

**POPULATION, DESCRIPTIONS, AND SITE CONDITIONS FOR SELECTED SETTLEMENTS  
AT THE TIME OF THE 1811-1812 EARTHQUAKES  
Ron Street**

***Comment: The population along the Ohio and Mississippi River valleys and neighboring states increased abruptly after the end of the hostilities that led up to the war of 1812. Consequently, the census figures of 1810 are considered to be the best estimates of the population distribution at the time of the 1811-1812 earthquakes. Unfortunately, many of the census records from the 1810 census were destroyed when the British sacked Washington, D.C., during the war.***

**Table of selected settlements:**

|                        |                           |
|------------------------|---------------------------|
| American Bottoms, Ill. | New Madrid, Mo.           |
| Big Prairie, Ark.      | Newport, Ky.              |
| Chillicothe, Ohio      | Pittsburgh, Penn.         |
| Cincinnati, Ohio       | Putnam, Ohio              |
| Circleville, Ohio      | Red Banks, Ky.            |
| Coshocton, Ohio        | St. Charles, Mo.          |
| Dayton, Ohio           | St. Louis, Mo.            |
| Fort Massac, Ill.      | Shawneetown (old), Ill.   |
| Goshen, Ohio           | South Union, Ky.          |
| Harrison, Ill.         | Springfield, Ohio         |
| Henderson, Ky.         | Troy, Ohio                |
| Herculaneum, Mo.       | Tywappity Bottom, Ill.    |
| Jeffersonville, Ind.   | Uniontown, Ky.            |
| Knoxville, Tenn.       | Vicksburg, Miss.          |
| Lancaster, Ohio        | Vincennes, Ind.           |
| Lexington, Ky.         | Washington, Ky.           |
| Limestone, Ky.         | Wheeling, (West) Virginia |
| Louisville, Ky.        | Wolf Island, Ky.          |
| Marietta, Ohio         | Worthington, Ohio         |
| Maysville, Ky.         | Yellow Banks, Ky.         |
| Nashville, Tenn.       | Zanesville, Ohio          |

**Locations in alphabetical order**

American Bottom, Illinois.  $V_{30}=195$  m/s; limestone bedrock at 33 m (Robert Bauer, Illinois State Geological Survey, personal communication, February 24, 2005). These remarks were based on drill hole data from two geotechnical holes in the northern part of American Bottoms.

Big Prairie, Arkansas. "Big Prairie is situated on the 1<sup>st</sup> point of land below the St. Francis distance from thence about three miles...several houses" (Drinker, 1812).

Chillicothe, Ohio. Crammer (1811) gives a detailed description of Chillicothe (pages 115 & 116). In his description he states that Chillicothe had 202 houses of freestone, brick, or timber clapboarded, as well as fourteen stores, a brick market house, a free stone courthouse, two newspaper offices, and two brick churches, centered along Water, Paint, and Market Streets.

The settlement was built on coarse grain deposits of sand and gravel, with thin layers of clay and silt, which were deposited by glacial melt water, overlying shale. A water well log near the intersection of Paint and Water streets, indicates that the depth to bedrock is in excess of 85 feet (Schmidt, 1980).

Cincinnati, Ohio. Ford and Ford (1881) described Cincinnati in 1810 as a place of about 360 dwellings, with about two-thirds of the houses in the bottom (i.e., the alluvium between the river and Third Street), and the rest on the Hill (i.e., between Third and Seventh Streets). They described the streets as not being paved, noted the lack of alleys, and stated that the dwellings were chiefly brick and frame, with some stone.

Dwellings built on the hill above the alluvial flood plain, rested on approximately 25 m of till consisting of a fine sand, clay, and gravel overlying limestone dominate bedrock (Brockman *et al.*, 2004). Shear-wave velocity profiling along what was the western edge of Cincinnati in 1811 yields a  $V_{30}$  of 260 m/s (Edward Woolery, University of Kentucky, personal communication, May 17, 2005).

The population in 1810 was 2,540.

Circleville, Ohio. Circleville was built on top of a 1,100 foot diameter Hopewell era earthwork centered at the intersection of present-day Court Street (State Route 188) and Main Street (US Rte 22/State Route 56) (Patti Hempsted, Administrative Assistant, City of Circleville, email, Dec. 4, 2006).

Circleville is located on a thick (> 30 m) layer of unconsolidated sand and gravel (Mangione, *et al.*, no date).

Coshocton, Ohio. In 1811, Dr. S. Lee, described Coshocton as "...a hamlet with a score or so of rude structures." The structures in the settlement were made of beech logs with bark intact, and were about 15 to 20 feet on a side. The jail, which was built in June of 1811, was a 36 by 16 foot structure built of oak logs. The settlement was centered in an area bounded by Water, Locust, 4<sup>th</sup>, and main Streets (Hill, 1881, pages 255, 268, and 298).

Site conditions at the location of the settlement, consist of a thick (tens of meters) layer of coarse sand and gravel (Sugar, 1988).

Dayton, Ohio. In 1811-1812 the settlement at Dayton occupied the area border by Monument Ave., Jefferson Street, 5<sup>th</sup> Street, and the Great Miami River, and according to the 1810 census, had a population of 383. It had a brick court house, a brick school, the Dayton Academy, and miscellaneous other brick buildings (Crew, 1889).

Site conditions at the location of the settlement, consist of a thick (tens of meters) layer of coarse sand and gravel. A water well near the center of the settlement's location goes to a depth of 176 feet without hitting bedrock (Schmidt, 1986).

Fort Massac, Illinois. Site conditions at the fort consists of about 19 m of Mounds Gravel, overlying 57 m of the McNairy Formation, and the Paleozoic bedrock (personal communication from John Nelson, Illinois State Geological Survey, January 22, 2007). Shear-wave stacking velocities from a nearby site in Woolery and Street (2001), suggest velocities of 280, 350, and 445 m/s for the Mounds Gravel, and upper and lower McNairy Formations, respectively.

Frankfort, Kentucky. In 1810, the number of residents in Frankfort was 1,099 ([www.cityoffrankfortky.com/co/history.htm](http://www.cityoffrankfortky.com/co/history.htm)). The state penitentiary that reportedly suffered minor damages during the earthquake of February 7, 1812 (*Western Sun*, Feb. 22, 1812, pub. in Vincennes, Indiana), is described as a medium-sized, two-story stone structure with barred windows and doors, surrounded by a 10-ft stone wall (*Herald-Leader*, Nov. 11, 1962, pub. in Lexington, Ky.). Site conditions at the location of the former penitentiary, the northwest corner of the intersection of High and Homes streets, is a veneer of an alluvium (< 5 m in thickness) overlying Tanglewood limestone (USGS Frankfort West (KY) Quadrangle).

Goshen, Ohio. In 1811-1812 Goshen was a Moravian mission that had a congregation of 28 persons (Mortimer, 1812).

Harrison, Illinois. "Harrison is a mean looking place of perhaps a dozen log cabins " (Drinker, 1812).

Henderson, Kentucky. The type of and depth to bedrock (limestone, shale, coal, etc.) in Henderson is highly variable. One block northwest of Audubon's house, which was at the corner of 2<sup>nd</sup> and Main streets, the thicknesses and shear-wave velocities of the soils beginning at the surface are 2.1 m at 116m/s, 3.4 m at 229 m/s, and 19.5 m at 274 m/s. Bedrock is at a depth of 25 m, and its shear-wave velocity is 1674 m/s (Higgins, 1997; Site H-13).

The first settlement at what is now Henderson, was the Dutch settlement of Red Banks. In 1810, the population was 159.

Herculaneum, Missouri. Herculaneum consists of fifteen to sixteen houses and none of them well built (Drinker, 1812). Cramer (1811), describes the houses as being built on a bluff along the Mississippi river.

Jeffersonville, Indiana. The historic area of Jeffersonville is bounded by Court Ave., Graham St., the Ohio River, and Interstate 95. Cramer (1811) describes the settlement as having 35 to 40 frame and log houses, a brick court house, and a population of 175 inhabitants.

For more detailed information on site conditions in Jeffersonville, geotechnical holes for a new bridge across the Ohio River were drilled and logged in 2006. At least one hole was drilled and sampled in the historical district of Jeffersonville.

Knoxville, Tennessee. The population in 1810 was 730.

Lancaster, Ohio. The original name of the settlement was New Lancaster, and it was bounded by Mulberry Street, Pearl Street, Chestnut Street, and Front Street ([www.ci.lancaster.oh.us/about/history.asp](http://www.ci.lancaster.oh.us/about/history.asp)). In 1810, it had at least three brick houses and a log cabin school (Graham, 1883).

The settlement was built on "...relatively thick clay layers interbedded with water bearing sand and gravel deposited in ancestral drainage channels (Anderson *et al.*, 1997). A 105 ft test well near the intersection of Mulberry Street and Front Street does not reach bedrock (Schmidt, 1992).

Lexington, Kentucky. On Vine Street in downtown Lexington, a shear-wave velocity refraction profile for the site indicates 4 m of 195 m/s soil overlying bedrock with a velocity of 966 m/s.

In 1810, the population in 1810 was 4,326.

Limestone, Kentucky. See Maysville, Kentucky.

Little Prairie, Missouri. Drinker (1812) states that Little Prairie once had 26 or 27 houses in it, and about 100 inhabitants, but not one house which is unroofed and almost completely fallen. The houses were built of logs and were one story high.

Louisville, Kentucky. Cramer (1811) describes Louisville as containing about 250 houses, a printing office, and containing several stores and warehouses. He also states that it is "...on an eminence about 70 feet in height..." and is situated at the mouth of Bear Creek. The eminence that Cramer describes is paralleled by present-day Main Street; it is a glacial outwash that consists of sand, gravel, clay, and silt.

The mouth of Bear Creek has changed from where it was when Cramer described it.

At the corner of Shelly and Market, a site on the glacial outwash, personnel at the University of Kentucky calculated a time-averaged shear-wave velocity for the uppermost 30 meters to be 601 m/s

(Edward Woolery, personal communication, June 2, 2010).

Marietta, Ohio. Cramer (1811) describes Marietta as a settlement of about 90 houses, a bank, printing office, a post office, and an academy. The historical location of the settlement is approximately the area bounded by S. Cammel, 3<sup>rd</sup>, Green e streets, and the Muskingum River. According to Walker (1984) and Rodgers *et al.* (2006), the location of the settlement puts it on a silty clay with traces of sand and gravel, that grades into shale and sandstone.

Maysville (Limestone), Kentucky. Cramer (1811) describes Maysville as a settlement on the west side of Limestone Creek standing on an uneven bank with 70 houses, a post office, and several stores. Two buildings from the time of the 1811-1812 earthquakes still stand, one 102 Front Street, and the other at 2 West Third Street. The uneven bank referred to by Cramer, consists of Wisconsin age glacial outwash that has a shear-wave velocity of 440 to 886 m/s (Woolery, *et al.* (2008).

The settlement was incorporated as Maysville in 1787, but it was frequently referred to by the original name of the landing, "Limestone".

Nashville, Tennessee. Nashville contains about 150 houses, some of them built of brick three stories high & in handsome style. From the number of stores presume there must be considerable business done here (*Travel Diary of Samuel Hastings Stackhouse* (1811).

[www.rootsweb.com/~mswtterr/diaryintro.htm](http://www.rootsweb.com/~mswtterr/diaryintro.htm)).

New Madrid, Missouri. Shear-Wave velocity of soils at Sand Hill Cemetery in New Madrid: Surface, 10 m of 100 m/s, 8.75 m of 179 m/s, 3.75 m of 251 m/s, 9 m of 303 m/s, 18.5 m of 240 m/s, and 28.75 m of 278 m/s (personnel communication from Jamie Harris, Millsaps College, Jackson, Miss. , 12 July, 2004).

The *Philadelphia Aurora* (June 4, 1812) describes the houses in New Madrid as being of frame or log construction.

Newport, Kentucky. Newport is described by Cramer (1811) as being a small settlement just above (i.e., upstream) the junction of the Licking and Ohio rivers, with a brick arsenal. The settlement was located on a ridge of Wisconsin age glacial outwash. Similar age glacial outwash in Maysville, Kentucky, was determined by (Woolery *et al.*, 2008) to have a shear-wave velocity of 440 to 720 m/s. The location of the arsenal is present-day James Taylor Park, and it was built on a thin layer of recent alluvium overlying Wisconsin age glacial outwash.

Pittsburgh, Pennsylvania. The number of inhabitants had increased in Pittsburgh by 1810 to 4,740. The town is described at this date as containing eleven stone buildings, 283 brick, and 473 of frame and log. In December, 1811, at about 3 o'clock in the morning an earthquake shook the town and was followed by another at about 7 o'clock in the morning (Fleming, 1922).

Putnam, Ohio. See Zanesville, Ohio.

Red Banks, Kentucky. See Henderson, Ky.

St. Charles, Missouri. At the time of the 1811-1812 earthquakes, the houses were wooden structures, except for one building, the Kibby House at 600 South Main Street (Olson, 1998; see inside of front cover). A chimney fell and a gable end was damaged on the Kibby House; the house was vacant from 1812 until 1820 when repairs were completed.

One block from the Kibby House, along Riverside Drive, the shear-wave velocity of the uppermost 30 m of sediment and bedrock was determined to be 740 m/s, and the depth to the bedrock 11 m (personal communication, Dr. Rob Williams, U.S. Geologic Survey, email dated April 3, 2005).

St. Louis, Missouri. The town of St. Louis was incorporated by the Court of Common Pleas in 1809. It covered an area of 7.63 square miles and was largely rural in character. In 1811 the built-up section of the town was defined for municipal purposes as extending from the foot of present Franklin Avenue west to what is now Broadway and south to Mill Creek, thence east to

the river. The population then was estimated at about 1,200 (pg. 6, stlouis.missouri.org/heritage/History69/).

The first brick house in St. Louis was built for William C. Carr in 1813 ( pg. 5 stlouis.missouri.org/ heritage/History69/).

Early houses were either stone or timber posts set on end in the ground, one story in height with a loft above, and steeply pitched roofs on all sides. The larger ones had porches or galleries all around, others only in front. They were about 20' by 30', divided into 2 or 3 rooms, and usually had fireplaces in each room, if they were stone houses (pg. 4 stlouis.missouri.org/heritage/History69/).

Shawneetown, Illinois. The original location of Shawneetown, is now Old Shawneetown.

Smithland, Kentucky. In 1807-1808, Schultz describes Smithland as a small settlement called Smith Town, consisting of only five houses at the mouth of the Cumberland River (Schultz, 1810).

South Union, Kentucky. At the time of the 1811-1812 earthquakes there were no structures at South Union except for a stone warehouse being used as a shelter by the construction crew. Site conditions

consist of 1 to 2 meters of soil overlying Girkin limestone that overlies Ste. Genevieve limestone.

Springfield, Ohio. See Zanesville, Ohio.

Troy, Ohio. Troy was laid out in 1808 and incorporated in 1814. The area of the settlement was within Water, Clay, Back, and Short streets. The houses were of wood, the first brick house in the settlement was built by A. McCullough [www.tdn-net.com/genealogy/stories/hist1880/concord.htm]. The court house was a double log house [Drake (1815). Picture of Cincinnati and Miami County].

According to Schmidt (1984), site conditions in the settlement consisted of several tens of meters of sand and gravel overlying limestone.

Tywappity Bottom, Illinois. The strip of land along the Mississippi River extending from Commerce to

Bird's Point, Illinois. Settlers began to move into the area as early as 1798 (Goodspeed, 1887).

Uniontown, Kentucky. In 1808, the location at present day Uniontown had only one house. The town was not granted a charter to incorporate until 1819 [*Union County Past and Present*, American Guide Series, Schuhmann Printing Company, Louisville, Ky., 1941].

Vicksburg, Mississippi. Vicksburg derives its name from Methodist minister Bewit Vick who established a mission there in 1817. The settlement was founded in 1825 [personal

communication, George Bolm, Director/Curator, Old Court House Museum, 30 Nov., 2006]. The settlement did not exist in 1811-1812.

Vincennes, Indiana. According to the *Census of Indiana Territory, 1810*, Vincennes had a total population of 670 individuals.

Descriptions of Vincennes in 1804 by Edward Hempsted in 1804 and David Thomas in 1816 provide some insight as to what the settlement may have looked like in 1811-1812. Hemsted states that the settlement "...contains upwards of a hundred houses, most of them in a battered situation, poorly constructed and wretched in appearance. The Governor's house [Grousland] is the best in it – The streets are narrow, and the public buildings are not to be boasted of, yet the soil is luxuriant, and the society genteel." In 1816, David Thomas, stated that there were several "good buildings of frame and brick," while the majority were of log and plaster. He also stated that the streets were not paved and during the wet season the roads became ribbons of mud (Bears, 1968).

Cauthorn (1902) states that the first houses erected in the settlement "were of timbers set upon end, thatched with straw and plastered with adobe." He also states that the first brick home in the settlement was Governor Harrison's home which was erected in 1804. The only other brick structure in Vincennes at the time of the earthquakes was a seminary that was built in 1807.

Shear-wave velocities of the soils in the Wabash River Valley about 6.8 km north (Fig. 6) and 8.6 km south (Fig. 5) of Governor Harrison's home can be found in Bauer (2005). The geotechnical hole north of Gov. Harrison's house went was sampled to a depth of 13 m, and was determined to have a time-averaged shear-wave velocity of 286 m/s, while the geotechnical hole north of Gov. Harrison's house went was sampled to a depth of 17.7 m, and was determined to have a time-averaged shear-wave velocity of 242 m/s.

Washington, Kentucky. Washington is built on the Bull Fork limestone formation.

Wheeling, (West) Virginia. Cramer (1811) describes the settlement as standing on a high bank with but one main street running parallel to the river. He states that the settlement as consist of 115 dwellings 14 stores, a courthouse, post office, and miscellaneous other businesses. E. Zane built one of the first brick homes in the settlement in 1810. It still stands at the corner of present-day intersection of 11<sup>th</sup> and Main streets in 1810, which was near the center of the settlement.

Based on drill logs along the river front just north of the location of the settlement, bedrock could either be sandstone or limestone, and is typically about 10 to 12 m below the normal pool level of the Ohio River (Oliver and Chambers, 1996). The settlement did not extend into the alluvial flood plain which experienced a severe flood in the fall of 1811; at that time the alluvial flood plain was being used for farming. The 1811 flood is known as the "Great Pumpkin Flood." It is possible that the high bank upon which Wheeling was located, as described by Cramer, was a glacial outwash which is common along the Ohio River.

Wolf Island, Kentucky. "...there are or were before the earthquakes several houses and settlers on this island" (Drinker, 1812).

Worthington, Ohio. Worthington was founded as a planned community in 1803. By the time of the earthquakes it had at least two brick buildings, the Griswold Tavern and Orange Johnson house. The former was on the northwest quadrant of the town square, and the latter is at 956 High Street. The original settlement was bounded by North, Morning, South, and Evening Streets ([www.Worthingtonmemory.org](http://www.Worthingtonmemory.org))

The settlement was built on Devonian and Mississippian age shale bedrock (Schmidt, 1993).

Yellow Banks, Kentucky. At the time of the earthquakes in 1811-1812, Yellow Banks was an unincorporated settlement consisting of a general store/post office and a few nearby farms. The general store/post office was located at what is now the corner Main and Frederica streets.

Most of the settlement was situated along what is now Elizabeth Street. In 1817 the settlement was incorporated as Owensborough, which was later shortened to Owensboro ([www.kdla.ky.gov/resources/countyomonth/daviess.htm](http://www.kdla.ky.gov/resources/countyomonth/daviess.htm)).

Zanesville, Ohio. In 1811-1812, what is now Zanesville, was two settlements, Springfield and Zanesville. Springfield was located on the southwest side of the Muskingum River in the area roughly bounded by the river and Woodlawn Ave., and Van Buren St. In 1814, Springfield was renamed Putnam, which some time later was annexed into Zanesville. The settlement of Zanesville in 1811-1812, was centered along Main Street between South and Market Streets, and extended eastward to about N 6<sup>th</sup> St. Buildings in the two settlements were a mixture of brick, frame and log structures (Sutor, 1905).

There are no U.S. census figures for the settlements in 1810 because those documents were destroyed by the British when they sacked Washington in the war of 1812. However, in 1807, Schneider (1950) describes Springfield as having fifty houses and some taverns and stores, and Zanesville as having about forty houses and Cramer (1811) states that Zanesville had 60 families in 1807. But in 1810, Zanesville was the capital of Ohio, so the population would have been somewhat larger.

The original sites for Zanesville and Putnam are underlain by thick (~30 m) deposits of sand and gravel (Walker, 1992).

## REFERENCES

Anderson, S. C., J. M. Raab, L. C. Brown, and K. T. Ricker, (1993). *Fairfield County Ground-Water Resources, AEX-490.23-97*, pub. by Ohio State University Extension, Columbus, Ohio.



Bauer, R. A., 2005. *Central U.S. shear –wave velocity database with accompanying geological/geotechnical information of un lithified geologic materials*, Final Technical Report, External Grant Award Number 04-HQ-GR-0074, 29 p.

Bears, Edwin C. (1968). *Vincennes in the years 1800-1820*, Vincennes Historical and Antiquarian Society, Vincennes, Indiana.

Brockman, C.S., R.P. Pavey, G.A. Schumacher, D.L. Shrake, E.M. Swinford, and K.E. Vorbau , 2004. Surficial geology of the Ohio portion of the Cincinnati and Falmouth 30x60-minute quadrangles, Ohio Division of Geological Survey Map SG-2 Cincinnati-Falmouth, scale 1:100,000.

Cauthorn, H. S. , 1902. *History of the City of Vincennes, Indiana, 1702-1901*, Moore & Langen Printing, Terre Haute, Ind., 271 p.

Cramer, 1811. *The Navigator* [7<sup>th</sup> ed.], Pittsburgh, Cramer, Spear, and Eichbaum, 215 p.

Crew, H. W., 1889. *A History of Dayton, Ohio with Portraits and Biographical Sketches of its Pioneers and Prominent Citizens*, United Brethren Publishing House, Dayton, Ohio.

Drinker, H. W., 1812. *Journal of a passage from St. Louis to New Orleans, containing remarks of the late ravages of earthquakes on the bank of the Mississippi, commencing March 13, 1812, Henry W. Drinker*, Copy at St. Louis Mercantile Library, University of Missouri-St. Louis, transcribed by N. K. Moran.

Fleming, G. T. (1922). *History of Pittsburgh and Environs*, American Historical Society, American Historical Company, New York, 1922, Vol. II, pg 52.

Ford, H.A., and K.B. Ford, 1881. *History of Cincinnati, with illustrations and biographical sketches*, Cleveland, Ohio, L.A. Williams & Co., 189 p.

Goodspeed, 1887. *History of Southwest Missouri* . See New Madrid District.

Graham, A. A., 1883. *History of Fairfield and Perry Counties, Ohio, transcribed by E. Fisher of the Perry Historical Society*, W. H. Beers & Co., Chicago, Ill.

Higgins, B.A., (1997). *Site amplification of earthquake ground motions in unconsolidated sediments in Henderson, Kentucky*, M.S. thesis, 220 p.

Hill, N. N., 1988. *History of Coshocton County, Ohio it's Past and Present, 1740-1881*, A.A. Graham & Co., Publishers, Newark, Ohio.

Mangione, D.A., J.M. Raab, K.M. Boone, and L.C. Brown (no date). Pickway County Ground-Water Resources, AEX-490.65, Ohio State University Extension, Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr., Columbus, Ohio 43210, 7 p.

Mortimer, Rev. B. Diary of the Indian congregation at Goshen on the river Muskingum for the year 1812, Ohio History, The Scholarly Journal of the Ohio Historical Society, Vol. 22, p. 205.

Oliver, D., and D. Chambers, 1996. Subsurface Exploration and Geotechnical Evaluation of the proposed Heritage Port, Wheeling West Virginia, a *report*, Triad Engineering, Inc., Project No. 96142, Morgantown, West Virginia.

Olson, E. M. (1998). Historical Saint Charles, Missouri, St. Charles County Historical Society, 107 p; *see inside of front cover*.

Rodgers, D., N. Beach., E. Kistner, and S. Harris, 2006. Red Flag Summary (Geotechnical Portion), District 10, Washington North Muskingum River Crossing (Route 7), PID 10592.

Schmidt, J. J., 1980. Groundwater resources of Ross County, map, Ohio Division of Natural Resources.

Schmidt, J. J., 1881. Ground water resources of Fairfield County, map, Ohio Dept. of Natural Resources, revised 1992.

Schmidt, J.J., 1984. Ground water resources of Miami County (map), Ohio Dept. of Natural Resources.

Schmidt, J. J., 1986. Groundwater resources of Montgomery County (map), Ohio Dept. of Natural Resources.

Schmidt, J.J., 1993. Ground water resources of Franklin County, map, Ohio Dept. of Natural Resources.

Schneider, N.F., 1950. Y Bridge City: The story of Zanesville and Muskingum County, Ohio, Cleveland and New York, The World Publishing Company, 407 p.

Schultz, Jr., C., 1810. *Early Travelers, Travels on an inland voyage through the states of New York, Pennsylvania, Virginia, Kentucky, and Ohio, and through the territories of Indiana, Louisiana, Mississippi and New Orleans in the years of 1807 and 1808*, pub. By Isaac Ripley, New York, N.Y. 2 Vols.

Sugar, D. J., 1988. Groundwater Resources of Coshocton County, map, Ohio Division of Natural Resources.

Sutor, J. H., 1905. Past and present of the city of Zanesville and Muskingum County, Ohio, Chicago, S. J. Clarke Publishing Company, 845 p.

Walker, A. C., 1992. Ground water resources of Muskingum County, map, Ohio Department Of Natural Resources, Columbus, Ohio.

Woolery, E. W. and R. Street (2002). An integrated geophysical assessment of Late Quaternary neotectonics along the northern Mississippi Embayment extension of the Flourspar Area Fault Complex, U.S. Geological Survey Final Technical Report 01HQGR0044, Fig. 4]

Woolery, E., T.-L. Lin, Z. Wang, and B. Shi, 2008. The role of local soil-induced amplification in the 27 July 1980 northeastern Kentucky earthquake, *Environmental and Engineering Geology*, XIV (4), 267-280.