UNEARTHING NEW JERSEY

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MESSAGE FROM THE STATE GEOLOGIST

This issue of *Unearthing New Jersey* highlights the historic aspects New Jersey's geologic resources and their legacy. Although New Jersey is known as the Garden State, Larry Müller recounts its early history as the nation's premier iron producing state. Most iron ore was taken from the crystalline rocks of the New Jersey Highlands. These mines were extensive and played an important role in the economy and history of both the state and country. Forges that processed Highlands ore began operating in the early eighteenth century and supplied iron for Colonial America and later for cannons and shot duriing the Revolutionary War.

Although there are no underground mines operating in New Jersey today, the legacy of past mining persists. Shallow voids and filled near-surface mine openings collapse regularly around the state, often catastrophically. A plan to locate and mitigate subsidence hazards related to abandoned mines has been developed by the NJGS for the State Police Office of Emergency Management, Multihazard Mitigation Plan.

Steve Johnson provides a fascinating description of the first artesian well in the state drilled at Winslow Village, Camden County in 1853. It was 335 feet deep and bored into the Piney Point, an aquifer which today serves nearby Ancora State Hospital. The well supplied water to a steam engine boiler that powered equipment at Winslow Glass Works; it was named after its owner, Andrew K. Hay, who also served as a U S Congressman representing New Jersey's 1st District in Southern New Jersey. The well served as a model for locating ground-water supplies along New Jersey's Atlantic coast.

Given the current interest in global climate change, Jeff Hoffman summarizes some of the extremes in historical meteorologic observations compiled on the State Climatologist's web site. The striking number of warmest months that have occurred in New Jersey since 1998 argues that an actual change is occurring to our climate.

The Survey welcomes your feedback on the content or format of the newsletter (njgeology.org/comments.html). Other recent geologic activities and digital publications of the Survey are noted in the newsletter and elsewhere on the Survey's Web site. Printed maps and reports are available to the public through the DEP Maps and Publications Office (609) 777-1038, PO Box 438, Trenton, N.J. 08625-0438 and a publications price list is maintained on the Web. Unpublished information is provided at cost by writing the State Geologist's Office, N.J. Geological Survey, PO Box 427, Trenton, N.J. 08625-0427. Staff are available to answer your questions 8 a.m. - 5 p.m. Monday through Friday by calling (609) 292-1185.

Karl W. Muessig,
New Jersey State Geologist

Miners loading ore, Scrub Oak Mine, Mine Hill Twp, Morris County, 1941. *NJGS archives, photographer unknown.*

IRON IN THE NEW JERSEY HIGHLANDS

By F. L. Müller

Although New Jersey is known as the Garden State for the rich agricultural crops grown here, until the great Minnesota mines of the Mesabi Range were discovered, it was also the premier iron-producing state. The last issue of *Unearthing New Jersey* recounted the history of the limonite-goethite iron mines of the South Jersey bogs. Although, there was some mining of limonite-goethite in North Jersey, the lion's share of iron ore came from the hard-rock mines of the Highlands Physiographic Province. These mines were extensive and played an important role in the economy and history of the state and country.

Forges that processed Highlands ore began operating in the early eighteenth century. Three of the first were at Whippany in Morris County (1716), Oxford in Warren County (1742), and High Bridge in Morris County (1754). The earliest forges were charcoal fired, but the use of anthracite coal as a fuel caused the number of these to decline. By

1882, Highland mines had produced 932,762 tons of iron. In a census of 1879-1880 magnetite mines numbered 92 and produced 727,790 tons, while limonite mines counted 11 and produced 16,003 total tons of ore.

Hundreds of shafts and prospects dotted the Northern New Jersey landscape. Mine adits and tunnels stretched for miles penetrating great depths. Vast quantities of ore were removed. For example: the Scrub Oaks Mine in Mine Hill produced 7,000,000 long tons (a long ton equals 2,240 pounds) and reached over 3,200 vertical feet below the surface; Mount Hope Mine in Rockaway produced 6,500,000 long tons and was 2,694 feet deep; the Hibernia Mine in Rockaway produced 5,230,000 long tons and reached 1600 feet, the Washington Mine in Oxford produced 4,650,000 long tons and penetrated 2,200 feet.

The ores were mainly extracted from the Highlands gneiss, although some were from limestone. The Sulfur Hill Mine in Andover and the mines on Jenny Jump Mountain, are examples of mines extracting ores from limestone. The ore minerals sought were magnetite (called "blue ore"), hematite ("red ore"), specularite, and martite. Magnetite (figure 1), by far the most important ore, is, in it's pure form, a black, magnetic mineral which is very heavy (specific gravity = 5.17). Some varieties of magnetite are natural magnets called "lodestones". Magnetite is an iron oxide with the chemical formula Fe_3O_4. Magnetite crystals are usually octahedral and some very fine examples have been found in New Jersey. Magnetite will often alter to martite, a hematite pseudomorph[1], or to the iron oxyhydroxide goethite, FeO(OH).

Figure 1. Magnetite in a hematite matrix. Sample from Andover Mine, Andover Twp, Sussex County. *Photo by J.H. Dooley*

Hematite, originally named for its blood-red color, actually occurs in several colors, including brown and a shiny black-silver variety called "specularit," which is often cut, polished and used for jewelry. Hematite has the chemical formula Fe_2O_3. It most commonly occurs as earthy masses, but can also occur as platy mica-like sheets, compact columnar, kidney-shaped (botryoidal), or stalactic forms. At times hematite mixes with and colors quartz to form jaspellite and it is, as well, the coloring agent in a great many soils. Hematite was an important ore of the Andover Mine, where it was mined along with magnetite. Mining started at the Andover Mine during the American Revolution and by the time it stopped operations in the nineteenth century it had produced 400,000 tons of ore making it the most productive hematite mine in the state.

Interested in mining? Iron Miners, a group dedicated to preserving the sites and history of iron mining in the northeastern United States, has a website (www.ironminers.com) you can visit. The site provides photo-tours of sixteen mines in New Jersey. A word of caution, do not try to explore abandoned mines on your own. Old mine shafts can be extremely dangerous. If you would like to experience a real mine, visit The Sterling Hill Mining Museum (sterlinghillminingmuseum.org) in Ogdensburg, N.J. Sterling Hill was a working mine until 1986.

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[1] pseudomorph is a mineral whose outward crystal form is that of another mineral species that develops by alteration, substitution, or incrustation.

Fe_3O_4

NEW JERSEY'S ABANDONED MINES: A SUBSIDENCE MITIGATION PLAN

By Karl Muessig, Richard Dalton and Richard A. Volkert

MINING AND SUBSIDENCE HAZARDS

Although there are no underground mines currently operating in New Jersey, the mining industry (see lead article) was active from colonial times until 1986 when the Sterling Hill zinc mine closed. Coverage on the New Jersey Geological Survey web site (www.state.nj.us/dep/njgs/geodata/dgs03-2.htm) indicates there are over 570 abandoned mines in the state. As northern New Jersey development continues, the impact from these abandoned mines persists. Subsidence occurs from natural forces such as rain, freezing and thawing and gravity. This can cause voids and shallow filled areas of historic underground mines to collapse, often with catastrophic results. Unfortunately,

NJGS 1835

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Figure 1. Collapse in North Arlington Boro, Bergen County. *Photo courtesy Borough of North Arlington*

most of the mines are not accurately located, and there is little information concerning the potential hazard they pose to the public. Many of the surface openings were improperly filled and roads and buildings have been built adjacent to or over the old workings. Periodically, especially after significant rain, a shaft or filled area may collapse causing damage to a yard, building or infrastructure. Repairs are expensive, generally beyond the financial resources of a private land owner or community.

Starting in 1977 the Office of Mine Safety (Office of Safety Compliance) in the Department of Labor and Workforce

Figure 2. Collapse along the White Meadow Mine workings, Rockaway Twp, Morris County. *Photo by R.A. Volkert*

Development printed a series of reports on abandoned mines, generally by township. They tried to locate the mines by tax map, when possible, a method useful to local officials and property owners. This extensive data source has significant shortcomings: many mines were not found; many locations are shown only on sketch maps; original source maps cannot be located; few were surveyed accurately. Also the reports only addressed the iron mines, not the copper, graphite, manganese, mica or zinc mines. The “Introduction” to these reports indicates that prior to 1977 about 25 collapses of old partially filled shafts were reported. Currently, a search of various reports, newspapers and limited field investigations has documented at least 77 collapses, many occurring in the 30 years since the 1977 reports.

EXAMPLES OF RECENT SUBSIDENCE

The potential hazard of collapse from abandoned mines is great. Several communities have passed ordinances requiring certification that there is no danger from abandoned mines before a building permit can be issued. In some cases the developer has been required to undertake extensive drilling investigations to locate and seal abandoned workings and shafts. Nevertheless, much development has occurred in mining areas prior to local awareness of the potential problem.

Remediating a collapse is expensive. North Arlington Bergen County, spent about $250,000 per shaft to remediate the copper mines in the area (fig. 1). Rockaway Township, Morris County, has remediated collapses along the White Meadow Mine workings (fig. 2) several times since the 1950’s, most recently in 2005 and 2007 at a cost in excess of $500,000. Spending for other recent mine remediation activities including engineering drilling are: Woodhull Mine about $1,000,000; Orchard Mine over $400,000; and Drake Mine, more than $700,000.

In July 2005, the Cooper Mine collapse in Ringwood Boro, Passaic County, occurred in a back yard within 50 feet of a house. The hole, about 20 feet across and 10-15 feet deep, has yet to be remediated. The town sought over $200,000 of state aid for grouting subsurface voids and filling the hole because neither they nor the home owner have the funds to do it. About $230,000 of state funds were spent to grout the public road (fig. 3) which crosses the Cooper Mine and provides access to the affected homes.

In October 2006 a collapse occurred in a yard near the jug handle for Weldon Road and State Route 15, at Hurdtown in Jefferson Township, Morris County. The hole was about 6 feet by 15 feet and at least 20 feet deep, and warm moist air was circulating out of it. This Hurd or Hurdtown Mine was worked until about 1900 reaching a depth of over 2,600 feet when abandoned. Many other collapses associated with this mine have occurred near the Route 15 exit ramp intersection which was constructed directly over the near-surface portions of the mine. Heavy rains were the likely

Figure 3. This collapse occurred where the road crossed the Cooper Mine. It is approximately 125 feet from a previous collapse in the back yard of a private home, Ringwood Boro, Passaic County. *Photo by R.A. Volkert*

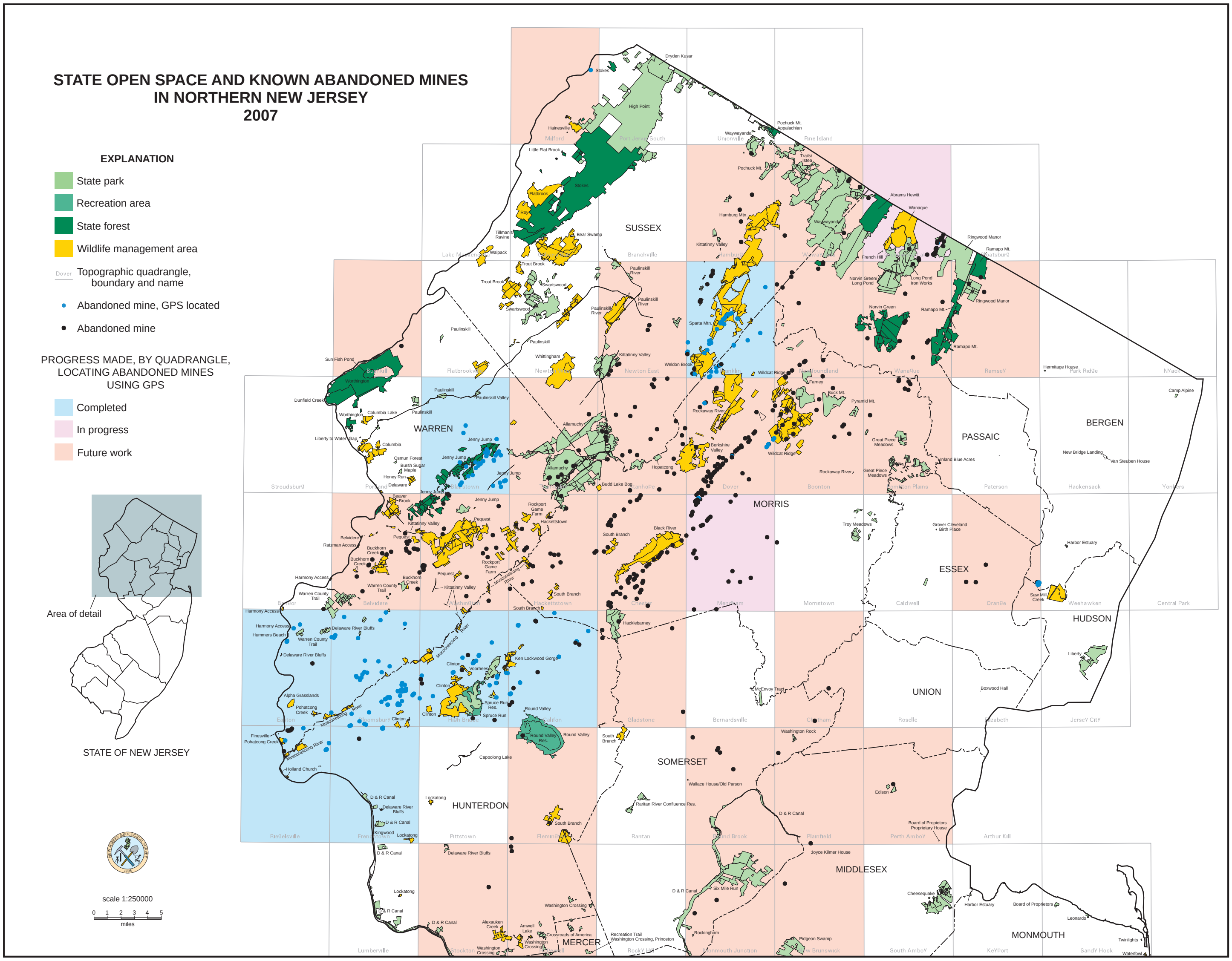


Figure 4. State open space and known abandoned mines in northern New Jersey. *Cartography by Z. Allen-Lafayette*

cause of the collapse.

In addition, there are several state, county and municipal parks on land where the locations of abandoned mine workings are poorly known (fig. 4). An evaluation of risks associated with public land and the necessary protective precautions to be taken is underway.

A PLAN TO MITIGATE MINE SUBSIDENCE

The New Jersey Multi-Hazard Mitigation Plan requires that the subsidence hazard related to abandoned mines be addressed. Development of an accurate database of all the known mines will be completed and include the locations of all shafts and pits, information about their size, history of previous subsidence and any remediation known to have been undertaken. In a grant application to FEMA, the New Jersey Geological Survey proposes to compile historic information, accurately locate all mine and subsidence features in the field using GPS, develop a georeferenced database including the historic information, prioritize the subsidence hazard risk for all mine features, and guide subsidence mitigation by public agencies through an interagency task force, public outreach and professional education.

Compilation of historic information includes searching old maps, reports and permanent notes and plotting the most accurate locations possible on air photos to help field locate the mine. After a mine is located in the field, GPS coordinates will be generated. Some mines consist of a single pit or shaft while others may have a dozen or more pits or openings. A mine may be near a road or might be more than a mile from the nearest paved road. Many mines are located in heavily forested areas, but some are in heavily developed regions that were filled and graded over and buildings constructed on top of the old mine workings. These sites present the greatest danger to a public that is often unaware there is an old mine on their property. Some mine shafts are now under buildings, roads and parking lots. These will require significant time to accurately locate.

Over the past several years, GPS locations have been collected in the field for about half the mines. Once the workings are found, all known shafts and pits are documented with written descriptions and GPS locations. Photographs are also taken of many of the shafts, pits or subsidence features. Although about half the mines remain to be located (fig. 4), past mapping experience has shown that some mines will not be found and a few unnamed and unknown mines or prospect pits will be discovered. Contingent on the support of FEMA, it will take approximately three years to accurately locate the remaining mines.

Developing a georeferenced database with this information is in progress. It includes all abandoned mine features, mine name, alternate name, location by county and municipality, GPS coordinates, identified workings, shafts, pits or subsidence features, and any past remediation activities. Current air photos will be examined to evaluate land use, and this information will also be included in the database.

Using this database, a risk prioritization procedure will be designed based on mining and subsidence history, current land use and remediation. Evaluations of land use, that is, proximity of residences, public roads and buildings, will be critical to risk evaluation. The procedure will determine the likelihood of subsidence from the physical characteristics of the mine and risk of public exposure given the current and projected land use.

Once prioritization is complete, mitigation of mine subsidence hazards will be guided through a multiagency task force of the Department of Community Affairs, Labor and Workforce Development, Transportation and the Office of Emergency Management. The focus will be on outreach to state, county and local emergency managers. Appropriate mitigation may include securing the site, acquiring it as open space or remediating the hazard. It will also include outreach to affected communities and the education of professionals regarding mine subsidence hazards and remediation.

Fe_3O_4

THE A. K. HAY WELL – NEW JERSEY'S FIRST ARTESIAN WELL

By Steve Johnson

THE WELL

New Jersey's first documented artesian well was drilled in 1853. It was 335 feet deep and bored into the Piney Point aquifer at Winslow Village, Camden County, New Jersey (fig. 1).

An artesian or confined well is one driven or drilled into an aquifer which contains ground water under pressure between or below confining unit(s) so that the water rises above the aquifer in a tightly cased well. Reportedly, Levi Disbrow drilled a deep well in May 1824 into the Passaic Formation at New Brunswick and the water flowed above the land surface. However, little information is available on this venture and the Passaic Formation's aquifer -- Brunswick -- is not typically artesian. The A. K. Hay well was probably drilled using the cable-tool method which uses metallic tools that drive a steel casing (pipe) into the ground. The broken-up rock and sediment is cleaned from inside the casing which is pushed and driven deeper until sufficient water rises within it. A well screen was probably not used but rather the well worked much like a straw in a bottle of soda. Today, this

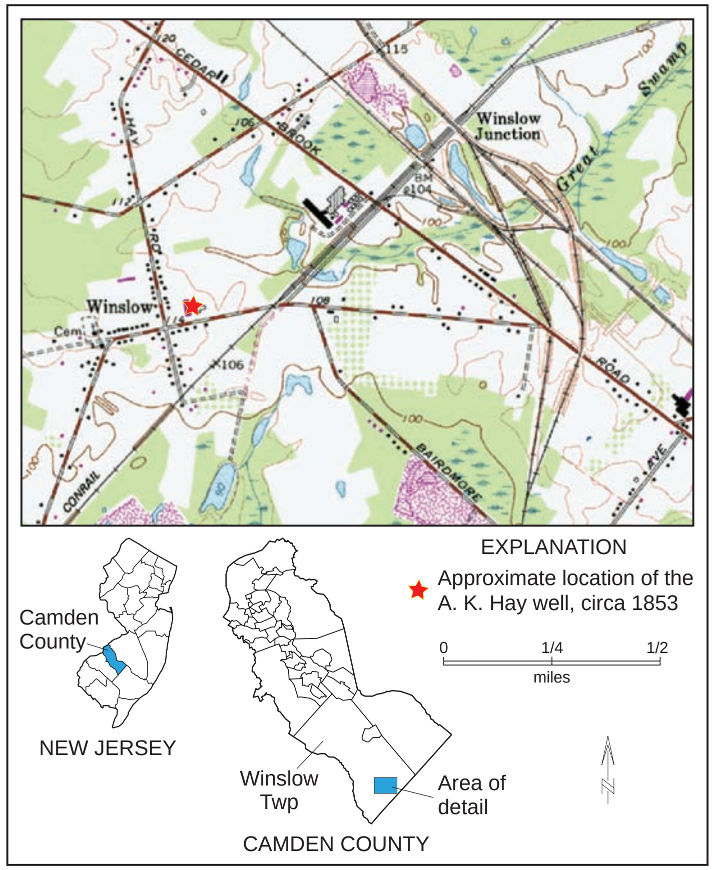


Figure 1. Winslow Village and the approximate location of the well, Winslow Twp, Camden County.

construction method is called a tube well and is no longer used in New Jersey.

The A. K. Hay Well is named after its owner, Andrew K. Hay, an industrious individual involved in many enterprises. He served as proprietor of the Winslow Glass Works (1831-1892), as Congressman representing New Jersey's First District in Southern New Jersey during 1849-51, and was president of the Camden and Atlantic City Railroad from 1872-76. A steam locomotive was named for him on that line.

Hay was appointed to the New Jersey Geological Survey's First Board of Managers in 1864, representing the First Congressional District. Other notable members of the board on which he served were John A. Roebling (Trenton), Second District, and Abraham S. Hewitt (Passaic), Fourth District. The Board oversaw New Jersey Geological Survey salaries, purchases of materials and tools, and provided to the state geologist, "any and all information which will contribute to the more full and complete development of the facts relating to the agricultural, mining, mechanical, and other industrial interests of the State".

The Winslow Glass Works operated from about 1831 to 1892 producing mostly fruit jars (Winslow Jar, fig. 2) and window lights (glass panes). The company was founded by Hay's father-in-law, William Coffin, Sr., who named the area Winslow after his youngest son. In 1865 the glass works employed about 400 men, and Winslow Village consisted of 150 homes, a Methodist church, an Odd Fellows Hall, a company store, and a "Model Farm" of 800 acres with

Figure 2. Winslow Jar produced at the Winslow Glass Works, circa 1875. *Photo by S.W. Johnson*

a connection to the glass works. In 1879 the Winslow Glass Works was 15 acres in size, made 6,000 gross (864,000) of fruit jars, and 6,400 boxes of window glass a month, and employed 225-250 people.

The well was used to supply water to the boiler of the steam engine which powered the mill's saws and grinding stone. Hay built the mills about 1851 after he and his nephew, John B. Hay, became co-proprietors of Winslow Glass Works. Somewhat unusual for New Jersey, the mill was not powered by a running stream and mill pond but rather by a steam engine. Figure 3 shows a sketch of the mill (building 12), steam engine building (building 13), and well house (building 14). Two wooden elevated water storage tanks are shown at the well house and adjacent to the engine building.

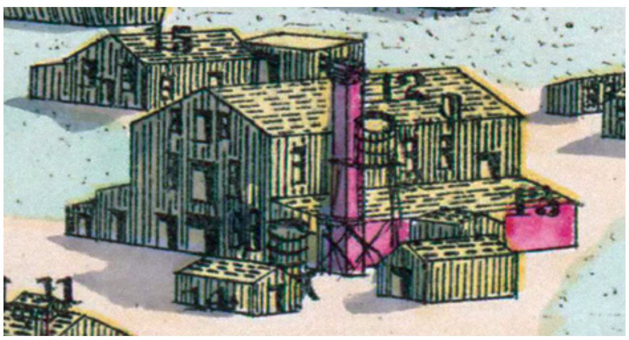


Figure 3. Schematic drawing of a portion of the Winslow Glass Works. Sketch modified from Hexamer Survey, Volume 25, 1882.

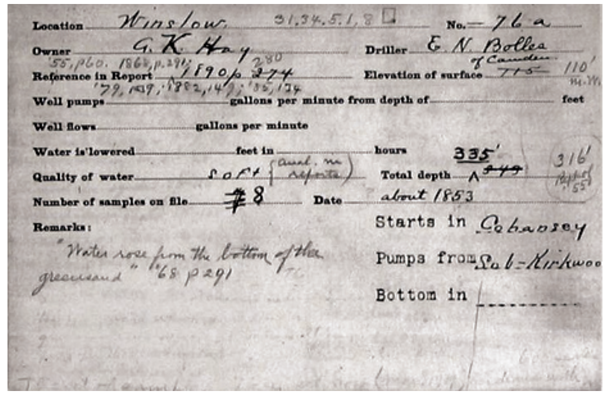
The well house was located near Hall Street in today's Winslow Village, east of Hay Street.

According to the survey completed by E. Hexamer & Son of Philadelphia, the building housing the steam engine was constructed with brick walls. A portion of one wall remains today supporting a more recent foundation and cement floor (fig. 4). The well house (building #14), which no longer exists, was a 1-story, wood framed structure.

Figure 4. Steam engine and boiler house wall built circa 1851. Note wall made of various sized bricks, purply red "Jersey" stone and recent cement floor overlying it. *Photo by S.W. Johnson*

WELL SAMPLES

E. N. Bolles of Camden drilled the well and collected soil sediment samples at various depths, while doing so under the interested eye of A. K. Hay. The samples have been stored in the NJGS sample library for over 150 years. The drilling of the well was reported to the New Jersey Geological Survey soon after it was constructed and a description was included in the 1855 Annual Report of the State Geologist. Figure 5 is a photograph of the original well record. A. K. Hay



Location Winslow 31.34.5.1.8 No. 76 a
Owner G. K. Hay Driller E. N. Bolles of Camden
Reference in Report '55, p60. 1868, p.291; 1890 p 274 '79, 139; 1882, 14; '85, 134 Elevation of surface 110'
Well pumps gallons per minute from depth of feet
Well flows gallons per minute
Water is lowered feet in hours
Quality of water soft Total depth 335'
Number of samples on file #8 Date about 1853
Remarks:
"Water rose from the bottom of the greensand" '68 p 291
Starts in Cohansey
Pumps from Sol-Kirkwood
Bottom in

Figure 5. Photograph of the original well record. *Photo by S.W. Johnson*

furnished a log of sediments or strata penetrated by the well that was later modified slightly and included in George H. Cook's landmark study, *Geology of New* Jersey, published in 1868. The log reads:

0-5'	Sandy loam
5-20'	Blue and black clay
20-115'	Glass sand, described as quick sand
115-150'	Miocene clay, described as hard, black clay
150-257'	Micaceous sand, described as quicksand
257-300'	Brown clay, described as black, hard clay (A gum tree log one foot in diameter found here.)
300-320'	Greensand marl, and white shells, teeth, etc.
320-335'	Pure greensand-no fossils

Today we know the upper 150 feet of the Cohansey Formation (Miocene) and Holocene deposits are sand and clay. A fine-grained and almost pure white "glass sand" occurred between 20-115 feet below land surface. From 150' to 300' is the Kirkwood Formation composed of Micaceous sand, and an underlying dark brown clay. Beneath the dark clay of the Kirkwood confining unit is the Shark River Formation composed of greensand with fossils (shells and shark teeth). Figure 6 is a photograph of the original soil samples collected in 1853. The aquifer in the Shark River Formation is today called the Piney Point.

Near Winslow Village the Piney Point aquifer is used by Ancora State Hospital and Winslow Township. Well yields range from 40-150 gallons per minute.

The A. K. Hay well was used as a model for locating ground-water supplies along New Jersey's Atlantic coast. It was the deepest well drilled in southern New Jersey until the 1880's. From well logs and studies of rock outcrops, former State Geologist Cook (1863-1888) understood that

Figure 6. Eight original glass vials containing the soil samples collected in 1853. *Photo by S.W. Johnson*

the Kirkwood and Cohansey sands were underlain by a clay confining unit and greensand marl, and that they might be open to salt water intrusion along the coast. Cook also noted that under the clay and marls there was a greensand formation yielding water as the A. K. Hay Well did at Winslow. Cook observed that the greensand marl outcropped in Kirkwood 45 miles from Atlantic City at elevation 70 feet above mean sea level, and that the marl dipped about 25 feet a mile to the east. He reasoned that the greensand aquifer might be found approximately 1,050 feet below Atlantic City. Further, Cook noted that the marl and clay formations to the north were not as far beneath the surface. Based on these findings, in the 1880s, test wells were drilled along the coast and the Wenonah-Mount Laurel and Englishtown aquifers were discovered beneath the subsurface clays and marls along the Northern New Jersey coast at Asbury Park and Ocean Grove.

Test-well drilling for the greensand beneath Atlantic City discovered a more recent and higher clay/marl bed in a member of the Kirkwood Formation and beneath it, the Atlantic City 800-foot sand, a most important water supply aquifer serving coastal and barrier island communities of Ocean, Atlantic and Cape May Counties.

Although the A.K. Hay Well and the Piney Point aquifer served as a model for water-supply exploration on the New Jersey coast, today the Piney Point is not used for water-supply along New Jersey's southeastern shore.

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Fe_3O_4

GOING TO EXTREMES

By Jeff Hoffman

It's warmer in the summer, colder in the winter. We expect this normal variation in temperatures. But pick one month, April, for example. We know that some Aprils are a little cooler, others warmer. In what year was the warmest April? When was the coldest?

New Jersey's State Climatologist is Dr. David Robinson, a Rutgers professor. His web site (climate.rutgers.edu/stateclim/) provides meteorological data that show current weather patterns as well as historical observations. One data set on the web site is average monthly temperature in New Jersey from January 1895 to the present.

Using this data set it is easy to determine the warmest or coldest April. (For the record, the warmest April was in 1921, the coldest in 1908). One can also rank, for every month, all the years from warmest to coldest.

Figure 1 shows the three warmest and three coldest years for each month. The warmest year is indicated by a bright red box and labeled with a '1'. The 2nd warmest year is pink with a '2' and the 3rd is orange with a '3.' At the other extreme, each month's coldest year is dark blue with a '1.' The 2nd and 3rd coldest years for that month are medium and light blue boxes labeled '2' and '3', respectively.

This is a purely visual way to see when the warmest and coldest months occurred. What jumps out is the number of warmest months that have occurred since 1998. October 2007 was the warmest October on record. November and December 2006 were the warmest of those months. In the years 2000-2007 there were 11 months that were in the top 3 rankings of warmest, and only one month, July 2000, that was one of the coldest.

At the other end of the record, 1895-1919 has more than its share of coldest months. (So if your great-grandmother told you she walked to her one-room school-house through blinding snow, uphill, both ways, perhaps she wasn't exaggerating about the snow.) A similar analysis of wettest

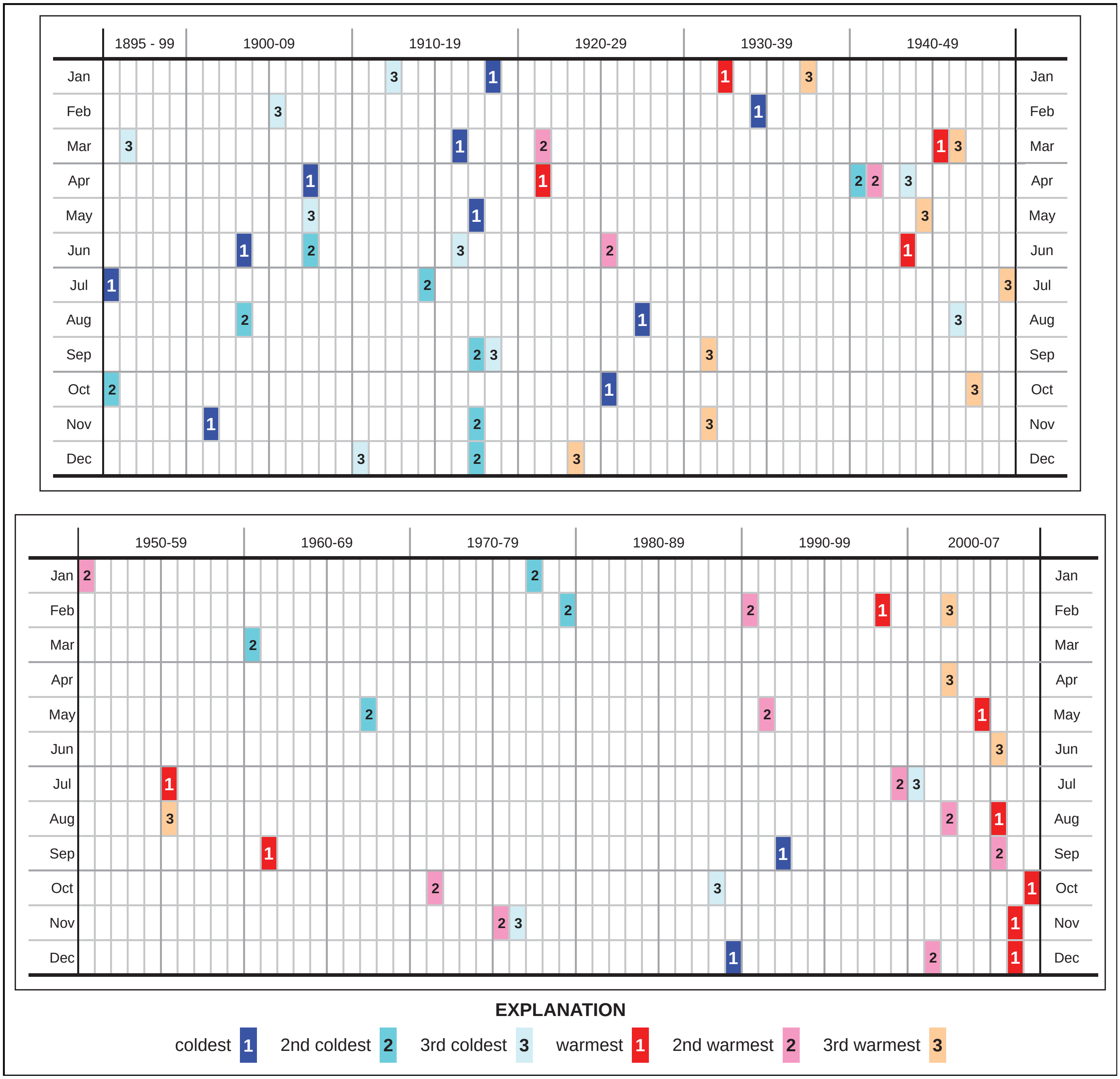


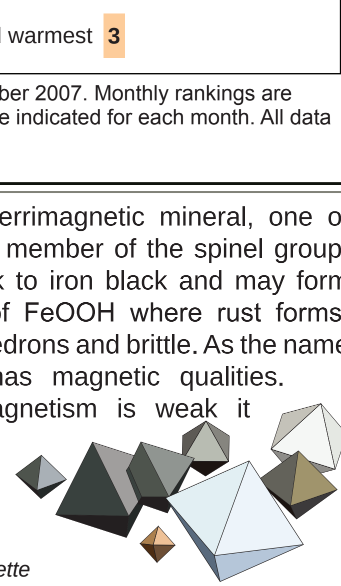
Figure 1. This chart records temperatures for New Jersey starting in January 1895 and extending through December 2007. Monthly rankings are based on estimated monthly State-wide temperature averages. The three warmest and the three coldest years are indicated for each month. All data are from the web page of the New Jersey State Climatologist (climate.rutgers.edu/stateclim/).

and driest months doesn't show a significant pattern.

Does this show global warming? These temperature data are averaged across New Jersey, from the mountains near High Point to the shores of Cape May. It would be better to analyze data from just one gage and compare trends. This data set itself isn't proof of global warming. But it is a striking indication that something is happening.

I think we are bound to, and by, nature. We may want to deny this connection and try to believe we control the external world, but every time there's a snowstorm or drought, we know our fate is tied to the world around us. --Alice Hoffman, author--

Magnetite (Fe_3O_4) is a ferrimagnetic mineral, one of several iron oxides and a member of the spinel group. The color is greyish black to iron black and may form a yellow-brown coating of FeOOH where rust forms. Crystals are usually octahedrons and brittle. As the name suggests, this mineral has magnetic qualities. Although magnetite's magnetism is weak it will attract large nails. Magnetite is a valuable source of iron.



Banner collage by Z. Allen-Lafayette

NEW PUBLICATIONS

DIGITAL GEODATA SERIES (DGS)

NEW GIS DATA. DGS 07-2, Surficial Geology of New Jersey. Metadata and ESRI shapefile data available for download at www.njgeology.org/geodata/dgs07-2.htm

NEW GIS DATA. DGS 07-3, Bathymetric Digital Elevation Grids Offshore of New Jersey. Metadata and ESRI GRID data available for download at www.njgeology.org/geodata/dgs07-3.htm

OPEN-FILE MAP SERIES (OFM)

NEW MAP. OFM 70, Surficial Geology of the Beverly and Frankford Quadrangles, Burlington County, New Jersey, Stanford, Scott D., 2008, scale 1 to 24,000, size 24x40, 3 cross-sections. $10.00. Available for download at www.njgeology.org/pricelst/ofmap/ofm70.pdf

NEW MAP. OFM 71, Bedrock Geology of the Beverly and Frankford Quadrangles, Burlington County, New Jersey, Stanford, Scott D. and Sugarman, Peter J., 2008, scale 1 to 24,000, size 28x34, 3 cross-sections. $10.00. Available for download at www.njgeology.org/pricelst/ofmap/ofm71.pdf

HISTORICAL PUBLICATIONS (on-line at www.njgeology.org/enviroed/freepubs.htm#oldpubs)

A Report on the Cretaceous Paleontology of New Jersey (Weller, 1907)

Annual Report of the State Geologist for the Year 1900 (Smock, 1901)

Annual Report of the State Geologist for the Year 1903 (Kummel, 1904)

Bulletin 35, Ground Water Supplies in the Vicinity of Asbury Park (Thompson, 1930)

Bulletin 38, Ground Water Supplies of the Passaic River Valley near Chatham, N.J. (Thompson, 1932)

Bulletin 57, Copper Mines and Mining in New Jersey (Woodward, 1944)

Special Report 7, Water Supplies from the No. 1 Sand in the Vicinity of Parlin, New Jersey (Barksdale, 1937)

Special Report 10, Preliminary Report on the Geology and Ground-Water Supply of the Newark, New Jersey, Area (Herpers and Barksdale, 1951)

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SCIENCE LAB OPENS

By Dave Pasicznyk

On Friday, February 29, State Geologist Karl Muessig attended the opening of the new Science Lab at the Hedgepeth/Williams School in Trenton. Dr. Muessig joined members of the Trenton Board of Education at this event and spoke to students about the importance of science and environmental education. Dr. Muessig and others watched as the students demonstrated their experiments. Students and science teachers then asked Dr. Muessig to "identify the rock", asking him to help identify specimens they had collected at various locations. Dr. Muessig gave science teacher Jonathan Gaffin and Principal Kenneth B. Moore geoscience teaching materials, such as water-cycle posters, maps, bilingual Earth science posters, and rock kits. The students also engaged Dr. Muessig in conversations about their experiments and demonstrations and their applications to Earth science. Women and minorities are often under represented in Earth science professions and because of this NJGS reaches out to young people hoping to spark an interest in the earth sciences.

The presentation of geoscience teaching materials to Principal Kenneth B. Moore and science teacher Johnathan Gaffin by State Geologist Dr. Karl Muessig. *Photo by D.L. Pasicznyk*

Principal Moore chats with Dave Pasicznyk and Karl Muessig of the New Jersey Geological Survey. *Photo by J. Gaffin*

Students demonstrating science experiments at the opening of the new science lab at Hedgepeth/Williams School in Trenton, Mercer County. *Photo by D.L. Pasicznyk*

EARTH SCIENCE WEEK RESOURCES

Earth Science Week is more than one week of the year. If you've got Internet access, you can teach and learn about Earth science all year long.

The Earth Science Week website, at www.earthsciweek.org, features classroom activities, theme-based resources, research projects, local events and organizations, and careers. Most importantly, the site features dozens of recommended lessons that teachers and parents can conduct with children. All are aligned with the National Science Education Standards. Check it out!

The American Geological Institute (AGI) is a nonprofit federation of 44 geoscientific and professional associations that represents more than 120,000 geologists, geophysicists, and other earth scientists. Founded in 1948, AGI provides information services to geoscientists, serves as a voice of shared interests in the profession, plays a major role in strengthening geoscience education, and strives to increase public awareness of the vital role the geosciences play in society's use of resources and interaction with the environment. For contact information, please visit www.earthsciweek.org/contactus/index.html.

NJGS OFFERS RSS ON WEBSITE

The New Jersey Geological Survey now offers Really Simple Syndication (RSS) feeds from its Web site, adding to the suite of e-government services available to DEP constituencies. DEP is the second New Jersey State department to offer the free service, along with the Department of Labor and Workforce Development. RSS allows people to subscribe to a Web site. Subscribers receive new Web content automatically directly to their desktops or web browsers, avoiding the chore of repeatedly visiting a Web site for updates.

To subscribe to the NJGS website, go to www.njgeology.org and click on the orange RSS icon in the upper left hand corner of the page. Or, for more info, click on the *What is RSS?* link next to the orange icon.

The folks at Commoncraft created a clever 3.5 minute video called *RSS in Plain English*. See it at commoncraft.com/rss_plain_english.

DO YOU RECOGNIZE ANY OF THESE FINE GENTS?

Above and left, geologists, circa 1905, exploring the Onondaga-Marcellus contact in Orange County, New York. *NJGS archives, photographer unknown.* Although they took a photograph, our Survey ancestors apparently did not think this was a momentus occasion (perhaps it was the company), they left us few clues as to who these fine gentleman (doing field work in suits!) are. We have 8 names on the back, but 23 people on the front. We know that N.L. (Norman) Bowen, of MIT, and Frederick Lahee are here. We know that a number of them are from Boston, because they wrote their addresses with their names on the back. We do not know the occasion (broken down carriage?). We are not certain who took the photograph. We know the price of a copy (8 cents), so there may be other copies out there (with more information on them?). If you are able to identify any of our gents, please contact us.

CROSSWORD BONANZA

Scrub Oak Mine, 1941, Mine Hill Twp, Morris County. *NJGS Photo archives, photographer un-*

ACROSS

3. Well drilling method
6. Having the form of a bunch of grapes
8. 2240 pounds
9. Rain, snow, sleet and hail
11. Study of weather
13. $(K,Na,Ca)(Mg,Fe,Li,Al)_{2\text{-}3}(OH,F)_2[Si,Al)_4O_{10}]$
15. Workshop where pig iron is transformed into wrought iron
16. Blue ore
19. Power source that converts pressurized steam to mechanical energy

DOWN

1. Region
2. Greenish grains of glauconite
3. Characteristic weather
4. Change
5. Compound characterized by linkage of sulfur with a metal
7. Hard coal
10. Confined well
12. Set straight
14. Bog iron
17. Means of locating a fixed position on the Earth
18. Underground excavation

Go my Son, burn your books and buy stout shoes, climb the mountains, search the valleys, the deserts, the sea shores, and the deep recesses of the earth . . . Observe and experiment without ceasing, for in this way and no other will you arrive at a knowledge of the true nature of things. --Petrus Severinus, Danish alchemist--

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CROSSWORD PUZZLE ANSWERS. Across: (3) Cabletool well, (6) botryoidal, (8) long ton, (9) precipitation, (11) meteorology, (13) mica, (15) forge, (16) magnetite, (19) steam engine. **Down:** (1) Province, (2) greensand, (3) climate, (4) variation, (5) sulfide, (7) anthracite, (10) artesian well, (12) remediate, (14) geothide, (17) GPS, (18) mine.