving paths, in many cases running 1,000 feet or more. They are strongly concentrated in areas where the Brereton Limestone lies directly on the coal, and they follow the curving borders of limestone roof areas. Dikes occur in lesser numbers under other roof types. In Energy Shale, they tend to run parallel with the long axes of shale lenses. They also follow the axes of the channel-like areas of thin coal in the northern part of the River

King Mine. There is no overall preferred trend. Sets of dikes commonly branch and cross one another. Similar patterns have been documented at other mines in western Illinois (Krausse et al., 1979).

Clay dikes and faults clearly formed before the peat and sediments were fully lithified. They are products of horizontal extension, or stretching of the strata. Correlation with roof-rock patterns implies that stresses were set up or influenced by differential compaction of sediments. They were not regional, tectonic stresses. It is likely that dikes and faults formed as a result of shrinkage and de-watering of peat during early stages of coalification. They may be analogous to mud cracks.

Clay dikes and faults, when numerous, are detrimental to mining because they introduce waste rock into the coal and they weaken the roof in underground mines.

Natural Gas

The Freeburg underground gas-storage field is located in the southeastern part of the map area. The field was originally developed in 1956 as a gas field producing from the Cypress Formation at depths of 300 to 420 feet. The 29 wells encompassed an area of 2,400 acres and had initial open-flow capacities of 139,000 to nearly 4 million cubic feet per day (Meents 1959).

In 1959 Illinois Power Company converted the Freeburg field to gas storage. Gas received from out-of-state via pipeline is stored in the underground reservoir to be released as needed, principally during the winter. Illinois Power drilled more wells, bringing the total to 90 (83 injection and withdrawal wells plus 7 for observation) and expanding the field area to 4,222 acres. Yearly injection and withdrawal has been as great as 2 billion cubic feet (Buschbach and Bond 1974).

The reservoir is sandstone as thick as 47 feet, capped by impermeable shale. Average sandstone porosity is 21.5%, permeability averages 216 millidarcys. The trap is stratigraphic, created by westward, up-dip pinch-out of the sandstone on the flank of a northeast-facing monocline. A structure map by Buschbach and Bond (1974) depicts two monoclines, trending NW to NNW, and separated by a terrace. Similar step-like structure was observed in the Herrin Coal by ISGS geologists who visited strip mines in the Freeburg field area. These step-like folds may reflect faulting at depth.

The deepest test in the Freeburg Quadrangle is the Eason Oil # 1 Thomas well in Sec. 4, T1S, R8W, which reached total depth of 2,172 feet in the St. Peter Sandstone (Middle Ordovician). Several other wells tested the Kimmswick (Trenton) Limestone, whereas others finished in Silurian strata. Shows of oil were reported in the Kimmswick and Plattin Limestones, but no commercial production has been achieved from formations older than the Cypress.

Ground Water

Many farms, homes, and businesses in the map area depend on drilled wells for water, as does the city of Smithton. Some domestic wells produce from sand and gravel lenses in the glacial drift. However, most wells obtain water from bedrock. Several wells west and southwest of Freeburg are completed in Pennsylvanian bedrock at depths of 100 to 150 feet. It appears that in several cases, the Colchester Coal is the water-bearing unit.

Sandstone of the Cypress Formation is the principal aquifer in the eastern and central part of the map area. Its depth varies from less than 300 to more than 500 feet. Where the Cypress is absent or does not contain water, wells are drilled into the deeper Aux Vases Sandstone. West of the Richland Creek Fault, the Cypress is largely eroded and the Aux Vases is closer to the surface, generally lying at depths of 200 to 250 feet.

A peculiar fact of the Freeburg area is that the primary aquifers also contain oil and gas. In a number of cases, water wells could not be completed because of high gas or oil content.

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