



Midlothian Mines Park, A Unique Abandoned Mined Lands (AML) Project



Melissa Rodriguez, Virginia Department of Mines, Minerals and Energy
Kenneth Megginson, Schnabel Engineering

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This project centers around transforming AML features into a historical park that, when complete, will highlight Richmond's coal mining heritage.

Geologic Setting

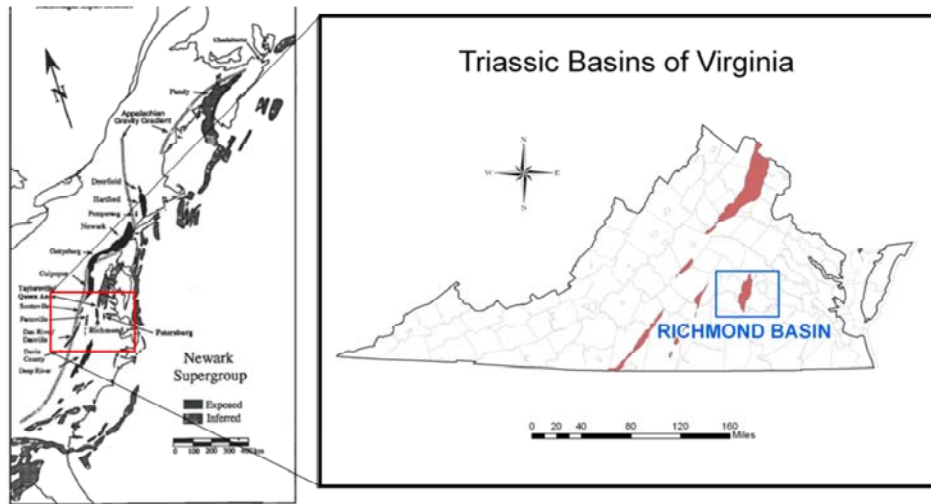
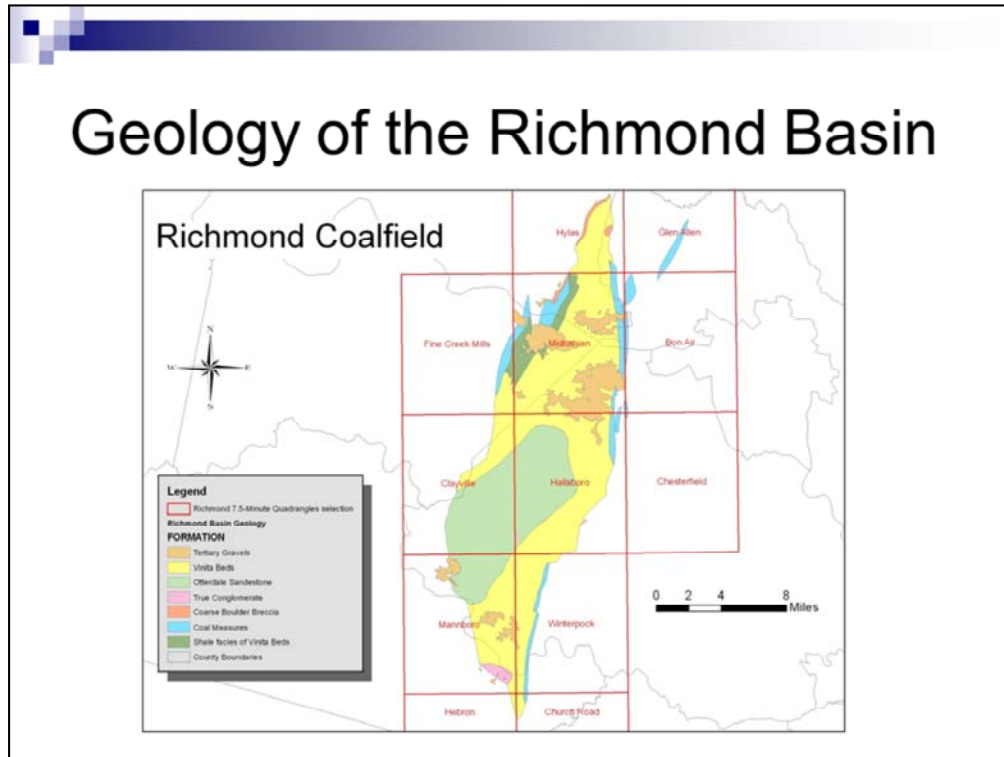


Fig. 1. Newark Supergroup of eastern North America. Modified from Olsen et al., 1989.

For a little geologic background, the Richmond Coalfield is Triassic Basin that is part of a large chain of Mesozoic-aged rift basins that stretches up and down the east coast of NA. The bedrock in the Richmond Basin is comprised of interbedded sandstones, siltstones, shales, with seams of coal occurring in some of the formations along the eastern and western margins of the basin. Within the Richmond coalfield, we recognize 5 distinct mining districts that are categorized based on similarities of the mines. These districts are used for easy and efficient cataloging of AML features and projects.

Geology of the Richmond Basin



Geology – Otterdale: coarse, arkosic, at least 1500' thick in some locales

Vinita: black shale, siltstone, gray arkosic sandstone, may be up to 6000' deep

Shale Facies of Vinita

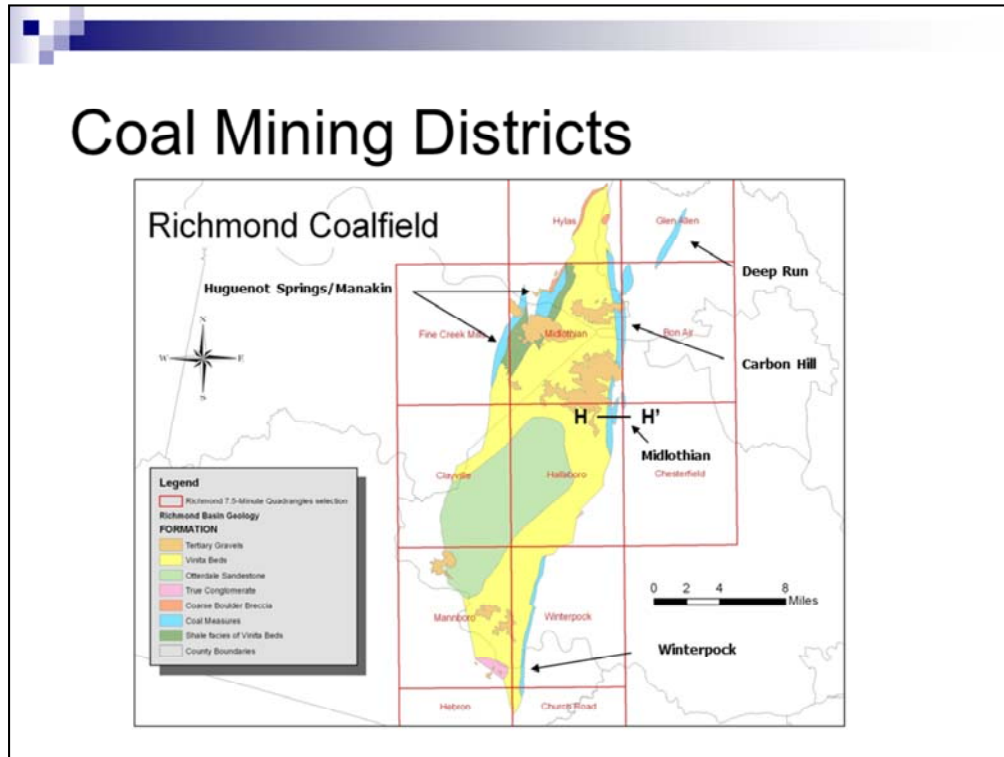
Coal Measures: Interbedded coal, coke, black shale, siltstone, and arkosic sandstone; 3-5 beds of coal with upper being the thickest; dip ranges from 25° to 90°, coal is bituminous

Coarse Boulder Breccia (Boscobel Boulder Bed)

True Conglomerate

Structure: beds generally dipping 20 to vertical high angle normal faults offset and pinch out coal seams – no basin wide strata correlation

Coal Mining Districts



Five mining districts, among them Midlothian (includes Black Heath, Union, Cunliffe, and Stonehenge basins).

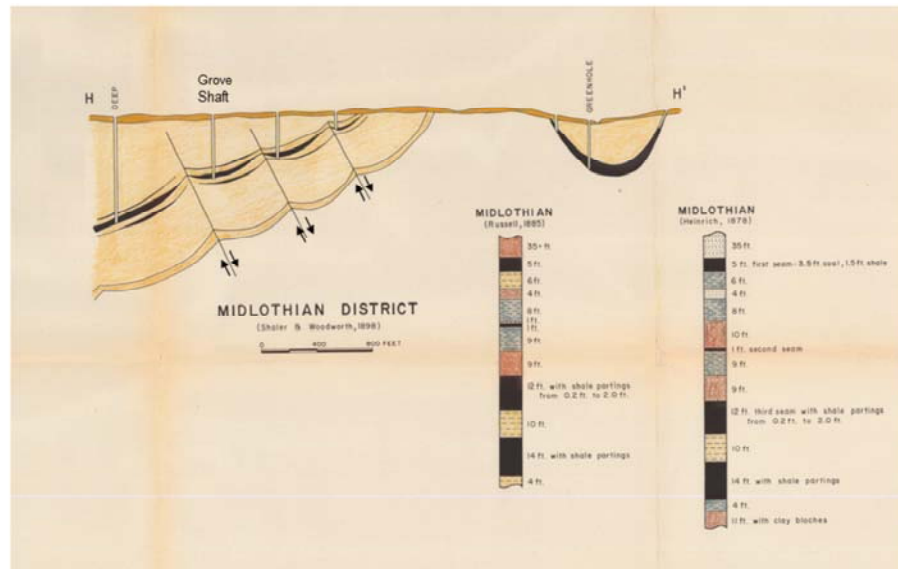
Brief timeline of Richmond coal:

- discovery 1701
- first commercial production 1748
- 1794 tariff caused greater need
- 1830's is height of production
- decline during Civil War
- steady decline in late 1800's
- mines abandoned by late 1920's
- several attempts to reopen have failed

Coal mining in Richmond not always easy – structure of basin caused rolling and pinching out of coals.

Used old mining techniques, which also presented a challenge.

Midlothian District Cross-Section



- Stonehenge and Union basin separated from main basin by erosion; represent areas of severe deformation.
- Several rolls and minor faults caused minor problems.
- Black Heath and Cunliffe are part of main basin. Not as eroded as Stonehenge and Union, structurally the same.
- "Average dip" of coal in main basin is 22 degrees.
- Midlothian District was a very important mining district - 4 coals are found in this district, lots of mining activity.
- One mining complex in particular that was prominent was Grove/Murphy.

Grove Shaft/Murphy Slope Operations, Midlothian, VA

- Grove Shaft was 11'x11'
- Divided into quarters by wooden brattice structures
- Boiler house provided steam for hoisting engines
- Air shaft dug north of Grove shaft for ventilation
- Exploration slope into coal at 517' – followed 4' coal
- Murphy Slope located 900' south of Grove Shaft
- 2330' slope entrance that connected with Grove Shaft workings
- Murphy Slope utilized tippie structure for unloading coal into trains

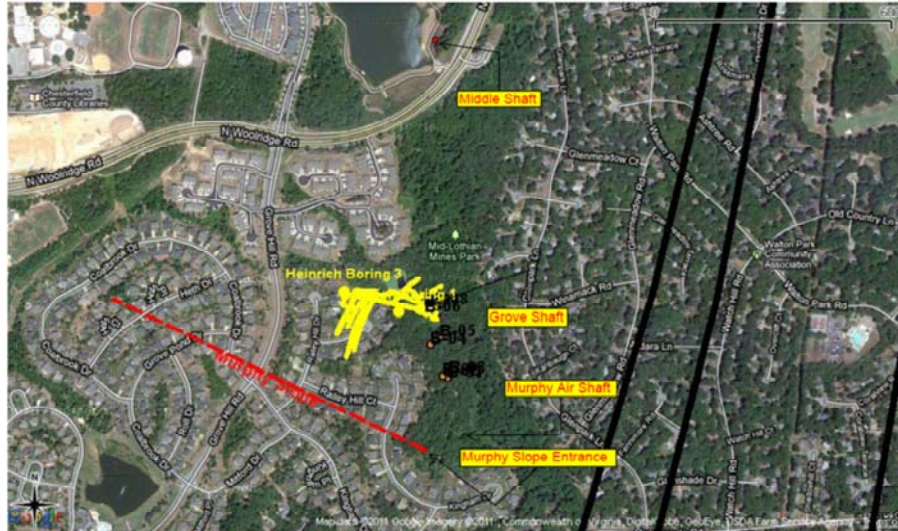


Talk about shaft mining techniques – boilers and boiler house, updraft shaft, head frame.

Abandoned Mine Features



Approximate Workings



Grove Shaft based on 1878 O.J. Heinrich Map

Murphy Slope inferred from literature

Abandoned Mine Land



- Abandoned mine features are problematic...
- Surface Mining Control and Reclamation Act of 1977 (SMCRA)
- Creation of the Office of Surface Mining (OSM)
 - AML Program

Abandoned mine features dangerous – especially in Midlothian/Richmond area where there is rapid suburban growth.

In the 1700 and 1800s, and especially into the first half of the 20th century, coal was mined with a complete disregard for the environment – some states tried to make their own regulations in 1930s-1970s, but most were unsuccessful at fixing the problem.

SMCRA passed in August 1977 – regulates active coal mines and reclaims abandoned coal mines, created OSM (within Dept of Interior) to oversee regulations and to fund state regulatory and reclamation efforts.

AML are lands and waters adversely impacted by inadequately reclaimed surface coal mines that were not subject to reclamation requirements of SMCRA.

AML covers reclamation on mined lands abandoned prior to the passage of the 1977 SMCRA law – coal companies today are responsible for cleaning up the area when they have finished mining.

AML is funded by a tax on coal mining – 31.5 cents per ton for surface mined coal, 15 cents per ton for coal mined underground.

Virginia Department of Mines, Minerals and Energy, Division of Mined Land Reclamation

Midlothian District Inventory



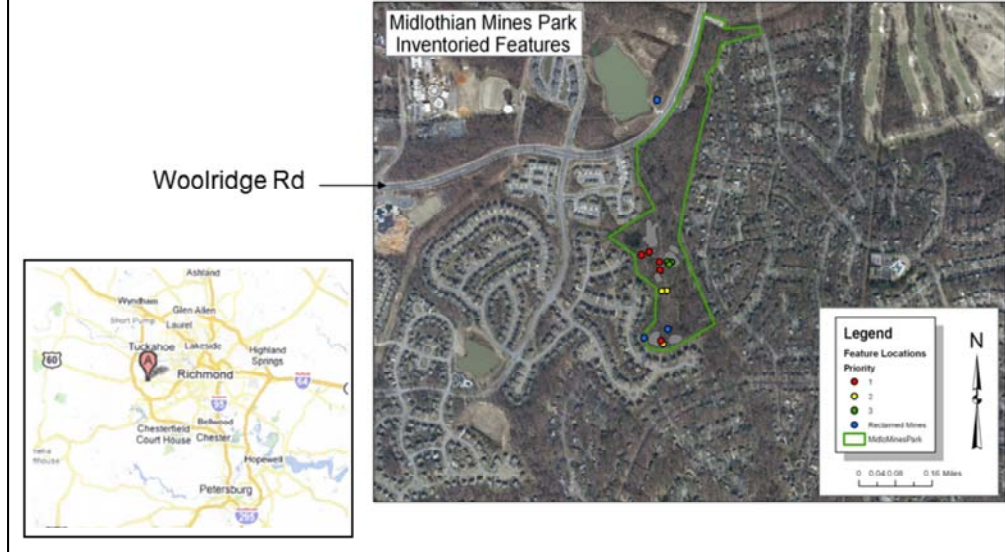
AML PROGRAM:

- Citizen Complaints
- Inventory
- Reclamation Projects



The Abandoned Mine Land (AML) Unit of the Division of Mined Land Reclamation (DMLR) was established in the late 1970's to abate pre-federal Act coal mine related problems adversely impacting the public health, safety, general welfare, and the environment .

Reclamation Project – Midlothian Mines Park



Map of area with AML features

AML Features in Park



The priority 1 features include the 2 vertical shafts associated with the Grove operation. This is the main entrance to the Grove Shaft. It is approximately 621' deep.

AML Features in Park



Wingwall for the tipple pile at the Murphy slope railroad operations.

AML Feature in Park – Project Feature #1



And a subsidence feature located next to the Boiler House – origin for this subsidence was unknown

Located in a mining refuse pile full of gob and red dog (burned rock) – observations of the area show that an emergent stream surfaces at the toe of an abandoned railroad grade approx. 110 ft northeast of this feature – sediments in this stream reveal fragments of red dog and gob – indicates channel or some kind of outlet below surface of this feature – could be workings

AML Features in Park – Project Feature #2



Several subsidence features of unknown origin – did not know of any other mine openings in area based on literature, and thought the workings to be 600+ feet underground.

AML Features in Park – Project Feature #3



Several subsidence features of unknown origin – did not know of any other mine openings in area based on literature, and thought the workings to be 600+ feet underground.

Related Features



Reclamation Project – Midlothian Mines Park

- DMME & Chesterfield County
- Goal: Historic, educational, and safe recreational park
- Approach:
 - Phase I – Exploration
 - Phase II – Construction
 - Phase III – Infrastructure

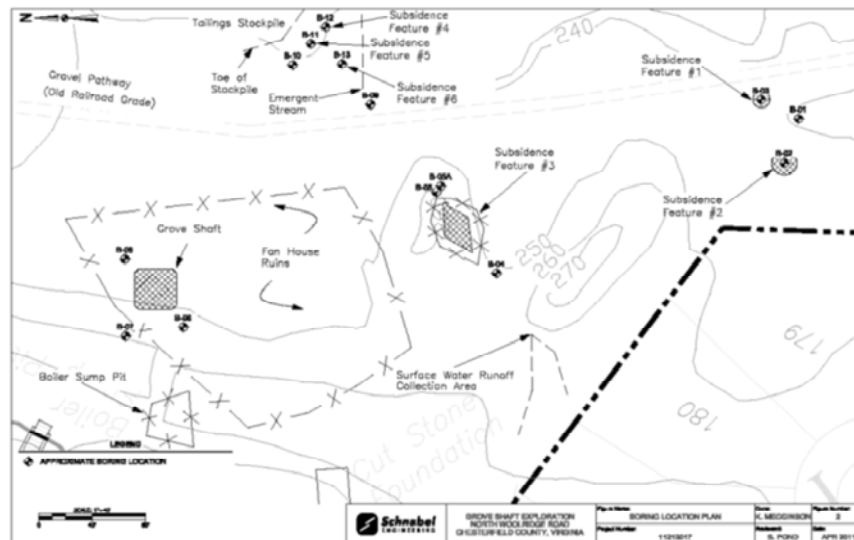
Historical – oldest standing coal mining structure in the country.

Phase I - Exploration

- Two-fold purpose
 - To understand surface features
 - 5 slumps of unknown origin
 - 1 subsidence of unknown origin
 - Exploration findings will dictate reclamation plans
 - To determine subsurface characteristics for reclamation engineering purposes
 - Grove Shaft
- Key to understanding these features is drilling



Phase I – Exploration Boring Location Plan



Drilling from March 4, 2011 – March 22, 2011

Fourteen holes drilled:

- 3 reference holes
- 5 borings directly overtop features
- 3 borings near Grove Shaft
- 2 borings bordering subsidence
- 1 angled boring

Safety Measures

- Timber mats were needed for support over the subsidence features



Subsurface Exploration in Progress



Subsurface Exploration in Progress



Subsurface Exploration in Progress



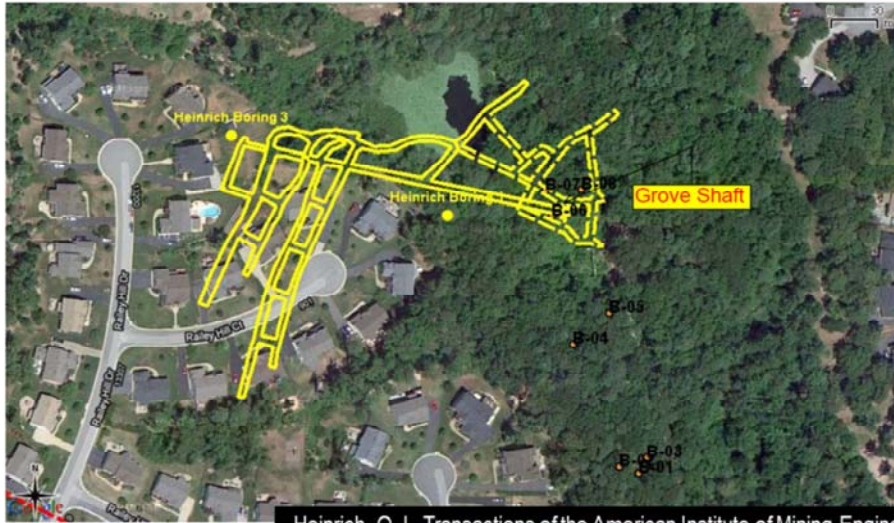
Exploration Observations

- Feature #1 –encountered soft to medium stiff “recent” fill
- Feature #2 –encountered very soft clay (mine gob) from 17 to 50 ft, and soft to stiff clay “recent” fill from 8 to 17 ft.
- Feature #3 – no voids encountered in boring, other field observations:
 - Surface Water Collection area up-gradient
 - Emergent stream at toe of railroad embankment
 - Observation of red dog and brick fragments in stream bed
 - Encountering alluvial soils in B-09
 - Elliptical surface geometry of features
 - Red dog source in vicinity of feature
- Additional features adjacent to stockpile
- Grove Shaft
 - Fill to 8', then natural regolith
 - Bedrock encountered from depths of 40 to 50 ft
 - No workings encountered
 - DEQ and DMME – down-hole video to assess condition
- Residuum to depths of about 50 ft, but variable

Exploration Observations



Drilling Comparison



Heinrich, O.J., Transactions of the American Institute of Mining Engineers, Vol. 5, 1876

Borehole No. 1

Total Depth 1140 ft

Coal encountered at a depth of 477.5 ft

Granite basement

Borehole No. 3

Total Depth 715.5 ft

Coal encountered at 608 ft, 633 ft, 662 ft, and 692 ft

Explanation of AML Features

- Slump features
 - Of the 5 features drilled, 2 determined to be exploration shafts of 20' and 50'
 - These exploration shafts likely predate Grove Shaft and did not encounter coal
 - Other slumps possibly caused by winnowing of sandy material – not coal related
- Subsidence feature
 - Observations and drilling suggest feature likely from raveled, transported soils possibly due to presence of old culvert
 - Subsidence not likely due to presence of a shaft or underground mine workings
- Grove Shaft
 - Subsurface conditions will support multiple reclamation construction possibilities
 - Corrosion series testing of select soil samples is still needed for specific remediation options
- Overall Area
 - Fill encountered in most borings from ground surface to depths of up to 50 ft
 - Stream channel appears to be altered from natural course
 - Entire park modified by mining activities



Remediation

- Characterization phase – no design yet
- Remediation options
 - Compaction grouting
 - Construction of cap – concrete or wiremesh
 - Grouting
 - Stowing
 - Polyurethane Foam

Summary

- Coal Mining in Richmond has created abandoned mine hazards that must be abated.
- Midlothian Mines Park is an example of work that is being done using AML funds to keep citizens safe.
- Drilling will provide the knowledge to safely and effectively reclaim coal mining hazards of the Grove Shaft and Murphy Slope and adjacent features.



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