FIRST DAY
ROAD LOG, THURSDAY, SEPTEMBER 19, 1963
Mileage - 141.3 miles

Buses will line up in parking space in front of hotel for departure at 8:30 AM.

Mileage		
0.0		Bedford, Pennsylvania. Main entrance of New Hoffman Hotel.
0.1	0.1	Follow hotel driveway to intersection with Pitt Street (U.S. 30), noting the stone building to the left of the driveway. TURN RIGHT and continue through Bedford business district. Route is now heading west on U.S. 30. (Refer to Route Map 1.)

Bedford Village

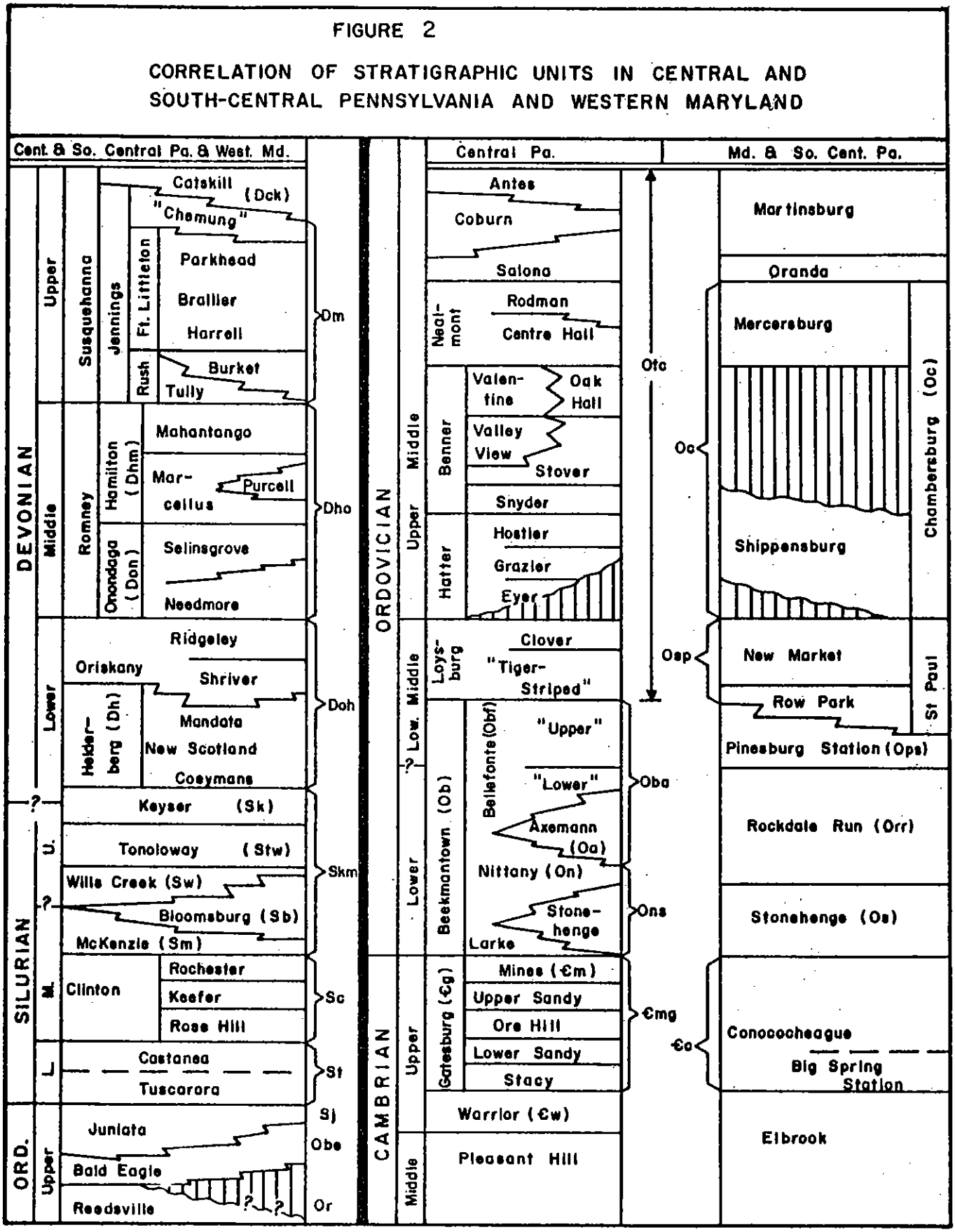
Settled about 1750, known then as Raystown. Site of an early trading post and Fort Bedford, 1758. Base for Forbes and Bouquet expeditions to the west. In 1794 Washington here reviewed forces involved in the Whiskey Rebellion. The stone building in front of New Hoffman Hotel was a powder magazine during Whiskey Rebellion.

Bedford is located on the axis of the relatively shallow Bedford Syncline between Friends Cove (or Roaring Spring) Anticline to the east and Wills Mountain Anticline to the west. Regional structural strike of the Bedford syncline is N 35° E. The route of this field trip cuts diagonally across the regional strike, passing through a poorly exposed Silurian section on the east flank and on the northeast plunging nose of Wills Mountain Anticline in which the following sequence (youngest to oldest) exists:

Keyser Formation
Tonoloway Formation
Wills Creek Formation
Bloomsburg Formation
McKenzie Formation
Rose Hill Formation

FIGURE 2

CORRELATION OF STRATIGRAPHIC UNITS IN CENTRAL AND SOUTH-CENTRAL PENNSYLVANIA AND WESTERN MARYLAND



Mileage		
0.5	0.4	Passing obliquely through the Silurian Wills Creek shale, Bloomsburg shale and McKenzie Formation during the next 0.6 miles.
1.1	0.6	Entrance to Bedford County Fairgrounds (at 9 o'clock).
1.4	0.3	Approximate contact Rose Hill (Clinton) shale with overlying McKenzie shale. Poor exposures of Rose Hill shale can be observed in fields and road-cuts in next 2.6 miles around the northeast plunge of Wills Mountain Anticline.
3.0	1.6	Bridge over Raystown Branch of Juniata River. Small Rose Hill shale crops, both sides of road.
3.4	0.4	Crossing the axis of the Wills Mountain Anticline. Sloping topographic ridge at 9 o'clock reflects the rapid northeast plunge. Good exposures of Rose Hill shale in Turnpike road-cuts at 2 o'clock. Attitude N 70 E/24 NW.
		Colonial iron workings, pits and mounds can be observed in the Rose Hill "iron-rich" sands, north of the Turnpike at 3 o'clock.
		The Juniata River provides an excellent example of a structurally-controlled stream adjustment around the northeast plunging nose of the Wills Mountain Anticline.
4.0	0.6	Approximate contact of Rose Hill shale and McKenzie shale, on west flank of Wills Mountain Anticline.
4.2	0.2	Junction Pa. 56. Continue STRAIGHT AHEAD on U.S 30. At 9 o'clock note the profile of Wills Mountain which reveals the rapid plunge of the anticline. The ridge-former on skyline is the Silurian Tuscarora sandstone.
4.3	0.1	Approximate contact of Wills Creek shale with younger Tonoloway argillaceous dolomite. Attitude N 30 E/50 NW.
4.8	0.5	Junction with Pa. 31. Bear to the LEFT at traffic island and continue southwest on Pa. 31, proceeding through Tonoloway rocks.

The Forks

Monument marks the point where Forbes Road of 1758 diverged from the path cut by Col. Burd in 1755. Forbes Road leads from Fort Bedford to Fort Duquesne (Pittsburgh) via Fort Dewart and Fort Ligonier. The army of General Forbes marching against the French at Fort Duquesne established a camp at this point.

5.0	0.2	Route 31 parallels the strike of beds on the western side of Buffalo Mountain (which is the topographic expression of the west flank of Wills Mountain Anticline). Road follows very close to the Wills Creek-Tonoloway contact; most road-cut crops are Tonoloway. At 3 o'clock are good exposures of Keyser limestone, and of the Coeymans and New Scotland limestone members of the Helderberg Group immediately north of Turnpike underpass.
5.7	0.7	East-dipping exposure (minor synclinal flexure) of Tonoloway is to be seen in road cut at 9 o'clock. The low ridge paralleling the route is comprised of Silurian Keyser limestone, and of Devonian Helderberg limestone and Oriskany sandstone; this secondary topographic ridge can be traced along the west flank of Wills Mountain Anticline southward into Maryland.
6.8	1.1	Bridge. Raystown Branch - Juniata River.
7.9	1.1	We are travelling parallel to strike in Devonian Onondaga and Hamilton beds.
8.1	0.2	Wonderland "Coral" Caverns at 9 o'clock (high). The cave is developed in the Keyser limestone along steeply dipping bedding planes. Attitude N 50 E/80 NW.
8.3	0.2	Entering the village of Manns Choice. Founded 1848.
8.5	0.2	Junction Pa. 31 and Pa. 96. Proceed STRAIGHT AHEAD (southwest) on Pa. 96 South.
9.6	1.1	Highly fossiliferous Lower Devonian Oriskany-Helderberg is exposed in road cuts at 9 o'clock. Onondaga and Hamilton groups lie in the valley of Buffalo Run at 3 o'clock.
10.7	1.1	TURN LEFT (east) at sign directing to White Sulphur Springs hotel.

Mileage		
		From this point the route follows the drainage of White Sulphur Run up the west flank of Wills Mountain Anticline. In rapid succession the section from Middle Devonian Hamilton shale to Upper Ordovician Reedsville (Martinsburg) shale will be traversed.
10.9	0.2	At 3 o'clock, Oriskany-Helderberg ridge.
11.2	0.3	Entering the narrows through Buffalo Mountain.
11.4	0.2	At 9 o'clock, vertical to overturned (east-dipping) Silurian Tuscarora sandstone.
11.5	0.1	Caution. One-way bridge over White Sulphur Run. Tuscarora float is abundant at 3 o'clock.
11.6	0.1	Juniata Formation is at 3 o'clock; vertical to overturned (east-dipping).
11.9	0.3	Narrow bridge over White Sulphur Run.
12.1	0.2	Junction; continue STRAIGHT AHEAD over concrete bridge. Zone of Orthorhynchula is in left bank at junction; zone occurs in siltstone assigned to Reedsville Formation.
12.2	0.1	The White Sulphur Springs Hotel - built in 1886. The mineral spring is located in the gazebo at 9 o'clock. Analysis of the water from this spring, by F. A. Genth of the University of Pennsylvania, discloses the presence of the following chemical compounds:

Lithium chloride	Trace p/m
Sodium chloride	3.29 p/m
Sodium sulphate	17.10 p/m
Potassium sulphate	3.70 p/m
Calcium sulphate	6.08 p/m
Magnesium sulphate	16.78 p/m
Calcium bicarbonate	154.63 p/m
Magnesium bicarbonate	22.03 p/m
Ferrous bicarbonate	11.29 p/m
Silica	30.96 p/m
Total solids	263.86 p/m

A Shawnee trail to this spring, and relicts of that tribe, prove that this spring was an Indian "resort" long before white men settled in central Pennsylvania.

Mileage		
12.3	0.1	Upper Ordovician Reedsville shale in road-cuts on both sides of road.
12.5	0.2	Proceed southwest along the surface crest of Wills Mountain Anticline. Skyline rim at 9 o'clock is a Tuscarora ridge on the east flank of the anticline; the lower secondary ridge is supported by Oswego (or Bald Eagle) sandstone. The oldest rocks exposed along the surface crest of this structure are Reedsville shale.
12.8	0.3	TURN LEFT, proceed on single-track dirt road. Use caution-- very rough road.
13.1	0.3	Bear to RIGHT at road fork.
13.3	0.2	Bear to LEFT at road fork.
13.8	0.5	STOP I. Group Leader: Walt Skinner, Sun Oil Company Location: Kerr-McGee Petroleum Industries, No. 1 Mary Martin well.

The No. 1 Mary Martin was spudded in Reedsville shale, probably about 600' below the top of the formation. The section was "normal" until the Nittany Member of the Beekmantown Formation was reached. (It is thought that the well did not penetrate stratigraphically lower than basal Nittany.) The Nittany, expected to be from 800' to 1000' in thickness, actually was 2184' thick and occurred immediately above the major thrust which was encountered at 6174'. The entire lower section of the Nittany is extremely contorted; it is possible that the lowest part of the Nittany was not found by the well.

Below the thrust at 6174', the well re-entered the Reedsville shale, this time in an inverted position. A series of shales and siltstones of varying shades of gray, somewhat calcareous and fossiliferous was penetrated to approximately 6500'. Greenish gray quartzitic siltstones were encountered at 6500' and some red siltstone and shale at 6540'. The section seems to parallel, in inverse order, the upper Reedsville section in the No. 1 Jesse B. Miller well, and also the section exposed in the cut in Buffalo Mountain. The section in the lower part of the Martin well is considered to be the upper Reedsville sandy unit which is exposed in Bedford Narrows. This will be seen later in the trip (at mileage 32.7 on First Day, or mileage 79.2 on Third Day).

Mileage		
		No significant shows were encountered in the well although some minor indications were noticeable on the gas detector while the Trenton section was being drilled.

(See skeletal log on page 40 , and Figure 3.)

Editor's Note:- The significance of this recent well (Martin No. 1) and the well (Rankey No. 1) at Stop II is the contribution which each makes to our understanding of the regional structure. A detailed interpretation, however, by a geologist familiar with the pertinent facts is not available at the time of this writing. Nevertheless, we feel sure that an informal and lively discussion will ensue at each of these stops at the time of the trip and that mutual educational benefit will result from such a sharing of opinions.

Return to paved road along the axis of the anticline.

14.9	1.1	Dirt road ends at paved road; TURN LEFT, traversing the Reedsville shale southwesterly along crest of Wills Mountain Anticline.
15.0	0.1	Ridge at 3 o'clock supported by Oswego sandstone.
15.5	0.5	Scar low on ridge at 9 o'clock is the No. 1 Mary Martin location.
17.0	1.5	Entering the narrows of Buffalo Run through Buffalo Mountain. Steep-dipping to vertical Reedsville shale and Oswego sandstone in road-cut at 3 o'clock. Prominent Orthorhynchula linneyi zone may be seen 27 feet below the base of the Oswego in the brown and green fossiliferous Reedsville.
17.1	0.1	Oswego (Bald Eagle) sandstone exposure; steep to nearly vertical beds in road-cut at 3 o'clock.
17.3	0.2	Overturned (east-dipping) Juniata beds at 3 o'clock.
17.4	0.1	Overturned (east-dipping) Tuscarora sandstone at 3 o'clock.
17.5	0.1	West-dipping (normal) Tuscarora sandstone is at 3 o'clock; Castanea contact is concealed but float is evident.

The following are skeletal logs of the three wells in the vicinity of the field trip in Bedford and Blair counties.

(See also Figure 3.)

Stop I.
No. 1. Mary Martin

Reedsville	0-1462
Trenton	
Coburn	1462-1710
Salona	1710-1898
Rodman	1898-2000
Centre Hall	2000-2082
Oak Hall	2082-2138
Black River	
Valley View	2138-2151
Stover	2151-2190
Snyder	2190-2244
Hostler	2244-2336
Grazier	2336-2380
Chazy	
Clover	2380-2464
"Tiger Striped"	2464-2610
Beekmantown	2610-6174
Fault	
Reedsville	6174-6677 TD.

- - - - - - -

Stop II.
No. 1 Rankey

Rose Hill	0- 775
Thorold-Castanea	775- 835
Tuscarora	835-1432
Juniata	1432-2400
Fault	
Tonoloway	2400-2980
Wills Creek	2980-3623
Bloomsburg	3623-3667
McKenzie	3667-4102
Rochester	4102-4192
Keefer	4192-4220
Rose Hill	4220-4896
Thorold-Castanea	4896-4970
Tuscarora	4970-5110 TD.

(Located on Route Map 1.)
No. 1. Miller

Shriver	0- 43
Helderberg	43- 112
Keyser	112- 247
Tonoloway	247-1053
Wills Creek	1053-1658
Bloomsburg	1658-1723
McKenzie	1723-2160
Rochester	2160-2206
Keefer	2206-2219
Rose Hill	2219-2770
Thorold-Castanea	2770-2881
Tuscarora	2881-3215
Fault	
Rose Hill	3215-3251
Thorold-Castanea	3251-3350
Tuscarora	3350-3792
Juniata	3792-4910
Oswego	4910-5615
Reedsville	5615-7810
Trenton	
Coburn	7810-8070
Salona	8070-8282
Rodman	8282-8313
Centre Hall	8313-8343
Oak Hall	8343-8392
Black River	
Stover	8392-8493
Snyder	8493-8587
Hostler	8587-8650
Grazier	8650-8685
Chazy	
Clover	8685-8727
"Tiger Striped"	8727-8835
Beekmantown	8835-8980 TD.

	MARTIN	MILLER	RANKEY
BASE REEDSVILLE TO BASE TRENTON	676	582	
BASE REEDSVILLE TO BASE BLACK RIVER	762	777	
BASE REEDSVILLE TO BASE CHAZY	1148	1025	
BASE TONOLOWAY TO TOP ROSE HILL		1164	1240
TOP ROSE HILL TO BASE TUCARORA		1092*	1333*
BASE WILLS CREEK TO BASE ROSE HILL		1112	1347

COMPOSITE *

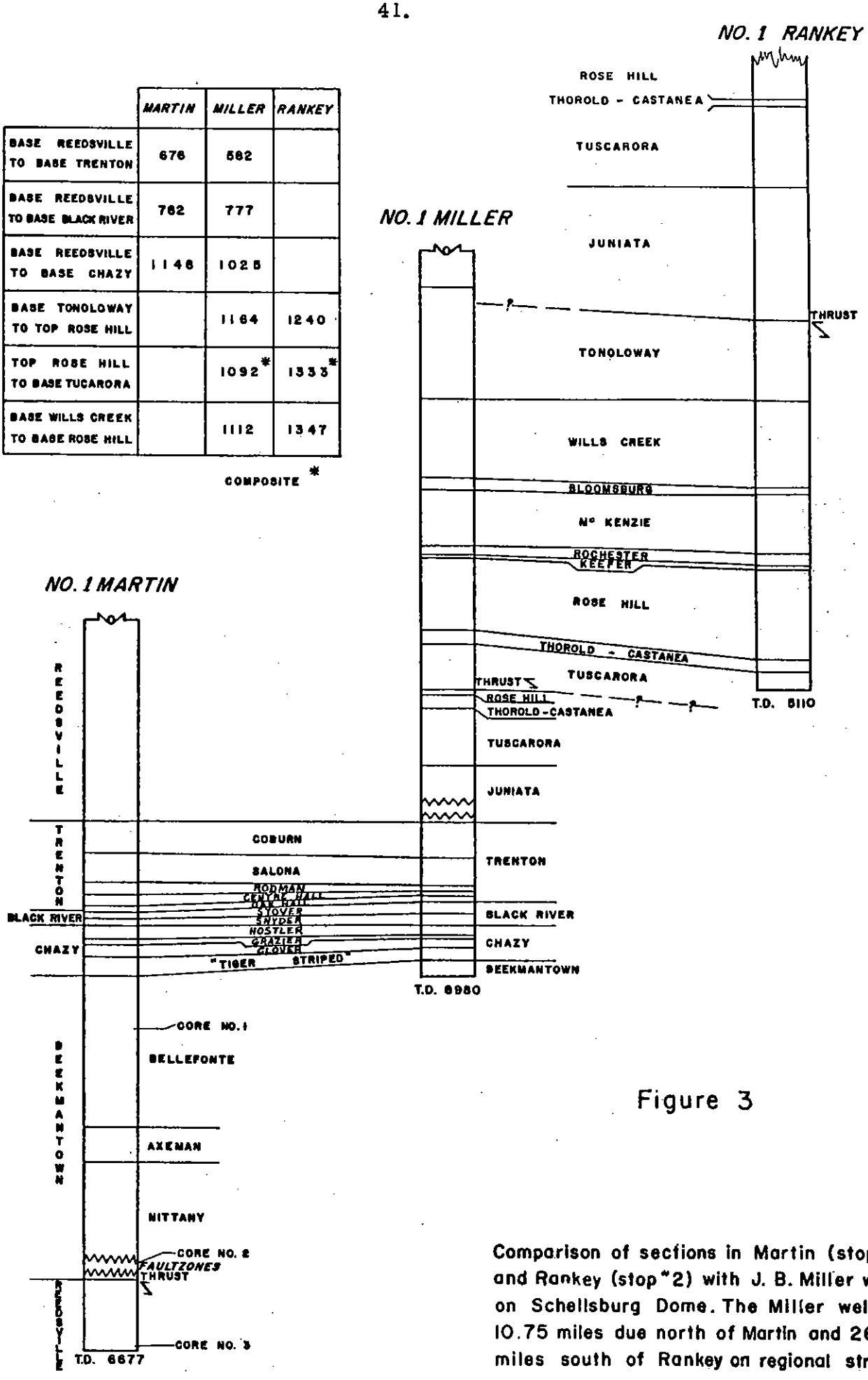


Figure 3

Comparison of sections in Martin (stop 1) and Rankey (stop 2) with J. B. Miller well on Schellsburg Dome. The Miller well is 10.75 miles due north of Martin and 26.5 miles south of Rankey on regional strike.

Mileage		
17.6	0.1	Silurian Rose Hill shale outcrops in road-cut at 3 o'clock.
17.8	0.2	Bridge over Buffalo Run. Entering the village of Buffalo Mills. An Oriskany-Helderberg ridge is at 10 o'clock.
18.1	0.3	Junction with Pa. 96 (north). TURN RIGHT.
19.1	1.0	Beds of the Devonian Hamilton group are exposed in road-cut at 9 o'clock.
19.7	0.6	Hamilton rocks are in the road-cut at 9 o'clock.
23.2	3.5	Manns Choice. Junction of Pa. 96 and Pa. 31. Continue STRAIGHT AHEAD on Pa. 31 (east).
26.8	3.6	Junction with U.S. 30. Stop. BEAR RIGHT and continue on U.S. 30 (east).
30.7	3.9	Entering Bedford. Continue on U.S. 30 (east) STRAIGHT through town.
31.5	0.8	Junction with U.S. 220. Continue STRAIGHT AHEAD on U.S. 30 (east). We are now crossing the east flank of the Bedford Syncline.
32.3	0.8	Silurian Rose Hill shale to be seen in cuts at 3 o'clock.
32.7	0.4	Entering the Bedford Narrows where the Raystown Branch of the Juniata River cuts through Evitts Mountain. The highway cut exposes overturned (east-dipping) Silurian and Ordovician sandstone on the west flank of Friends Cove Anticline. The stratigraphic succession shows the oldest beds to be to the east, but dips range from vertical to as low as 35° SE (overturned).

Numerous slip-planes and faults of small throw, tending to shorten the section, may be found in this exposure and in the Kilcoin Quarry to the north. At the east end of the cut, at the Turnpike underpass, is a section of red sand once thought to be Oswego repeated by faulting; no fault of significant magnitude, however, is evident. This section is now believed to be the upper sandy unit of the Reedsville; the section furthermore, closely matches that encountered in the No. 1 Jesse B. Miller 10 miles to the northwest. The dip and strike of this Reedsville outcrop also is similar to that of the "Tiger-Striped" member of the Loysburg which crops out in the Juniata River beneath the Turnpike bridge to the

Mileage		
		east. The Turnpike outcrop ties into the section exposed in and below Kilcoin Quarry and appears to be "normal". with the possibility of faulting in the Trenton limestone section, which has been apparently shortened considerably at both the Turnpike and Kilcoin exposures. A similar section may be measured to the east, at the town of Everett. The Reedsville, including the upper sandy unit, measures 1270' at Bedford Narrows, 1320' at Kilcoin Quarry, and 1316' at Everett.
32.9	0.2	Silurian Tuscarora sandstone at 11 o'clock in Turnpike road-cut.
33.0	0.1	Silurian Tuscarora sandstone float at 3 o'clock.
33.1	0.1	Upper Ordovician Juniata formation; best exposures are at 9 o'clock in Turnpike road-cut.
33.2	0.1	Upper Ordovician Oswego (Bald Eagle) sandstone in road-cuts on both sides of highway.
33.3	0.1	Junction of U.S. 30 (east) and Pa. 326 (south). BEAR LEFT, over bridge and continue on U.S. 30.
		Upper Ordovician Reedsville (Martinsburg) shale in Turnpike road-cut at 10 o'clock and in road-cut for secondary road at 2 o'clock Orthorhynchula fossils found.
33.5	0.2	Turnpike underpass. Reedsville sand (upper unit of formation) outcrop at 9 o'clock and 3 o'clock.
34.1	0.6	Paralleling Evitts Mountain, the route is over Reedsville shale.
34.8	0.7	Kilcoin Quarry at 3 o'clock. Middle Ordovician Trenton-Black River - Chazy limestones in near-vertical attitude.
35.0	0.2	Trenton-Black River limestone crops in road-cuts on both sides of road.
35.6	0.6	Cambrian Gatesburg sandy dolomite exposed in road-cuts on both sides of road. The Upper Cambrian has been faulted up against the Middle Ordovician here on the west flank of the Friends Cove Anticline.
36.1	0.5	Gatesburg still exposed in road-cuts on both sides of road. This is the approximate axis of the Friends Cove Anticline.

Mileage		
37.0	0.9	Approximate contact between the Cambrian Gatesburg and Lower Ordovician Beekmantown dolomite on east flank of Friends Cove Anticline.
37.7	0.7	Middle Ordovician Trenton-Loysburg limestone can be seen in road-cuts.
37.8	0.1	TURN SHARP LEFT on Pa. 36 (north). Route continues along strike on north plunge of Friends Cove Anticline. Road parallels the Middle Ordovician-Lower Ordovician contact. Beekmantown dolomite is at 9 o'clock and Trenton-Loysburg limestone at 3 o'clock.
38.7	0.9	Bridge over Snakespring Valley Run. Continue STRAIGHT AHEAD on Pa. 36 (north).
39.1	0.4	Tussey Mountain (at 3 o'clock) is the Tuscarora ridge on the east flank of Friends Cove Anticline. Beekmantown crops out at 9 o'clock. Route is traversing progressively younger beds on the north plunge of the anticline.
41.1	2.0	East-dipping Middle Ordovician limestones are exposed. Abundant Silurian Tuscarora sandstone float to be found in soil.
42.3	1.2	Tussey Mountain at 3 o'clock and Dunning Mountain at 9 o'clock are both Tuscarora ridges and they mark the east and west flanks respectively of Friends Cove (Roaring Spring) Anticline.
43.3	1.0	Crossing the north-plunging axis of Friends Cove Anticline.
43.7	0.4	Intersection. BEAR RIGHT and continue on Pa. 36 (north). Reedsville shale is exposed in borrow pits and road cuts on both sides of the road.
		During the next 3.2 miles the route crosses a topographic ridge marking the structural saddle separating Friends Cove and Roaring Springs anticlines. In this interval the route traverses the Upper Ordovician Reedsville shale, Oswego (Bald Eagle) sandstone and Juniata red silty shale to the crest of the divide. Reverse sequence may be observed from the crest into the anticlinal valley ahead.
46.9	3.2	Intersection is in Reedsville shale. BEAR RIGHT. Entering Morrison Cove Valley in the core of Roaring Springs Anticline. The ridge on skyline at 9 o'clock (Dunning Mountain) is Tuscarora-supported, the lower secondary ridge is supported by the Oswego (Bald Eagle) sandstone.

Mileage		
47.3	0.4	East-dipping Middle Ordovician limestone is at 3 o'clock along the drainage of Beaver Creek.
48.2	0.9	East-dipping Middle Ordovician limestone is exposed at 1 o'clock (near bridge abutment) and along the drainage of Beaver Creek.
49.4	1.2	Tuscarora talus slope at 2 o'clock (high) in Yellow Creek Gap through Tussey Mountain. Reedsville shale is at 3 o'clock (low).
49.7	0.3	Slow, sharp RIGHT TURN.
49.9	0.2	Intersection of Pa. 868 (north). TURN LEFT. Village of Loysburg.
50.0	0.1	Reedsville shale crops out at base of ridge at 3 o'clock.
50.5	0.5	Middle Ordovician Trenton-Black River-Chazy limestones are to be seen in road-cuts.
51.4	0.9	Northern Bedford County High School. Black River-Chazy limestone exposed here.
51.5	0.1	Approximate Middle Ordovician-Lower Ordovician contact. Route enters upon Beekmantown dolomite here.
52.2	0.7	TURN LEFT on Pa. 868 (north), following drainage of Potters Creek. Almost continuous exposures of Beekmantown dolomite are to be seen in road-cuts at 9 o'clock. (Waterside Section)
53.3	1.1	TURN RIGHT. In Cambrian Gatesburg sandy dolomite.
53.6	0.3	Settlement of Maria. We are crossing a nearly continuous exposure of Gatesburg dolomite. Best exposures are in road-cuts at 3 o'clock. This is on the east flank of Roaring Springs Anticline.
55.4	1.8	Approximate contact of Upper Cambrian Warrior dolomite and shale.
55.6	0.2	Cambrian Warrior is exposed at 3 o'clock in road-cuts.
56.9	1.3	Route parallels the Warrior-Gatesburg contact; road is on Warrior dolomite; wooded area ("the Barrens") at 3 o'clock is underlain by Gatesburg sandy dolomite.

Mileage		
57.7	0.8	Junction with Pa. 867 (north). TURN RIGHT.
57.8	0.1	Approximately 1500 feet to the west and parallel to the road is the Bakers Summit (Halter Creek) Fault with Cambrian Warrior dolomite thrust up (on the east) into contact with Ordovician Reedsville shale.
58.6	0.8	Settlement of Bakers Summit. Road parallels the axis of Roaring Spring Anticline.
59.3	0.7	Warrior outcrops at 3 o'clock.
60.5	1.2	Junction. BEAR LEFT and continue on Pa. 867 (north); in Gatesburg dolomite.
61.1	0.6	Cambrian Gatesburg is here in contact with the Lower Ordovician Beekmantown. Mines Dolomite Member of the Gatesburg Formation may be seen.
63.0	1.9	Route Parallels the strike in Beekmantown - an outcrop is at 3 o'clock.
63.7	0.7	Entering Borough of Roaring Spring. Continue through town on Pa. 867 (north).
64.5	0.8	Beekmantown dolomite is exposed in road-cut at 3 o'clock, Middle Ordovician limestone at 9 o'clock.
64.8	0.3	Junction with Pa. 36 (north); TURN LEFT on Pa. 36.
65.1	0.3	New Enterprise Stone and Lime Co. at 3 o'clock. Near-vertical Middle Ordovician Limestone (Trenton, Benner and Hatter limestone formations).
65.2	0.1	Upper Ordovician Reedsville shale at 9 o'clock.
65.5	0.3	Entering McKee Gap through Evitts Mountain. We are on the steep west flank of Roaring Spring Anticline. In rapid succession the route will pass through a normal stratigraphic section from Ordovician Reedsville shale to Upper Devonian shales which occupy the center of the Reservoir Syncline.
66.4	0.9	Lower Devonian Ridgeley sandstone is exposed in borrow pit at 3 o'clock. Continue on Pa. 36 (north).

Mileage		
67.3	0.9	Junction. BEAR RIGHT and continue on Pa. 36 (north).
67.4	0.1	Middle Devonian Hamilton Group in road-cuts at 3 o'clock.
67.7	0.3	Short Mountain (a Tuscarora ridge) can be seen on skyline at 3 o'clock; the lower secondary ridge is supported by Oriskany sandstone (Ridgeley Formation).
68.3	0.6	Exposure of Middle Devonian Hamilton rocks at 9 o'clock; this is close to the axis of the Reservoir Syncline.
70.0	1.7	Middle Devonian Marcellus shale is exposed in road-cut at 9 o'clock. Our route is now traversing the east flank of the southwest-plunging nose of the Sinking Valley Anticline, the westernmost structural feature of the Nittany Anticlinorium (or Arch) at this latitude.
70.5	0.5	Lower Devonian Oriskany sandstone exposure.
70.6	0.1	Lower Devonian Helderberg limestone outcrop.
70.8	0.2	Silurian Tonoloway limestone exposure.
71.2	0.4	The Allegheny Front can be seen at 9 o'clock.
71.8	0.6	Upper Silurian Keyser limestone outcrops ("The Chimneys") stand out on skyline at 12 o'clock (high).
72.1	0.3	Entering Borough of Hollidaysburg. Continue on Pa. 36 (north); watch highway signs carefully.
72.6	0.5	Bridge over Beaverdam Branch of the Juniata River.
73.2	0.6	Route crosses south-plunging axis of Sinking Valley Anticline.
73.8	0.6	Junction. BEAR RIGHT and continue on Pa. 36 (north).
74.1	0.3	State Hospital at 9 o'clock. Route parallels Silurian Bloomsburg-McKenzie contact on west flank of Sinking Valley Anticline. Bloomsburg redbeds are to be seen at 9 o'clock, McKenzie Formation at 3 o'clock.
74.7	0.6	TURN RIGHT on unmarked dirt road. Traversing Silurian McKenzie Formation and Silurian Rose Hill shale. Continue straight up hill.

Mileage		
75.1	0.4	BEAR LEFT at road fork up slight rise to clearing.

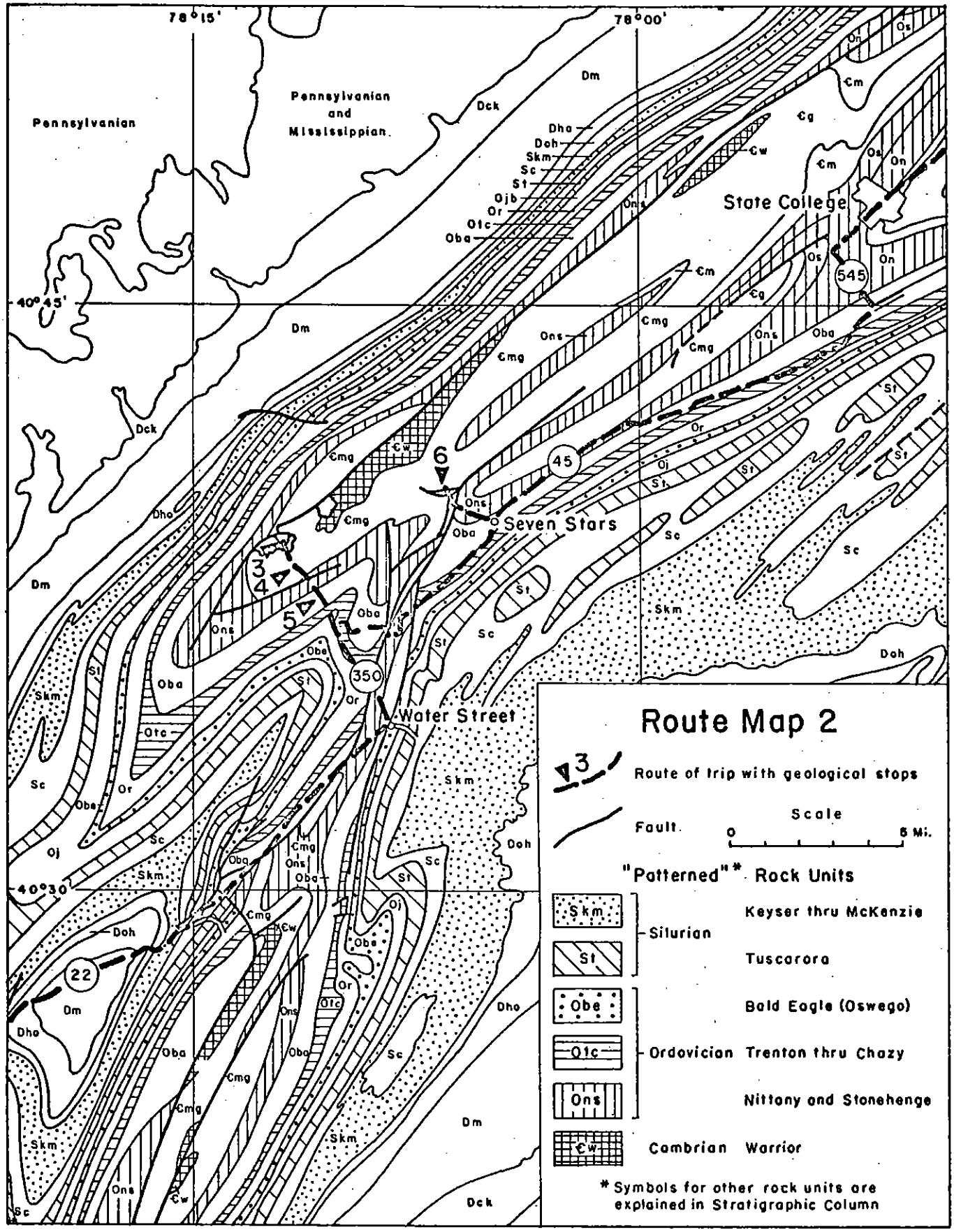
STOP II. Group Leader: Walt Skinner, Sun Oil Company
Location: Hollidaysburg Oil and Gas Company No. 1 Rankey well.

Hollidaysburg Oil and Gas Company intended the No. 1 Rankey well as a test of the Trenton on the northwest flank of the Sinking Valley Anticline. The well was spudded in the Rose Hill shale in October of 1961. Considerable difficulty was encountered with the 8" casing and water problems until a string of 7" was run in the Tuscarora at 1298'. A major thrust was encountered at 2400' and the well entered Upper Silurian Tonoloway at this depth. The Tonoloway is here an intertonguing limestone, shale, and dolomite with large calcite and anhydrite crystals, probably fracture-fill. Below the fault the well appeared to penetrate a "normal" section to the total depth of 5110' in the Tuscarora.

The well encountered no commercial shows of gas and was abandoned. (See skeletal log on page 40, and Figure 3.).

Return to paved road.

75.6	0.5	Junction with Pa. 36 (the paved road). TURN LEFT and retrace route previously travelled.
76.5	0.9	Junction. TURN LEFT around traffic island and continue on Pa. 36 (south), returning to Hollidaysburg.
77.6	1.1	Continue to Stop light, proceed one block straight ahead to junction with US. 22 (east) and TURN LEFT.
78.2	0.6	Bloomsburg redbeds in borrow pits at 3 o'clock.
79.2	1.0	In road-cut (Bald Hill Section) at 9 o'clock we pass, in rapid succession, southeast dipping Silurian Tonoloway and Keyser limestone, Devonian Helderberg limestone, Oriskany sandstone, limestone, and shale, Onondaga and Marcellus shale. Oriskany sandstone quarries may be seen across the river at 4 o'clock.
80.4	1.2	Entering the village of Frankstown.


78°15'
78°00'
40°45'
40°30'
Pennsylvanian
Pennsylvanian and Mississippian
State College
Seven Stars
Water Street
45
545
350
22
6
3
4
5
Dm
Dck
Dho
Doh
Skm
Sc
St
Ojb
Or
Otc
Oba
Obe
Oj
Ons
Cm
Cg
Cmg
Cw
Os
On
Route Map 2
Route of trip with geological stops
Fault
Scale
0
5 Mi.
"Patterned"* Rock Units
Silurian
Keyser thru McKenzie
Tuscarora
Ordovician
Bald Eagle (Oswego)
Trenton thru Chazy
Nittany and Stonehenge
Cambrian
Warrior
* Symbols for other rock units are explained in Stratigraphic Column

Mileage

Frankstown

The site, prior to 1748, of a Delaware-Shawnee village called Assunepachla. Here the trader, Frank Stevens, had a fur post as early as 1734. The Kittanning Path led through here.

Frankstown has lent its name to an "ore bed" of hematitic and fossiliferous sandstone once mined nearby (in the Rose Hill Formation).

Route here crosses northern termination of both the Reservoir Syncline and Roaring Spring Anticline.

80.6	0.2	Crossing the Frankstown Fault. (Turn to Route Map 2.)
80.7	0.1	At 9 o'clock, by fault repetition, is exposed the same Silurian-Devonian sequence as was seen at mile 79.2.
80.9	0.2	Entering village of Geeseytown.
81.4	0.5	Middle Devonian Hamilton shale can be seen in road-cuts. Route crosses diagonally the west flank of Scotch Valley Syncline.
82.0	0.6	Upper Devonian Brallier shale is exposed in road-cuts on both sides during next 2.6 miles. The type locality for the Upper Devonian Harrell shale is close by to the southeast.
84.6	4.6	Route crosses axis of Scotch Valley Syncline; Sinking Valley Anticline is to the west and Woodbury Anticline to the east.
85.2	0.6	Bridge over Canoe Creek; entering village of Canoe Creek.
86.3	1.1	We are now following the drainage of the Frankstown Branch of the Juniata River and the exposures are, in tight succession, from the Middle Devonian Hamilton shale to the Silurian Clinton shales.
87.6	1.3	Junction of US. 22 (east) and Pa. 866. BEAR LEFT and continue up the hill on US. 22 (east).
87.7	0.1	Crossing Jackson Fault (upthrown on east - we cross from Clinton to Bloomsburg).

Mileage		
88.4	0.7	Approximate Juniata-Oswego contact (to the west of the Jackson Fault). Our route moves from one side to the other of a complex fault system for the next few miles.
88.6	0.2	Crossing Jackson Fault into the Silurian Bloomsburg, McKenzie, and Clinton shales.
89.3	0.7	Crossing the West Henrietta Thrust -- we go from Silurian Clinton shale to Lower Ordovician Bellefonte dolomite.
90.0	0.7	Approximate contact of the Lower Ordovician Bellefonte dolomite with Nittany dolomite.
91.0	1.0	Approximate contact of Lower Ordovician Nittany dolomite with Cambrian Mines and Gatesburg dolomites.
91.3	0.3	Crossing Yellow Spring Thrust Fault -- Gatesburg (on the southeast) is thrust over Bellefonte (to the northwest). Spring at 9 o'clock marks the fault trace.
91.9	0.6	Etna Furnace Built in 1809 by the firm of Canan, Stewart & Moore, and operated until 1877, the furnace produced some of the "Juniata iron" for which this region was famous. The furnace stack and some of the stone buildings may be seen about 1 mile to the east on a side road at 3 o'clock.
94.2	2.3	Road parallels Bellefonte dolomite - Axemann limestone contact. Axemann limestone is at 3 o'clock, Bellefonte dolomite at 9 o'clock.
94.6	0.4	Crossing Yellow Spring Thrust Fault. Nittany is thrust over Bellefonte. Route continues along on Nittany dolomite, with the Mines-Gatesburg dolomite in the paralleling ridge at 3 o'clock.
96.1	1.5	Approximate contact of the Nittany dolomite and the Bellefont dolomite in a fault block between the Yellow Spring Thrust Fault and the Water Street Fault which is 3 miles to the east; Bellefonte outcrops in road-cuts.
96.8	0.7	Crossing Water Street Fault (normal), we go from Lower Ordovician Bellefonte to Upper Ordovician Reedsville shale and Oswego sandstone. East side of fault is down relative to west side.

Mileage		
96.9	0.1	Junction of US. 22 (east) and Pa. 350 (north). TURN LEFT at traffic island and proceed northwest on Pa. 350 (north)
97.0	0.1	Crossing Water Street Fault again, this time from Reedsville shale back into Bellefonte dolomite. The latter crops in road-cuts.
97.7	0.7	Junction of Pa. 350 (north and Pa. 45. Continue STRAIGHT AHEAD (left) on Pa. 350 (north).
97.8	0.1	Approximate contact of southeast-dipping Bellefonte with Nittany dolomite.
98.4	0.6	Crossing Yellow Spring Thrust Fault; Lower Ordovician Nittany dolomite has been thrust onto Upper Ordovician Reedsville shale.
99.0	0.6	Route is diagonally across the axis of a minor south-plunging anticlinal nose; Reedsville shale is beneath us here.
99.2	0.2	Middle Ordovician Trenton-Black River limestones, dips here are to the west off the anticlinal nose.
100.1	0.9	Route passes onto the new highway (Pa. 350-north) and is underlain by Reedsville shale.
100.6	0.5	Crossing drainage of Sinking Run; we are still in Reedsville shale; this is the approximate axis of the Scotch Valley Syncline.
100.8	0.2	Contact of Reedsville shale with Trenton limestone.
101.0	0.2	Top of Black River-Chazy group.
101.2	0.2	Top of Lower Ordovician Bellefonte dolomite.
101.5	0.3	Bridge over Little Juniata River. Junction Pa. 45. Continue STRAIGHT AHEAD.
101.7	0.2	Top of Nittany dolomite.
102.3	0.6	Crossing Shoenberger Thrust Fault - Nittany is thrust over Lower Ordovician Stonehenge.
102.6	0.3	Cambrian Gatesburg is exposed in cut at 3 o'clock.
103.1	0.5	Crossing the axis of Sinking Valley Anticline - in Gatesburg dolomite.

Mileage		
103.4	0.3	Crossing Birmingham Thrust Fault; Gatesburg dolomite is thrust north over Middle Ordovician limestones.
103.7	0.3	Birmingham Junction.
103.8	0.1	TURN LEFT onto bridge over Little Juniata River; proceed on dirt road through railroad underpass.
103.9	0.1	BEAR RIGHT and stop at railroad tracks.

(Buses will stop prior to railroad underpass and passengers will follow group leader on foot.)

STOP III.

Proceed southeast along railroad right-of-way approximately 1500 feet to observe Birmingham Thrust Fault.

The following description has been taken from a paper written by Moebs, N. N. and Hoy, R. B., in 1959 ("Thrust faulting in Sinking Valley, Blair and Huntingdon Counties, Pennsylvania", Geol. Soc. Amer. Bull., v. 70, p. 1079-1088).

GEOLOGY OF THE SINKING VALLEY AREA

The stratigraphy and the general structural relationships of the Sinking Valley area are described by Butts, et al. (1939, p. 1-78). The formations are included in the Cambrian, Ordovician, and Silurian systems. The oldest formation is the Upper Cambrian Warrior Limestone exposed along the axis of the Sinking Valley Anticline extending northwestward from a point about amile northeast of Birmingham. The youngest formation is the Silurian Tuscarora Sandstone which forms the summits of the mountains that surround the valley. The older units, up through the Ordovician Trenton Group, consist mainly of dolomites with subordinate formations and members of limestone. The younger units, the Ordovician Reedsville Shale, Oswego Sandstone and the Juniata Formation, consist of shale and sandstone.....

STRUCTURES

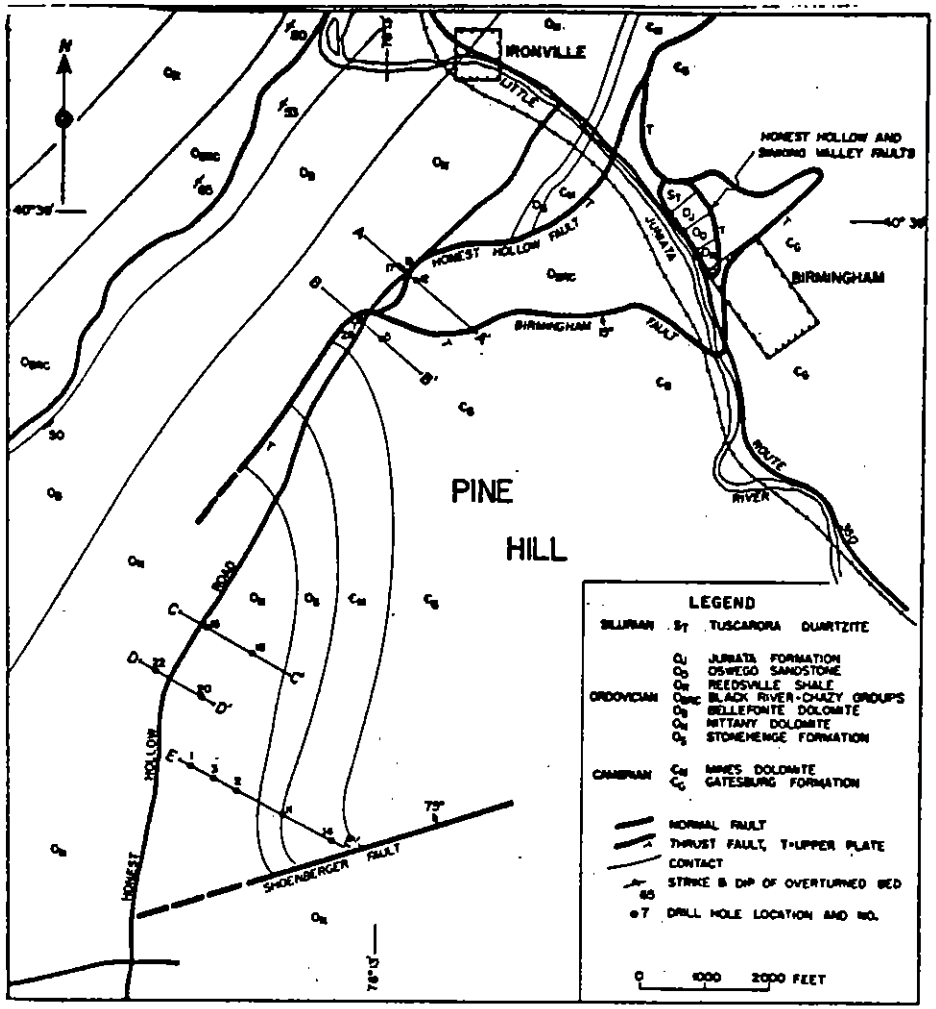
Butts et al. (1939, p. 75-78) point out that the area is located on the summit and flanks of the Nittany Arch, which is an anticlinorium extending for more than

80 miles northwestward. (See Route Map 2.) In cross section the arched form is modified by faults and minor undulation superposed on the major structures. The Sinking Valley Anticline represents the southwest extremity of the apex of the Arch. It is asymmetrical, overturned to the northwest. It is complicated by faulting along its axis where the Birmingham fault thrusts older formations to the northwest. The exposures of younger rocks at Birmingham and at the Knarr fenster, a little more than a mile northeast of Birmingham, indicate that additional faulting of considerable magnitude took place, but as Butts et al (1939, p. 78) stated, ".... no satisfactory explanation of the entire situation has yet been reached."

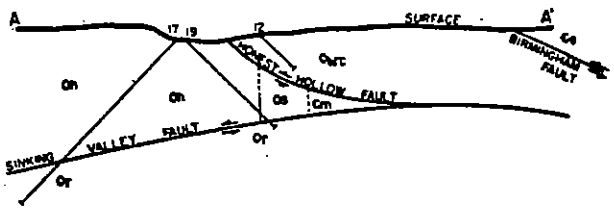
ANALYSIS OF DRILLING INFORMATION

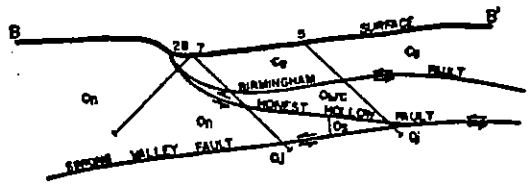
A series of exploration holes drilled west and southwest of Birmingham in 1956 provided information revealing the existence of a gently arched fault under the area (Fig. 4), which the authors named the Sinking Valley Fault. Eight holes reached sufficient depth to penetrate the fault, which is evidenced by abundant fracturing and recementation, grooving, polishing, and abrupt change in stratigraphy. Each hole cored black shale or red and green sandstone and shale under the fault in contact with Nittany dolomite or Stonehenge limestone above. The rocks cored under the fault have been tentatively identified as Reedsville shale and Juniata Formation on the basis of color and composition. These rocks correspond to the two formations observed in the Birmingham exposures, which have been identified by Butts, Zeller, and others as Reedsville and Juniata.

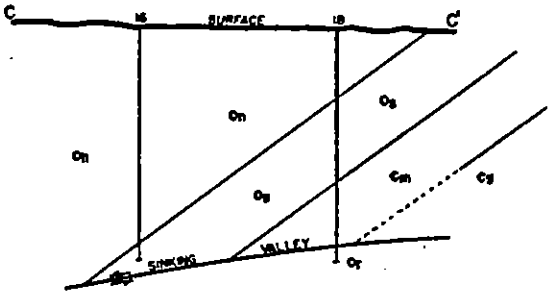
Recognition of the Sinking Valley Fault permits a relatively simple explanation for the presence of the younger rocks in the Birmingham area. The two exposures are fensters through an upwarped thrust fault which has an axis nearly coincident with that of the Sinking Valley Anticline. A net displacement of 2 miles on the Sinking Valley Fault would account for the position of the Tuscarora in the fenster relative to the Tuscarora of the upper block northwest at Brush Mountain. The other thrusts are lesser southeast-dipping branches of the main break. The Birmingham Fault has relatively little displacement and can logically die out to the southwest as mapped by Butts et al. (1939, p. 78). The slice under the Birmingham Fault, consisting largely of brecciated limestone, is probably the Black River-Chazy sequence, or possibly Stonehenge, in a horse dragged

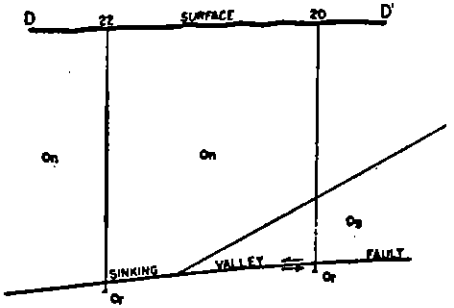


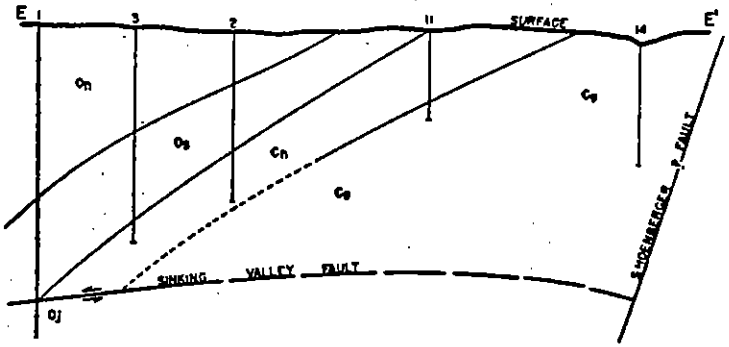
GEOLOGIC MAP OF SINKING VALLEY SHOWING DIAMOND-DRILL-HOLE LOCATIONS











1-300 FT.-1

DIAMOND-DRILL-HOLE SECTIONS SHOWING STRUCTURE AT SINKING VALLEY, PENNSYLVANIA

STOP III

Taken from figures 6 & 7 in Moebs and Hoy (G.S.A. Bulletin; 1959; Vol. 70; PP. 1085-86)

Figure 4

along between the Birmingham and the lower branch-fault, which was recognized by Zeller (1949, M.S. thesis, Pa. State Univ., p. 19) and is here named the Honest Hollow Fault. This slice has been thrust between the Gatesburg above and the Mines, Stonehenge, and Nittany below. The relatively large volume of limestone in the slice compared to the narrow trace of the Black River-Chazy sequence against the fault requires either that another thicker limestone unit is involved (for example, the Stonehenge) or that the Black River-Chazy sequence was intercepted where the dip is more gentle than indicated on the sections. Little is known regarding the structure of the under block. The strike component of the thrust offset may be so large that a gently dipping part of the structure is present under the Sinking Valley Fault. Section A-A' (Fig. 4) illustrates the Sinking Valley Fault, below and the Honest Hollow Fault branching therefrom to the surface, overlain by the Black River-Chazy sequence, and, near A' the Birmingham Fault overlain by Gatesburg. Section B-B' is similar, except that it illustrates the manner in which the Black River-Chazy block pinches out where the Honest Hollow and Birmingham faults rejoin near the surface.

Comparison of sections shows that the trace of the Sinking Valley Fault becomes progressively deeper to the southwest, which indicates that the "arch" of the fault, like the axis of the anticline, plunges southwest. The fault also dips northwestward from the fensters without causing any recognized stratigraphic breaks; it must continue subsurface under the Bald Eagle Valley and, unless it steepens or dies out along bedding, under the Allegheny Plateau.

This type of fault, having no apparent surface expression except that of the accident of erosion at the fensters, is unusual but not unique, because Rodgers described (1950, p. 680) and illustrated (p. 678, Fig. 3) an almost identical fault in the Sequatchie Anticline area of Tennessee. He states:

> "If they are windows, they have been eroded through a thrust fault that disappears northwestward, its displacement having been taken up in the arching along the Sequatchie Anticline and the folds farther northwest."

Mileage

Hayes (1891, p. 141-152) was the first to describe low-angle thrust faults in the southern Appalachians of great lateral displacement with the fault surfaces commonly warped. Rodgers (1949, p. 1649) noted that faults such as Hayes described have been found in many parts of the southern and northern Appalachians, whereas in the folded middle Appalachians, where the structure is simpler, large low-angle faults have nowhere been recognized. Rodgers was notably perceptive when he stated:

> "....the faulted area on the Nittany Anticline at Birmingham, Pennsylvania,.... strongly suggests low-angle faulting to a geologist who has worked among the low-angle thrust faults of east Tennessee."

Sterns (1955, p. 620-625) describes a number of low-angle thrust faults in the Cumberland Plateau of Tennessee. These differ from the Sinking Valley Fault in that they commonly show a low angle of faulting relative to bedding, and the beds above the fault planes are characteristically crushed, whereas at the Birmingham fenster the rocks below, as well as above, the Sinking Valley Fault are intensely crushed and thinned, and the angle of faulting relative to the bedding is large.....

104.1 0.2 Junction again with Pa. 350 (south). Stop. Exposure ahead, starting at 10 o'clock, is an overturned sequence from Silurian Tuscarora sandstone through the Upper Ordovician Juniata and Oswego, to the Reedsville shale. (This is in the over-ridden block).

TURN RIGHT and proceed on Pa. 350 (south).

104.7 0.6 Pull off highway to left and park on berm. Follow group leader to observe Gatesburg crop in curve straight ahead. Please observe extreme CAUTION and remain off the highway. Heavy and high-speed traffic area.

STOP IV. Group Leader: Dick Frost, Shell Oil Company

The Middle and Upper Cambrian in the Tyrone Quadrangle are composed of four formations (Butts, 1939). From older to younger these are the Pleasant Hills Formation (thickness unknown), the Warrior dolomite (1200'), the Gatesburg dolomite (1750'), and the Mines dolomite (250').

Mileage

The upper 1000 feet of the Gatesburg dolomite crops out in this exposure on the east flank of the Sinking Valley Anticline. (See Wagner paper, Fig. 1, sec. 3, page 4.

The lower part of the outcrop is composed of cyclic sequences of partly cross-bedded quartz sandstone, sparry oolite, and extremely fine-grained stromatolitic dolomite (dolomitized lime mud). A depositional environment of shallow water and the presence of currents are indicated by the sandstone and oolite; shallow water or subaerial exposure are suggested by the presence of intraformational conglomerates, stromatolites, burrowing, and mud cracks.

Overlying this unit is an interval of very fine to fine-grained dolomite containing some surface porosity. It is massive, lacks sedimentary structures, contains questionable relicts of shells, pellets, and ooliths.

The upper third of the outcrop is again interbedded sandstone, oolite, and dolomitized mud, containing shallow water sedimentary features.

105.3 0.6 Top of Gatesburg dolomite.

105.5 0.2 Basal Nittany dolomite is exposed in road-cut.

105.7 0.2 Pull off highway to right and park on road shoulder. Follow group leader to observe continuous section through Lower Ordovician Nittany dolomite, Bellefonte dolomite, and Middle Ordovician limestones to Reedsville shale. Please observe extreme CAUTION and remain off the highway. Heavy and high-speed traffic area. Buses will proceed ahead and pick up group at end of section.

STOP V. Group Leader: Dick Frost, Shell Oil Company

The Beekmantown in the Tyrone Quadrangle (Butts, 1939) is made up (from older to younger) of the Stonehenge limestone tongue (400'), the Nittany dolomite (1250'), the Axemann limestone tongue (0-200'), and the Bellefonte dolomite (1500'). It is overlain by about 1200' of Middle Ordovician limestones which have a complex nomenclature.

We will start at the base of the Nittany and walk up through a monotonous 3800' section of lithified carbonate mud. The main visible difference between the Nittany

Mileage

and the Bellefonte is a small change in grain size--the Nittany having a slightly less fine texture, on the average, than the Bellefonte. The lower half of the Nittany is extremely fine-grained dolomite (dolomitized lime mud), with interbeds of darker colored very fine to fine-grained dolomite containing relicts of pellets and shells. The frequency of these latter beds decreases upwards, and the upper half has an increasing amount of extremely fine-grained to sublithographic, featureless dolomite. Burrowed layers, occasional stromatolites, and clast zones indicate shallow water deposition.

The Bellefonte is composed of the extremely fine-grained to sublithographic dolomite with only rare interbeds of the larger-grained type. Several hundred feet at the top consist of light-colored sublithographic dolomite with conchoidal fracture. Sedimentary features are hard to find in this outcrop because of its freshness, and are more evident on weathered exposures elsewhere in the general area. Shallow water deposition is indicated by occasional stromatolites, clast zones, and mud cracks.

The contact of the Bellefonte and the Middle Ordovician is placed at the change from dolomite to limestone. In this exposure the change is gradational, and a bentonite bed is present at the approximate contact. Several weathered layers with a total of 10 to 15 feet of vuggy porosity are present in the upper 100 feet of the Bellefonte.

The lower 700 feet (Chazy-Black River) of the Middle Ordovician consist mainly of gray to light tan, sublithographic lithified lime mud, with common layers of fossiliferous intraformational conglomerate. There are several bentonite beds near the top of this unit.

The upper 400 feet (Trenton) are composed of dark gray, sublithographic to extremely fine-grained lithified lime mud. The limestones are thin-bedded, the lower half being featureless, the upper half containing shell fragments and an occasional intraformational conglomerate. Shale interbeds increase near the top, and the contact with the Reedsville shale is at the southeast end of the outcrop.

106.9 1.2 End of divided portion of highway.

107.4 0.5 TURN LEFT on unnumbered road.

Mileage		
107.7	0.3	TURN RIGHT - route is in Reedsville shale on axis of Scotch Valley Syncline.
107.9	0.2	Middle Ordovician limestone exposed here is on east flank of Scotch Valley Syncline.
108.2	0.3	Village of Union Furnace; BEAR LEFT (at road fork) toward Spruce Creek.
108.4	0.2	Lower Ordovician Bellefonte dolomite on west flank of the minor south-plunging anticlinal nose which was seen earlier (at "mile 99").
109.2	0.8	Approximate axis of the unnamed anticline - in Bellefonte dolomite.
109.4	0.2	Bellefonte dolomite crop at 3 o'clock.
109.6	0.2	Railroad underpass. Crossing through an imbricate zone of the Yellow Spring Thrust Fault -- Nittany dolomite on east thrust over Bellefonte dolomite on west.
109.8	0.2	Junction; stop, and then continue STRAIGHT AHEAD on Pa. 45 (north), crossing the second zone of the Yellow Spring Thrust Fault -- Stonehenge limestone is thrust to the west over Nittany dolomite.
109.9	0.1	Nittany dolomite outcrop.
110.1	0.2	Entering village of Spruce Creek. Caution, sharp left turn onto narrow bridge over Little Juniata River; continue on Pa. 45 (north) travelling in Nittany dolomite.
110.7	0.6	Nittany dolomite is in road-cut at 9 o'clock.
111.3	0.6	Crossing Water Street Fault (normal); we cross from Nittany dolomite to Reedsville shale (down to the east).
112.2	0.9	Middle Ordovician limestone crops at 9 o'clock.

Coleraine Forges

Nearby are sites of two forges, built in 1805 and 1809 by Samuel Marshall. "Juniata iron" became famous as a high-grade of "charcoal iron" during the era from 1790 to 1850. Spruce Creek was noted for its iron works.

Mileage		
112.9	0.7	Middle Ordovician limestone quarry at 9 o'clock. Southeast dip on flank of Pennsylvania Furnace Anticline.
113.5	0.6	Bridge over Warriorsmark Creek; road parallels Spruce Creek.
113.7	0.2	Ridge on the skyline at 2 o'clock is one formed by the Tuscarora; lower secondary ridge is Oswego-supported. The Tuscarora dips to the southeast into the topographically high Barree Syncline. Route continues in Middle Ordovician limestone.
114.3	0.6	Entering village of Franklinville. Indian Cavern at 3 o'clock. The cave is developed along bedding planes and parallel joints at right angles to the bedding in Middle Ordovician Trenton limestone. Bedding dips 40^{o} to the southeast.
115.3	1.0	Contact of Middle Ordovician limestones with Bellefonte dolomite.
115.6	0.3	Seven Stars Junction. TURN LEFT around traffic island and continue on unnumbered country road toward Warriorsmark. Route passes over poor outcrop area of Bellefonte dolomite, Axemann limestone and Nittany dolomite on the southeast flank of the Pennsylvania Furnace Anticline.
116.5	0.9	Approximate axis of southwest-plunging Pennsylvania Furnace Anticline - in Nittany dolomite.
116.9	0.4	Crossing the Grazier Mill fault complex; we cross from Nittany dolomite to a slice of Middle Cambrian Pleasant Hill limestone which is caught in a horst.
117.0	0.1	Upper Cambrian Gatesburg dolomite - to the west of the horst block.
117.5	0.5	Approximate southern termination of the Gatesburg Anticline and the Marengo Syncline. We are still in Gatesburg dolomite.
118.1	0.6	Gatesburg outcrops in road-cut at 9 o'clock.
118.8	0.7	Pull off highway to right and park on shoulder. Follow group leader to observe a partial section of the Upper Cambrian Warrior dolomite exposed along the crest of Sinking Valley Anticline. Exposures are in road-cuts at right of road.

Mileage

STOP VI. Group Leader: Dick Frost, Shell Oil Company

The Warrior is about 1200 feet thick (Butts, 1939). The top 500 feet are exposed in this outcrop. These rocks were deposited in an environment of shallow water that may, at times have been subaerially exposed, and they are composed mainly of extremely fine-grained, dark gray dolomite (dolomitized lime mud). Cyclic interbeds of quartz, sandstone, oolite, and extremely fine-grained algal dolomite are present in the lower part of the exposure. Stromatolites and intraformational conglomerate are common, with occasional burrowings, mud cracks, thin layers of dark gray shale, and some lithified lime mud.

119.0 0.2 TURN LEFT on old highway and make a U-turn. Return to Pa. 45 (east) at Seven Stars Junction.

122.5 3.5 Seven Stars Junction "stop sign". TURN LEFT on Pa. 45 (east) heading toward State College. In Bellefonte dolomite. Road parallels the strike (here in the Beekmantown Group) on the east flank of Pennsylvania Furnace Anticline.

125.8 3.3 Southeast-dipping Nittany dolomite in road-cuts on both sides of the route.

126.2 0.4 Entering village of Graysville. Lower Ordovician Stonehenge "ribboned" limestone is exposed in road-cuts on both sides of highway.

The Stonehenge is a limestone tongue which thickens toward the east and southeast, and is correlated with the Stonehenge of the Great Valley. It is derived from lithographic to sublithographic lime mud, deposited in shallow water with subaerial exposure, and contains abundant flat pebble conglomerate, stromatolites, fossiliferous layers, and occasional mud cracks. Laminations and thin beds of buff-weathering dolomite give it a characteristic banded or ribbon-like appearance. Toward the southwest it changes, becoming a fine to medium-grained dolomite called "Larke". (See Wagner paper, Fig. 2, page 6.

127.0 0.8 Stonehenge-Nittany contact. Route continues in Nittany dolomite.

128.1 1.1 Junction to village of Pennsylvania Furnace.

Mileage		Pennsylvania Furnace
		Some of the remaining buildings here were part of the ironworks established about 1810. Operating first as a charcoal iron "manufactory", the furnace later used coke. Iron was made here as late as 1888.
128.8	0.7	In southeast-dipping Bellefonte dolomite.
130.5	1.7	Bellefonte dolomite.
131.1	0.6	Route continues across typical Beekmantown "no-crop" area (in Nittany dolomite). Mountain at 3 o'clock is Tussey Mountain, a Tuscarora ridge; secondary ridge is supported by Ordovician Oswego sandstone and Juniata Formation.
132.1	1.0	Middle Ordovician Black River-Chazy limestone interval.
134.7	2.6	Entering the village of Pine Grove Mills. Continue on Pa. 45 (east). In Black River-Chazy limestone.
135.6	0.9	Approximate contact of Middle Ordovician Black River-Chazy limestone with Lower Ordovician Bellefonte dolomite.
136.4	0.8	Junction Pa. 45 and Pa. 26 (north). TURN LEFT and continue on Pa. 26. Route proceeds up southeast flank of Penn Valley Anticline in Bellefonte dolomite.
136.6	0.2	Bellefonte-Axemann contact.
136.8	0.2	Axemann-Nittany contact.
137.5	0.7	Approximate axis of Penn Valley Anticline, in Nittany dolomite.
138.0	0.5	Approximate axis of Nittany Mountain Syncline, in Nittany dolomite. Route continues up the southeast flank of the northeast plunging Pennsylvania Furnace Anticline.
138.5	0.5	Continue on Pa. 26 (north). Route parallels strike in the Nittany dolomite. Nittany Mountain Syncline at 3 o'clock, Pennsylvania Furnace Anticline at 9 o'clock.
139.5	1.0	Entering Borough of State College. Continue straight through town to intersection with South Garner Street.

Mileage		
141.0	1.5	Intersection with South Garner Street. TURN LEFT onto Pennsylvania State University campus. Continue straight ahead to stop sign in front of McElwain Hall.
141.3	0.3	TURN RIGHT and proceed to Pollock Hall. You'll be sleeping on Nittany tonight.

END OF FIRST DAY'S TRIP