

Operator: Clinchfield Coal Company
 Farm: Virginia Iron, Coal and Coke Company
 Well No: 215
 Location: Dickenson County
 3550' S. of 37° 00'
 10,300' E. of 82° 25'
 Elevation: 2244.0'
 Total Depth: 5481'
 Drilling Commenced: 1959
 Well Completed: Rig burned, standing January, 1962
 Result: Incomplete

Geologic Log
 Samples studied by
 K. Robinson
 Virginia Division of
 Mineral Resources
 June, 1962

GEOLOGIC LOG

<u>Depth (feet)</u>	<u>Thickness (feet)</u>	<u>Lithology</u>
<u>PENNSYLVANIAN SYSTEM</u>		
<u>Norton Formation (0' - 1195)</u>		
0' - 94'	94'	Sandstone, white to light gray and brown, hard, fine to medium and coarse, commonly very coarse and locally granular grained, variable moderate to poor sorting, subangular to round, interstitially very silty, siliceous with abundant chlorite, mica and carbonaceous material. Fair to poor porosity.
94' - 96'	2'	Shale, micaceous, medium to dark gray, moderately hard, brittle and fissile, locally silty, siliceous.
96' - 100'	4'	Coal, locally impure, grading to shale.
100' - 110'	10'	Siltstone, argillaceous, light to dark gray, moderately hard, brittle, siliceous, clayey with abundant mica and coaly carbonaceous material. Common stringers of sandstone, silty, light gray, very fine to medium grained.
110' - 113'	3'	<u>Upper Banner Coal</u> - Coal and siltstone, light gray, hard, brittle, siliceous with abundant mica and carbonaceous material.

113' - 123'	10'	Sandstone, white to light gray, hard, fine to medium grained, well sorted and rounded, very silty, siliceous with abundant mica, chlorite and common carbonaceous material. No porosity.
123' - 126'	3'	Coal and siltstone as 110' - 113'.
126' - 160'	34'	Sandstone, silty, white to light gray, hard, very fine to medium, rarely coarse grained, graded, well sorted and rounded, interstitially very silty, siliceous and slightly calcareous with abundant mica, chlorite and carbonaceous material. Common silty micaceous and coaly carbonaceous laminae and partings. Poor to no apparent porosity.
160' - 191'	31'	Siltstone, light gray, hard, brittle, siliceous and locally clayey, with very abundant finely divided mica, carbonaceous material and common silty micaceous coal laminae. Estimated thin coal seam in the interval 181' - 188'.
191' - 216'	25'	Sandstone, silty, light gray, moderately hard, silty to very fine, fine and rarely medium grained, moderately well sorted and rounded, interstitially siliceous and locally slightly calcareous with abundant mica, chlorite, carbonaceous material and common mica and coaly carbonaceous partings. No apparent porosity.
216' - 218'	2'	Siltstone, medium to dark gray, hard, brittle, siliceous with common mica and coaly carbonaceous laminae.
218' - 240'	22'	Sandstone, abundantly micaceous, light gray, hard, fine to very fine grained, well sorted and rounded, interstitially silty, siliceous with abundant mica, chlorite, carbonaceous material, and interbedded medium to dark gray siltstone laminae with micaceous and coaly carbonaceous partings. No porosity.

240' - 261'	21'	Siltstone, argillaceous and clayey, light to medium gray, hard, brittle, siliceous and locally calcareous with finely divided mica, carbonaceous material and common coaly micaceous laminae. Probable impure shaley coal partings 245' - 254'.
261' - 264'	3'	<u>Lower Banner Coal</u> - Coal, commonly impure and argillaceous.
264' - 307'	43'	Sandstone, white to light gray, moderately hard, fine to rarely very fine and medium grained, well sorted and rounded, interstitially slightly silty, siliceous and calcareous, with common to abundant mica, chlorite, carbonaceous material and silty micaceous to carbonaceous laminae or partings. Possible fair to no porosity. Siderite present throughout.
307' - 463'	156'	Siltstone, locally clayey and micaceous, light to medium gray, rarely light brown, hard, brittle, locally very finely sandy, siliceous and locally slightly calcareous with abundant finely divided carbonaceous material, mica, and rare pyrite. Common siderite fragments and coaly micaceous laminae throughout. Grades to interbedded shale of the same composition in the interval 389' - 411'.
463' - 486'	23'	Sandstone, light gray, very hard, very fine to fine, locally medium and rarely coarse grained, well sorted and rounded, very silty, siliceous and slightly calcareous with abundant mica, carbonaceous material and chlorite. Common silty micaceous and coaly carbonaceous laminae and partings. No apparent porosity.
486' - 508'	22'	<u>Equivalent Kennedy Coal Horizon</u> - no coal present. Siltstone, light to medium gray, commonly light brown and brown, very hard, siliceous with abundant mica and carbonaceous material.

508' - 549'	41'	<u>McClure Sandstone</u> - Sandstone, white to light gray, moderately hard, very fine to fine, medium and coarse, locally very coarse grained, graded, poor to well sorted, subrounded to round, interstitially silty, siliceous with abundant mica, carbonaceous material and common chlorite. Common coaly micaceous silty gray partings. Possible fair to poor porosity.
549' - 575'	26'	Siltstone, light to medium gray, locally dark gray, hard, brittle, siliceous, commonly argillaceous and clayey with abundant finely divided carbonaceous material and mica. Common coal and coaly micaceous partings.
575' - 599'	24'	Sandstone, white to light gray, hard, very fine to medium, commonly coarse grained, moderate to poor sorting, subround to round, silty, siliceous and locally slightly calcareous with abundant mica, chlorite and carbonaceous material. No apparent porosity.
599' - 608'	9'	Siltstone, clayey and micaceous, light to medium gray, hard, brittle, slightly fissile, siliceous with abundant mica and carbonaceous material. Common coaly micaceous laminae.
608' - 617'	9'	Shale, micaceous, medium gray, hard, brittle, slightly fissile, siliceous, with abundant mica, carbonaceous material and common coal fragments.
617' - 648'	31'	Sandstone, silty, light gray, hard, silty to very fine, fine and medium grained, moderate sorting, subround to round, siliceous and locally slightly calcareous with mica, carbonaceous material and chlorite. Minor interbedded siltstone stringers and coaly micaceous laminae in the interval 628' - 635'. Poor to no porosity.
648' - 708'	60'	Siltstone, argillaceous and clayey, light to medium gray, hard, brittle, rarely very finely sandy, siliceous, with abundant finely divided carbonaceous material and mica. Abundant to common silty micaceous and coaly carbonaceous laminae and partings.

708' - 733'	25'	<u>Equivalent Raven Coal Horizon</u> - no coal present. Shale, medium to dark gray, hard, brittle, poorly fissile, clayey with abundant mica and coaly carbonaceous material.
733' - 745'	12'	Sandstone, white to light gray, hard, fine to very fine grained, well sorted and rounded, very silty, siliceous with abundant carbonaceous material, mica and common chlorite. Poor porosity. Minor interbedded siltstone and abundant silty micaceous and coaly carbonaceous laminae.
745' - 787'	42'	Sandstone, white, hard, very fine to fine and locally medium grained, moderately well sorted and rounded, slightly silty, siliceous and calcareous with mica, carbonaceous material and chlorite. Rare silty micaceous laminae. Possible fair to poor porosity.
787' - 804'	17'	Siltstone, argillaceous and clayey, light to medium gray, hard and brittle with mica and carbonaceous material.
804' - 863'	59'	Shale, medium gray, hard, brittle, slightly fissile, locally silty, siliceous with abundant finely divided mica and carbonaceous material.
863' - 870'	7'	Siltstone, light to medium gray, hard, rarely very finely sandy, siliceous with abundant mica, carbonaceous material and pyrite.
870' - 875'	5'	Shale, medium to dark gray, carbonaceous, hard, brittle, slightly fissile, rarely silty, siliceous with mica and carbonaceous material.
875' - 877'	2'	<u>Jawbone Coal</u> - Coal, pure to argillaceous and shaley.
877' - 880'	3'	Siltstone as 863' - 870'.
880' - 902'	22'	Sandstone, white to light gray, hard, very fine to medium, commonly coarse grained, moderate to poor sorting, subround to round, silty, siliceous with abundant mica, chlorite and carbonaceous material. Common interbedded siltstone stringers and silty micaceous - coaly carbonaceous laminae and partings. Poor porosity.

902' - 905'	3'	Coal.
905' - 953'	48'	Sandstone, white, moderately hard, fine to coarse, very coarse and granular, locally pebbly grained, poorly sorted, subround to round, silty, siliceous and locally slightly calcareous with common siderite, chlorite, rare mica and carbonaceous material. Common interbedded siltstone stringers and silty micaceous - coaly carbonaceous partings in the interval 905' - 932'. Fair to poor porosity. Probably conglomeratic.
953' - 993'	40'	Siltstone, argillaceous and clayey, medium to dark gray, hard, brittle, locally very finely sandy, siliceous, with abundant mica and carbonaceous material. Common fine coal laminae in the interval 959' - 975'.
993' - 1019'	26'	Shale, silty, medium to dark gray, hard, brittle, poorly fissile, clayey with common mica and carbonaceous material.
1019' - 1072'	53'	Interbedded siltstone, light to medium gray, hard, locally argillaceous and very finely sandy, siliceous with mica and carbonaceous material; and sandstone, light gray, hard, fine to very fine and silty grained, poorly sorted, well rounded, siliceous and slightly calcareous with abundant carbonaceous material, mica, silty gray micaceous coal laminae and partings, and common pyrite. Poor porosity.
1072' - 1135'	63'	Siltstone, slightly argillaceous and clayey, light to medium gray, hard, brittle, locally very finely sandy, siliceous with abundant finely divided carbonaceous material and mica. Common stringers of sandstone, white, very fine grained, silty, siliceous, are present in the interval 1100' - 1133' and silty micaceous - coaly carbonaceous partings throughout.
1135' - 1180'	45'	Shale, medium gray, hard, brittle, poorly fissile, clayey, with abundant finely divided mica, carbonaceous material and common coal laminae.

1180' - 1195'	15'	Siltstone, argillaceous, light to dark gray and gray-brown, hard, brittle, locally very finely sandy, siliceous, with finely divided mica and carbonaceous material.
<u>Lee Formation (1195' - 2446')</u>		
1195' - 1252'	57'	Sandstone, white, moderately hard, very fine to fine, medium and rarely coarse, poor to moderately well sorted, subangular to round; interstitially slightly silty, siliceous with rare chlorite and mica. Fair to poor porosity. Locally common siltstone laminae and partings.
1252' - 1274'	22'	Sandstone, conglomeratic, very fine to granular and pebbly grained, as above.
1274' - 1300'	26'	Siltstone, argillaceous and clayey, medium to dark gray, hard, brittle, siliceous with abundant mica and carbonaceous material.
1300' - 1322'	22'	Sandstone, white, moderately hard, very fine to medium and coarse grained, poorly sorted, subround to round, silty, siliceous with common chlorite, mica and carbonaceous material. Probable interbedded siltstone laminae and silty micaceous - coaly carbonaceous partings. Poor porosity.
1322' - 1330'	8'	Siltstone, light to medium gray, hard, locally finely sandy, siliceous with abundant mica, coaly carbonaceous material and common micaceous coal laminae.
1330' - 1364'	34'	Sandstone, white, moderately hard, fine to medium and coarse, locally very coarse grained, moderate to poor sorting, subround to round, slightly silty, siliceous with common chlorite, mica, carbonaceous material and silty micaceous - coaly carbonaceous partings. Possible fair to poor porosity.

1364' - 1372'	8'	Sandstone, very fine to granular grained, poorly sorted, as above. Possibly conglomeratic?
1372' - 1399'	27'	Interbedded siltstone and sandstone, white, light to medium gray and gray-brown, hard, fine to very fine and silty grained, poorly sorted, well rounded, siliceous and locally calcareous with abundant mica, chlorite and carbonaceous material. Common silty micaceous- carbonaceous partings and laminae. Poor to no porosity.
1399' - 1409'	10'	Shale, silty, dark gray to black, carbonaceous, moderately hard and brittle, slightly fissile with abundant mica, carbonaceous material and coal laminae.
1409' - 1418'	9'	No sample.
1418' - 1460'	42'	Siltstone, light to medium gray, very hard, very finely sandy, siliceous and locally argillaceous, with abundant mica, carbonaceous material and silty micaceous- carbonaceous partings. Common very fine grained sandstone stringers throughout.
1460' - 1494'	34'	Shale, medium gray, hard, brittle, poorly fissile, clayey, with abundant mica, carbonaceous material and common micaceous partings.
1494' - 1511'	17'	Sandstone, white to light gray and gray-brown, hard, silty to very fine, fine, medium and locally coarse grained, poorly sorted, subround to round, siliceous, with abundant mica, carbonaceous material and silty micaceous - coaly carbonaceous partings. Poor to no porosity.
1511' - 1580'	69'	Sandstone, white, hard, fine to medium and locally coarse grained, well sorted, subangular to round, interstitially slightly silty, siliceous with common to rare chlorite, mica, carbonaceous material and silty micaceous- carbonaceous laminae. Common interbedded siltstone stringers in the interval 1559' - 1580'. Poor porosity.

1580' - 1588'	8'	Siltstone, argillaceous, medium gray, hard, brittle, locally very finely sandy, siliceous with abundant mica, carbonaceous material and coaly micaceous laminae.
1588' - 1610'	22'	Sandstone, white, very fine to fine grained, well sorted and rounded, silty, siliceous with abundant mica, common carbonaceous material and silty micaceous - carbonaceous partings. Poor to no porosity.
1610' - 1650'	40'	Shale, silty, medium gray, hard, brittle, poorly fissile, clayey, with abundant finely divided mica and carbonaceous material. Rare siltstone and sandstone laminae in the interval 1610' - 1624'.
1650' - 1708'	58'	Sandstone, white to light gray, hard, very fine to fine and medium grained, well sorted, subround to round, interstitially slightly silty, siliceous with rare mica, carbonaceous material and siderite. Common interbedded siltstone stringers. Fair to poor porosity.
1708' - 1715'	7'	Siltstone, light to medium gray and gray-brown, hard, siliceous with abundant mica, carbonaceous material, coaly micaceous and pure coal laminae.
1715' - 1735'	20'	Shale, medium gray, hard, brittle, poorly fissile, clayey, with abundant mica, coaly carbonaceous material and coal laminae.
1735' - 1748'	13'	Siltstone, argillaceous, medium to dark gray, hard, brittle, locally very finely sandy, siliceous with mica and carbonaceous material.
1748' - 1786'	38'	Sandstone, white, hard, very fine to medium, locally coarse grained, moderate to poor sorting, subround to round, interstitially silty, siliceous with abundant mica and chlorite, common carbonaceous material, siderite and silty micaceous- carbonaceous partings. Poor to no porosity.

1786' - 1793'	7'	Siltstone, light to medium gray, very hard, siliceous with abundant mica, carbonaceous material and micaceous - coaly carbonaceous laminae.
1793' - 1803'	10'	Sandstone, white, hard, very fine to fine, commonly medium grained, well sorted and rounded, interstitially silty, siliceous with rare mica, chlorite and carbonaceous material. Poor porosity.
1803' - 1823'	20'	Siltstone, argillaceous, light to dark gray, hard, brittle, locally very finely sandy, siliceous, with abundant finely divided mica, carbonaceous material and silty micaceous - carbonaceous laminae.
1823' - 1832'	9'	Shale, silty, medium to dark gray, hard, brittle, poorly fissile, clayey, with mica, coaly carbonaceous material, silty micaceous coal laminae and fine interbedded siltstone stringers.
1832' - 1836'	4'	Coal (interpreted depth and thickness)
1836' - 1850'	14'	Shale as above.
1850' - 1870'	20'	Sandstone, white, moderately hard, very fine to medium and rarely coarse grained, moderately sorted, subround to round, very silty, siliceous with abundant mica, carbonaceous material, common siderite and coaly micaceous partings. Poor porosity.
1870' - 1940'	70'	Siltstone, argillaceous, light to medium gray, hard, brittle, locally very finely sandy, siliceous with abundant finely divided mica, carbonaceous material and silty micaceous - carbonaceous partings.
1940' - 1983'	43'	Sandstone, white to light gray and locally light red-brown, ferruginous, hard, silty to very fine, commonly fine grained, well sorted and rounded, siliceous, with common silty micaceous - carbonaceous partings and laminae. Poor to no porosity.

1983' - 2004'	21'	Sandstone, white, hard, very fine to medium, commonly coarse and rarely very coarse grained, graded, moderate to well sorted and rounded, siliceous with common to rare silty micaceous - carbonaceous partings and laminae. Poor porosity.
2004' - 2023'	19'	Sandstone, fine to coarse, commonly very coarse and locally granular grained, poorly sorted, as above. Possibly conglomeratic? Fair porosity.
2023' - 2055'	32'	Sandstone, fine to medium, locally coarse grained, fair to moderate sorting, as above.
2055' - 2099'	44'	Sandstone, fine to coarse and very coarse, moderate to poor sorting, as above. Possibly conglomeratic.
2099' - 2124'	25'	Shale, silty and clayey, medium to dark gray, hard, brittle with abundant finely divided mica, carbonaceous material and fine coal laminae. Estimated 1' coal in the interval 2099' - 2107'.
2124' - 2193'	69'	Sandstone, white, hard, fine to medium, locally coarse grained, fair to moderate sorting, subangular to round, interstitially slightly silty, siliceous with common mica, chlorite, carbonaceous material and silty gray micaceous - carbonaceous partings. Possible fair to poor porosity.
2193' - 2198'	5'	Siltstone, argillaceous, medium gray, hard, brittle, with abundant mica and coaly carbonaceous material.
2198' - 2211'	13'	Sandstone, white, hard, very fine to medium, commonly coarse grained, poorly sorted, subround to round, very silty, siliceous with abundant interbedded siltstone laminae and silty micaceous - coaly carbonaceous partings. No porosity.
2211' - 2217'	6'	Coal and siltstone (interpreted depth and thickness)
2217' - 2229'	12'	Sandstone, white, hard, very fine to medium grained, moderately sorted, subangular to round, silty, siliceous with common carbonaceous material, chlorite, mica and interbedded siltstone stringers. Poor porosity.

2229' - 2231'	2'	Coal (interpreted depth and thickness)
2231' - 2252'	21'	Shale, silty, medium to dark gray, hard, brittle, clayey, with abundant finely divided mica and carbonaceous material. Common impure shaley coal laminae.
2252' - 2268'	16'	Sandstone, silty, white, moderately hard, very fine to fine grained, well sorted and rounded, siliceous, with abundant mica, carbonaceous material and silty micaceous partings. No apparent porosity.
2268' - 2282'	14'	Siltstone, light to medium gray, hard, brittle, locally very finely sandy, siliceous and argillaceous, with mica and carbonaceous material.
2282' - 2295'	13'	Shale, silty, medium gray, hard, brittle, clayey with mica, carbonaceous material, coal laminae and siltstone stringers.
2295' - 2320'	25'	Sandstone, as 2252' - 2268'.
2320' - 2331'	11'	Siltstone, as 2268' - 2282'.
2331' - 2363'	32'	Sandstone, white, hard, very fine to fine grained, well sorted, subangular to round, slightly silty, siliceous and locally very slightly calcareous, with very rare mica, carbonaceous material and silty micaceous partings. Poor to no apparent porosity.
2363' - 2429'	66'	Sandstone, very fine to fine, commonly medium grained, as above. Poor porosity.
2429' - 2446'	17'	Sandstone, very fine to medium, commonly coarse and rarely very coarse grained, poorly sorted with abundant silty micaceous-carbonaceous partings as above. Fair to poor porosity.

MISSISSIPPIAN SYSTEM

Pennington Group (2446' - 3779')

2446
300
2146

Bluestone Formation (2446' - 2971')

2446' - 2496'	50'	Interbedded shale and siltstone, light to medium gray, rarely brown, hard, brittle, locally very finely sandy, siliceous and clayey, with abundant mica, carbonaceous material and common silty micaceous - carbonaceous laminae.
2496' - 2520'	24'	Siltstone, argillaceous and clayey, variegated, light to medium gray, gray-green, brown and red-brown, hard, brittle, siliceous with common to rare mica and carbonaceous material.
2520' - 2540'	20'	Shale, variegated, light to medium gray, gray-green, green, brown and red-brown, hard, brittle, clayey, calcareous with abundant finely divided mica.
2540' - 2547'	7'	Siltstone, light gray to green, hard, brittle, very finely sandy, siliceous and locally slightly calcareous with abundant chlorite, mica and common carbonaceous material. Sandstone stringers, white to green, very fine to silty grained, present throughout.
2547' - 2588'	41'	Shale, variegated, predominantly red-brown and brown, mottled, commonly light to medium gray, gray-green and green, hard, brittle, clayey, generally non-calcareous. Common interbedded siltstone stringers.
2588' - 2600'	12'	Sandstone, light to medium gray, gray-green and light brown, hard, fine to very fine and silty grained, well sorted and rounded, siliceous with abundant chlorite, mica, carbonaceous material and silty gray micaceous partings. Poor to no porosity. Common interbedded siltstone laminae as above.
2600' - 2621'	21'	Shale, variegated and minor interbedded siltstone, variegated, as above.
2621' - 2629'	8'	Siltstone, argillaceous, light to medium gray, hard, brittle, siliceous and locally calcareous with mica and rare carbonaceous material.

2629' - 2641'	12'	No sample.
2641' - 2667'	26'	Sandstone, white to light gray, hard, silty to very fine and commonly fine grained, well sorted and rounded, siliceous, with rare mica and carbonaceous material. Common silty gray micaceous - carbonaceous partings and laminae, with thin coal laminae. Poor porosity.
2667' - 2680'	13'	No sample.
2680' - 2717'	37'	Sandstone as 2641' - 2667' with common interbedded siltstone stringers.
2717' - 2840'	123'	Siltstone, light to medium gray, locally gray-brown, hard, brittle, locally very finely sandy, siliceous and argillaceous, slightly calcareous, with finely divided carbonaceous material, mica and micaceous- carbonaceous laminae. Common interbedded sandstone stringers in the interval 2809' - 2840'.
2840' - 2849'	9'	Sandstone, white to light gray, hard, fine to very fine and silty grained, well sorted and rounded, siliceous and calcareous with abundant carbonaceous material, mica and silty gray micaceous- carbonaceous partings. Poor porosity.
2849' - 2914'	65'	Siltstone, argillaceous, medium gray, hard, brittle, slightly fissile, locally very finely sandy, siliceous with abundant carbonaceous material, mica and micaceous - carbonaceous laminae.
2914' - 2921'	7'	No sample.
2921' - 2927'	6'	Sandstone, white, hard, fine to very fine grained, well sorted and rounded, interstitially slightly silty, siliceous with rare mica. Poor porosity.
2927' - 2943'	16'	Shale, silty, medium to dark gray, hard, brittle, slightly fissile, siliceous and locally slightly calcareous, with abundant mica, carbonaceous material and silty micaceous - coaly carbonaceous laminae and partings.
2943' - 2953'	10'	No sample.

2953' - 2971' 18' Shale, silty as above, grading to siltstone, argillaceous.

Princeton Sandstone (2971' - 3130', time-stratigraphic and lithologic)

2971' - 2986' 15' Sandstone, white, hard, very fine to medium grained, poor to moderate sorting, subangular to round, interstitially slightly silty, siliceous and slightly calcareous, with common mica, chlorite, carbonaceous material, rare pyrite and common silty gray micaceous - carbonaceous partings. Poor porosity.

2986' - 3015' 29' Sandstone, very fine to coarse, rarely very coarse grained, poorly sorted, as above. Fair to poor porosity.

3015' - 3059' 44' Sandstone, very fine to medium, locally coarse and rarely very coarse, poorly sorted, as above, with abundant interbedded siltstone and silty micaceous - carbonaceous partings in the interval 3032' - 3059'.

3059' - 3077' 18' Sandstone, white, moderately hard, fine to very fine grained, well sorted, subround to round, siliceous and very slightly calcareous with very rare mica and carbonaceous material. Possible fair to poor porosity.

3077' - 3081' 4' Siltstone, argillaceous, hard, brittle, siliceous with abundant finely divided mica, carbonaceous material, common pyrite, and micaceous - carbonaceous laminae.

3081' - 3127' 46' Sandstone, white, hard, very fine to fine, rarely medium grained, well sorted, subround to round, siliceous, with rare siltstone partings in the interval 3081' - 3093'. Possible fair to poor porosity.

3127' - 3130' 3' Sandstone, fine to medium, commonly coarse grained, moderate sorting, as above.

Hinton Formation (3130' - 3779')

Avis Limestone Member (3130' - 3200')

3130' - 3200' 70' Limestone, dolomitic and silty, impure, light to medium gray, dark brown and black, hard, brittle, rarely very finely sandy, siliceous, locally oolitic, with mica, pyrite, calcite and fossil fragments.

Middle Red Member (3200' - 3530')

3200' - 3211' 11' Shale, silty and clayey, red-brown, gray-green and light gray, moderately hard and brittle with finely divided mica.

3211' - 3235' 24' Siltstone, argillaceous, red-brown, ferruginous, rarely light gray and gray-green, hard, brittle, locally very finely sandy, siliceous and slightly calcareous, with abundant mica and common carbonaceous material.

3235' - 3243' 8' Sandstone, silty, light to medium gray and gray-green, hard, very fine to silty grained, well sorted, siliceous and calcareous with abundant mica and carbonaceous material. Poor porosity.

3243' - 3250' 7' No sample.

3250' - 3271' 21' Shale, silty and clayey, red-brown, ferruginous and gray, mottled, hard, with common silty, siliceous laminae, abundant mica and rare carbonaceous material.

3271' - 3315' 44' Sandstone, white, light to medium gray, gray-brown and brown, hard, very fine to fine, rarely medium grained, well sorted, subround to round, interstitially silty, siliceous, with abundant chlorite, mica, carbonaceous material and silty gray micaceous - carbonaceous partings. Poor porosity.

3315' - 3319' 4' Limestone, dolomite and silty, impure, light gray and brown, hard, brittle, with common calcite and pyrite.

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| 3319' - 3323' | 4' | Shale, dolomite, medium to dark gray and black, hard, brittle, fissile with abundant finely divided mica and pyrite. |
| 3323' - 3329' | 6' | Limestone, dolomitic and silty, impure, as above. |
| 3329' - 3391' | 62' | Siltstone, argillaceous, clayey, red-brown, ferruginous, hard, brittle, locally very finely sandy, siliceous and slightly calcareous, with abundant mica, common pyrite and calcite fossil fragments. |
| 3391' - 3413' | 22' | Shale, silty and clayey, red-brown, ferruginous to light and medium gray, mottled, hard, brittle, poorly fissile, with mica and pyrite. |
| 3413' - 3465' | 52' | Sandstone, silty, white to light gray, hard, very fine to silty grained, well sorted and rounded, siliceous and generally non-calcareous, with common finely divided mica, carbonaceous material and silty gray micaceous - carbonaceous partings. Poor to no porosity. |
| 3465' - 3497' | 32' | Shale, silty, light to medium gray, hard, brittle, slightly fissile, siliceous and rarely calcareous, with abundant mica and carbonaceous material. Abundant silt and sandstone stringers and laminae with common fossil shell fragments. |
| 3497' - 3513' | 16' | Siltstone, light to medium gray, hard, brittle, siliceous, locally argillaceous and slightly calcareous with abundant carbonaceous material and mica. |
| 3513' - 3522' | 9' | Dolomite, light to dark gray, very hard, microcrystalline, slightly silty, siliceous.
(X-ray determination) |
| 3522' - 3530' | 8' | Siltstone, argillaceous, light to medium gray and gray-green, hard, brittle, locally very finely sandy, siliceous, with abundant carbonaceous material, mica, silty micaceous partings and common sandstone laminae. |

Stony Gap Sandstone Member (3530' - 3779')

3530' - 3550'	20'	Sandstone, white to light gray and brown, hard, very fine to silty grained, well sorted and rounded, siliceous and slightly calcareous with common mica, carbonaceous material, siltstone stringers, silty, gray, micaceous - carbonaceous partings, and rare pyrite. Poor to no apparent porosity.
3550' - 3555'	5'	Siltstone, light to medium gray, hard, brittle, locally very finely sandy, siliceous with abundant mica and carbonaceous material.
3555' - 3592'	37'	Shale, silty, medium gray, hard, brittle, poorly fissile, clayey, with abundant mica, common pyrite and rare carbonaceous material. Common fragments of dolomite throughout, with fossil shell fragments.
3592' - 3617'	25'	Interbedded shale and siltstone, variegated, red-brown, ferruginous to light and medium gray, mottled, hard, brittle, siliceous and clayey, with common mica. Fragments of dolomite throughout.
3617' - 3662'	45'	Siltstone, argillaceous and clayey, light to dark gray, hard, brittle, siliceous with abundant mica, carbonaceous material, common pyrite and coaly carbonaceous laminae.
3662' - 3700'	38'	Sandstone, white, hard, very fine to fine and medium grained, well sorted, subround to round, interstitially slightly silty, siliceous with common silty-gray, micaceous- carbonaceous partings and laminae. Fair to poor porosity.
3700' - 3707'	7'	Siltstone, light to medium gray, very hard, locally very finely sandy, siliceous with abundant mica, common carbonaceous material and pyrite.
3707' - 3739'	32'	Sandstone, white to light brown, hard, very fine to medium grained, well sorted and rounded, silty, siliceous, and locally calcareous with minor interbedded siltstone, as 3700' - 3707'. Poor to no porosity.

3739' - 3779' 40' Sandstone, silty, white to light gray and brown, hard, medium, to fine, very fine and silty grained, graded, well sorted and rounded, siliceous and locally slightly calcareous with common mica, pyrite carbonaceous material and silty gray, micaceous - carbonaceous partings. Commonly grades to siltstone of the same composition. Possible fair to poor porosity.

Bluefield Formation (3779' - 4332')

3779' - 3789' 10' Dolomite, slightly silty, siliceous, medium to dark gray, hard, microcrystalline with common pyrite.

3789' - 3794' 5' Siltstone, argillaceous and clayey, light to medium gray, hard, brittle, siliceous with abundant mica, carbonaceous material and common micaceous laminae.

3794' - 3817' 23' Dolomite, argillaceous and silty, siliceous, impure, white to light and dark gray, hard, microcrystalline with common pyrite. (X-ray determination)

3817' - 3827' 10' Siltstone, dolomitic, argillaceous and clayey, light to dark gray, hard, brittle, siliceous with abundant mica, carbonaceous material and micaceous laminae.

3827' - 3835' 8' Sandstone, white to light gray, hard, very fine to silty grained, well sorted, siliceous with common pyrite and silty, gray, micaceous-carbonaceous partings. No apparent porosity.

3835' - 3889' 54' Interbedded sandstone silty to medium grained, as above and siltstone, argillaceous and clayey as 3817' - 3827'. Intercalated limestone stringers, silty, impure, in the interval 3875' - 3889'.

3889' - 3937' 48' Shale, medium gray, hard, brittle, slightly fissile, clayey, locally silty, siliceous and slightly calcareous with common pyrite and rare fossil fragments. Minor interbedded siltstone, clayey, light green to red-brown, ferruginous, hard, brittle, siliceous and locally calcareous, in the interval 3904' - 3937'. Common fragments of limestone, silty, impure, and sandstone, as possible thin laminae.

3937' - 3958'	21'	Interbedded shale as above and limestone, silty, impure, light to dark gray and light brown, hard, brittle, microcrystalline locally very finely sandy, siliceous with common pyrite and calcite.
3958' - 4008'	50'	Sandstone, white, very hard, very fine to silty grained, well sorted and rounded, siliceous and locally calcareous with common carbonaceous material, mica and pyrite. Abundant interbedded siltstone stringers and silty gray micaceous - carbonaceous partings. No apparent porosity.
4008' - 4024'	16'	Siltstone, medium gray, hard, brittle, siliceous and very slightly calcareous with common carbonaceous material, mica and micaceous laminae.
4024' - 4067'	43'	Shale, clayey, light to medium gray, hard, brittle, slightly fissile, locally silty, siliceous and rarely calcareous with common mica, carbonaceous material, and pyrite. Locally common interbedded siltstone stringers and laminae.
4067' - 4076'	9'	Siltstone, calcareous, medium gray to gray-brown, hard, brittle, with calcite, pyrite and fossil fragments.
4076' - 4106'	30'	Shale, clayey, light to medium gray, hard, brittle, slightly fissile, commonly silty, siliceous and slightly calcareous as 4024' - 4067'. Common limestone and fossil fragments.
4106' - 4112'	6'	Siltstone, calcareous as 4067' - 4076'.
4112' - 4134'	22'	Limestone, white to light and medium gray, gray-brown and brown, silty, argillaceous, impure, hard, brittle and microcrystalline with common pyrite and fossil fragments. Probable interbedded calcareous siltstone laminae.
4134' - 4158'	24'	Limestone, generally oolitic and fossiliferous fragmental, white to light gray, tan, gray-brown and brown, hard, brittle, microcrystalline, slightly silty, impure with common calcite.

4158' - 4176'	18'	Limestone as 4112' - 4134'.
4176' - 4189'	13'	Siltstone, argillaceous, light to medium gray, moderately hard and brittle, siliceous and slightly calcareous with common mica and carbonaceous material.
4189' - 4249'	60'	Shale, silty, calcareous and dolomitic, medium gray, moderately hard and brittle, poorly fissile, clayey, siliceous, with common mica, carbonaceous material, pyrite and locally common fossil fragments (X-ray determination)
4249' - 4270'	21'	Interbedded siltstone, argillaceous, calcareous and dolomitic as 4176' - 4189', and limestone, oolitic and fossiliferous fragmental, white to light and medium gray, gray-brown and brown, hard, brittle, microcrystalline, slightly argillaceous and silty, siliceous, impure, with pyrite, calcite and fossil fragments.
4270' - 4292'	22'	Siltstone, dolomitic and calcareous, light gray to gray-green, red-brown, and brown, hard, brittle with common interbedded limestone stringers.
4292' - 4297'	5'	Limestone, silty, light gray, gray-brown and brown, hard and brittle.
4297' - 4318'	21'	Siltstone, dolomitic and calcareous, light gray, hard, and brittle with common mica.
4318' - 4322'	4'	Limestone, fossiliferous fragmental, medium to dark gray and gray-brown, hard, brittle, microcrystalline, commonly oolitic and silty, siliceous.
4322' - 4332'	10'	Siltstone as 4297' - 4318'.

Greenbrier Limestone (4332' - 4852')

4332' - 4341'	9'	Limestone, light to medium and dark gray, gray-brown and brown, hard, brittle, silty, siliceous, impure, with abundant fossil fragments.
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4341' - 4395'	54'	Limestone, commonly oolitic and fossiliferous fragmental, white to tan and buff, locally gray-brown and brown, hard, brittle and microcrystalline.
4395' - 4449'	54'	Limestone, locally oolitic and fossiliferous fragmental, white to tan, buff, gray-brown and brown, hard, brittle, microcrystalline and slightly silty, siliceous, with rare chert fragments 4414' - 4425'.
4449' - 4482'	33'	Limestone, white, light to dark gray, gray-brown and brown, silty, siliceous and argillaceous, impure, hard, brittle and microcrystalline with common fossil fragments.
4482' - 4552'	80'	Limestone, commonly oolitic and fossiliferous fragmental, white to light gray, gray-brown, brown, tan and buff, hard, brittle and microcrystalline.
4552' - 4560'	8'	Siltstone, dolomitic and calcareous, red-brown to commonly light gray-green, hard and brittle.
4560' - 4594'	34'	Limestone, oolitic and commonly fossiliferous fragmental, white to light gray, tan and buff, hard, brittle, microcrystalline with common calcite.
4594' - 4619'	25'	Limestone, white to tan and buff, hard, brittle and microcrystalline.
4619' - 4679'	60'	Limestone, oolitic and fossiliferous fragmental, white to tan, buff, light gray and gray-brown, hard, brittle and microcrystalline.
4679' - 4683'	4'	Siltstone, dolomitic and calcareous, red-brown to rarely light green, hard and brittle.
4683' - 4698'	15'	Limestone, oolitic and rarely fossiliferous fragmental, white to tan and buff, hard, brittle and microcrystalline.
4698' - 4712'	14'	Limestone, white to tan, light gray and gray-brown, hard, brittle, microcrystalline and slightly silty, siliceous.

4712' - 4764'	52'	Limestone, oolitic and commonly fossiliferous fragmental, white to tan and buff, hard, brittle and microcrystalline.
4764' - 4770'	6'	Dolomite, pale green, hard, brittle and coarsely crystalline.
4770' - 4806'	36'	Limestone, generally oolitic and fossiliferous fragmental, white to tan, buff, gray-brown and brown, hard, brittle and microcrystalline.
4806' - 4852'	46'	Limestone, tan to gray-brown and dark brown, hard, brittle, microcrystalline and slightly silty, siliceous with common pyrite, rare fossil fragments and abundant chert, creamy white, blue and brown.

Maccrady Shale (4852' - 4892')

4852' - 4892'	40'	Siltstone, dolomitic and ferruginous, red-brown to brown and gray-green, hard, brittle and siliceous with common mica, pyrite and carbonaceous material. Abundant quartz, fine to very coarse grained, well rounded.
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Price Formation (4892' - 5093')

4892' - 4940'	48'	Siltstone, light to medium gray, locally gray-brown and brown, hard, locally very finely sandy, siliceous, with common carbonaceous material and mica.
4940' - 4981'	41'	Sandstone, white to light and medium gray, hard, very fine to silty grained, well sorted, siliceous, with common carbonaceous material, mica, pyrite, and silty gray micaceous-carbonaceous partings and laminae. Poor porosity. The sandstone frequently grades into a siltstone of identical composition.
4981' - 4987'	6'	Siltstone, argillaceous, medium to dark gray, hard, brittle and siliceous with common carbonaceous material, mica, pyrite and micaceous laminae.

4987' - 5004' 17' Sandstone as 4940' - 4981'.

DEVONIAN - MISSISSIPPIAN SYSTEM

Big Stone Gap Shale (5093' - 5340')

5004' - 5093' 89' Siltstone, argillaceous and clayey, light to medium gray, hard, brittle, poorly fissile, siliceous, with common carbonaceous material, mica and pyrite. Rare very fine grained sandstone laminae throughout.

DEVONIAN SYSTEM

Devonian Shales, Siltstones and Sandstones (5340' - 5481'+)

5093' - 5197' 104' Shale, slightly silty, medium gray to locally brown, hard, brittle, slightly fissile, siliceous and clayey, with common mica, carbonaceous material and pyrite.

5197' - 5245' 48' Shale, silty, medium gray, hard, brittle, slightly fissile, siliceous, with common mica and carbonaceous material.

5245' - 5257' 12' Siltstone, argillaceous, medium gray, hard, brittle, poorly fissile and siliceous with abundant to common mica, carbonaceous material and pyrite.

5257' - 5340' 83' Shale, medium gray, hard, brittle and slightly fissile, with abundant finely divided mica.

5340' - 5387' 47' Siltstone, pyritic and carbonaceous, dark gray to black, hard, brittle, siliceous, with abundant carbonaceous material, mica and pyrite.

5387' - 5412' 25' Interbedded sandstone, white to light gray, hard, very fine to silty grained, well sorted and rounded, siliceous, with common carbonaceous material, mica and pyrite; and siltstone, argillaceous, clayey, medium gray,

hard, brittle and slightly fissile, with abundant finely divided mica, common carbonaceous material and pyrite. Common silty gray micaceous - carbonaceous partings and laminae throughout. Possible fair to poor porosity.

5412' - 5455'	43'	Sandstone, white to light gray, hard, very fine to silty grained, well sorted and rounded, siliceous, with common carbonaceous material and silty gray micaceous - carbonaceous partings. Poor porosity. Minor intercalated shale and siltstone laminae throughout. The sandstone frequently grades into a siltstone of identical composition.
5455' - 5458'	3'	Siltstone, argillaceous, clayey, medium gray, hard, brittle, and slightly fissile, with abundant mica and pyrite.
5458' - 5480'	22'	Sandstone, as 5412' - 5455', with minor intercalated shale and siltstone laminae as above.
5480' - 5481'	1'	No sample.

TOTAL DEPTH 5481'

GEOLOGIC SUMMARY

Pennsylvanian System

Norton Formation	in	surface
	bottom	1195
Lee Formation	top	1195
	bottom	2496

Mississippian System

Bluestone Formation	top	2496
	bottom	2971
Princeton Sandstone	top	2971
	bottom	3130
Hinton Formation	top	3130
	bottom	3779
Stony Gap Sandstone	top	3530
	bottom	3779
Bluefield Formation	top	3779
	bottom	4112
Greenbrier Limestone	top	4112
	bottom	4852
Maccrady-Price Formations	top	4852
	bottom	5093

Mississippian-Devonian Systems

Big Stone Gap Shale	top	5093
	bottom	5340

Devonian-Pre-Devonian Systems

Devonian-Pre-Devonian undivided	top	5340
	(sampled depth	5480)

Correlations by: Keith Robinson

September 1963

DEVONIAN-
MISSISSIPPIAN
SYSTEMS
(5093' - 5340')

Big Stone Gap Shale
(5073' - 5340')

DEVONIAN
SYSTEM
(5340' - 5481')

Devonian shales, siltstones and sandstones.

Summary

PENNSYLVANIAN
SYSTEM
(0' - 2446')

Pottsville
Group
(0' - 2446')

Norton
Formation
(0' - 1195')

Upper Banner Coal (110'-113')
Lower Banner Coal (261'-264')
Equivalent Kennedy Horizon
Coal (486' - 508')
McClure Sandstone (508'-549')
Equivalent Raven Coal
Horizon (708'-733')
Jawbone Coal (875'-877')

Lee
Formation
(1195' -2446')

Bluestone
Formation
(2446'-2971')

Princeton
Sandstone
(2971'-3130')

Pennington
Group
(2446'-3779')

Avis Limestone Member (3130-3200')

Hinton
Formation
(3130'-3779')

Middle Red Member (3200'-3530')

MISSISSIPPIAN
SYSTEM
(2446'05093')

Stony Gap Sandstone Member
(3530'-3779')

Bluefield
Formation
(3779'-4332')

Greenbriar Lim
Limestone
(4332'-4852')

Maccrady
Shale
(4852'-4892')

Price
Formation
(4892'-5093')

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Dickenson County
U.S. # 215
Index No. 79

T.	R.

COMPANY
NO.
COMMENCED
COMPLETED

ELEVATION

REMARKS

PRODUCTION

Well spudded
above Upper Banner
Coal.

FORM 187 - For Sale by Ross-Martin Co., Tulsa

