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Applied Geology in the Central Hundson Valley

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Trip 17

APPLIED GEOLOGY IN THE CENTRAL HUDSON VALLEY

Road Log

by

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Topographic maps (1:24 000) for the trip include:

Albany
Delmar
Ravena
Hudson North
Alcove
Leeds
Cementon
Saugerties
Kingston East

The chief purpose of this trip is to lay out the use of geology in the cement industry of the Hudson Valley, with the main emphasis on the quarry of the Hudson Cement Company at East Kingston. This is geologically the most complex of the New York cement operations and a program of continuing geologic control has been in effect since 1961. The road log will indicate the stratigraphy passed as the bus travels the New York State Thruway, although no stops can be made. Economic use of the various stratigraphic units will be emphasized.

Miles

0.0 Leave Thruway Hyatt House; turn right on Washington Avenue. Building complex on left is the new Albany Campus of the State University of New York, designed by Edward Durell Stone. Abundant use has been made of white cement (not a product of the Hudson Valley) and architectural aggregate, both in pre-cast panels and in cast-in-place concrete. Test borings at the campus site showed over 200 feet of clay.

Miles

0.9 Turn right on Fuller Road and follow signs to Thruway. The pine covered hills are sand dunes above the glacial Lake Albany Plain. Some dunes have crude barchan forms with the barbs to the west.

2.1 Enter New York Thruway. Bear left toward New York City. In the few short years since the Lake Albany beds were laid down, the area has been deeply dissected. The thick clays (up to 300 feet) of the lake bed are unstable in some of these valleys (or "kills," to use the Dutch word seen so often in this area) and landslides have been a problem. To the right can be seen the Helderberg Escarpment, the low ridge of Devonian limestone, and behind it the Catskill Mountains.

12.2 (138.6 on Thruway markers) East side. Road cut with Ordovician shales (Normanskill formation).

15.1 (135.7 on Thruway markers) Road cut with interbedded shale and graywacke of Normanskill formation.

Occasionally, operations can be seen along the Thruway or the Northway where Albany Molding Sand is removed. This is a dying business which once flourished from Kingston to Glens Falls. The sod is carefully removed to expose a thin (2 feet or so) layer of quartz sand bonded by clay. After removal of the commercial molding sand, the sod is replaced.

18.7 (132.0 on Thruway markers) To the west can be seen the plant of the Atlantic Cement Company. Below the bridge is the covered conveyor belt which carries the finished product from the plant site to the dock on the Hudson River. Geologists were involved in the search for suitable stone, in the selection of the plant site and the conveyor route, and in choosing the optimum location for the loading dock so as to meet engineering requirements without positioning over expensive brick clay reserves. The initial investment here was $44,000,000. Production comes from the Manlius, Coeymans, Kalkberg, Becraft and Esopus formations along the Helderberg escarpment west of the plant. The beds lie in gently-dipping folds cut by flat thrust faults which offset the beds as much as 10 feet.

21.8 (128.9 on Thruway markers) Road cut in Normanskill graywacke. To the west is the Hudson River Concrete Products plant. The raw materials for the concrete blocks are crushed Kalkberg limestone from a quarry about one mile to the southwest, local sand and cement Along the Hudson River, a string of brick plants grew up utilizing the Lake Albany clays. At one time there were 129 producers from Westchester County to Glens Falls. Now only a handful survive.

Miles

23.8 (126.9 on Thruway markers) New Baltimore Service Area. Geologists for the New York State Department of Transportation were given the assignment recently of augmenting the water supply, not an easy job in an area where the surface materials are deep clays and the bedrock is shale. A suitable well was found on the east side of the highway and a tunnel had to be constructed under the road bed.

27.4 (123.7 on Thruway markers) As the road rises to the south, we will pass from the Normanskill to the Helderberg group.

29.1 (122.0 on Thruway markers) East side: Lower Hannacroix member of Kalkberg formation; note black chert bands. West side: long cut contains all units from Manlius through New Scotland in a very complex structure.

30.5 (120.6 on Thruway markers) Kalkberg formation .

30.8 (120.3 on Thurway markers) New Scotland formation.

31.0 (120.1 on Thruway markers) Becraft formation.

31.9 (119.2 on Thruway markers) Esopus formation. Note the difference in weathering response between the clean Becraft limestone road cuts and the highly fragmented Esopus shale cuts. The latter indicates a high sensitivity to wet-dry or freeze-thaw alternations. A breakdown of the fine material at the base of a cut is an almost certain indication that the rock is unsuitable for use as crushed stone.

32.2 (118.9 on Thruway markers) Becraft formation, steeply dipping.

32.7 (118.4 on Thruway markers) New Scotland through Becraft.

33.0 (118.1 on Thruway markers) Esopus formation.

33.4 (117.7 on Thruway markers) Schoharie and Esopus formations.

34.1 (117.0 on Thruway markers) Onondaga formation. Note chert layers.

34.7 (116.4 on Thruway markers) Highly fractured Becraft. These calcite-healed fractures suggest nearness to a thrust fault.

35.1 (116.0 on Thruway markers) Note long, north-south lake on right. Structure and stratigraphy suggest the lake marks the position of a thrust fault, a common occurrence in this area.

Miles	
37.3	(113.8 on Thruway markers) East side. Note New Scotland faulted onto New Scotland.
37.4	(113.7 on Thruway markers) Becraft above New Scotland. The bridge crosses Austin Glen, the type locality of the Austin Glen member of the Normanskill formation.
38.2	(112.9 on Thruway markers) Esopus below Schoharie.
39.2	(111.9 on Thruway markers) Schoharie. The cut in the median strip is synclinal.
39.6	(111.5 on Thruway markers) Esopus-Schoharie-Onondaga.
41.0	(110.1 on Thruway markers) Schoharie-Onondaga.
41.3	(109.8 on Thruway markers) Cut east of Thruway. Esopus with lowest portion high in bedded chert.
42.0	(109.1 on Thruway markers) Esopus below, Schoharie above with broad transition zone.
43.1	(108.0 on Thruway markers) To east of Thruway lie three cement plants clustered in the beds of the Helderberg group. South to north they are: The Alpha Portland Cement Company; The Lehigh Portland Cement Company; and the Marquette Cement Manufacturing Company
47.3	(103.8 on Thruway markers) Port Ewen formation above Becraft. Note the large blocks that break loose from the face of the road cut. These are known to engineering geologists as wedge failures. These bedding plane and joint intersection problems have largely been eliminated by pre-split blasting of the final face. We will see this at a later stop.
48.8	(102.5 on Thruway markers) Prepare to leave Thruway.
49.5	(101.6 on Thruway markers) Leave Thruway at Exit 20.
49.6	Turn left (south) on Route 32.
49.8	Turn left (east) on Routes 32 and 212.
50.1	Turn right at sign pointing to Mt. Marion. Follow south on county road parallel to Thruway.
50.5	Onondaga formation.

Miles

51.6 Note historic house on east side. Many stone houses can be seen in this area. Formations used for such construction include Becraft, Onondaga and New Scotland as well as middle and upper Devonian graywackes from the Catskills.

52.5 East side. Plant of Hudson Lightweight Aggregate Corporation. Esopus siltstone is quarried in the ridge to the east. Note the twin rotary kiln and cascading slag. Another lightweight aggregate quarry will be visited later in the day.

53.7 Turn left (east) at cross road.

54.1 Road cuts in Esopus. Note the cedar growth on the Esopus. This gives a rough suggestion of underlying rock type where outcrops are lacking.

55.1 Turn right (south) on Route 9W.

55.8 East side. Glenerie limestone.

56.3 West side. Glenerie Falls of Esopus Creek.

56.9 East side. Dip slope of Glenerie limestone.

57.2 East side. Note mushroom plant. The mushroom growing industry once used the abandoned natural cement underground mines because of their constant temperature, darkness and low initial construction expense. Current production is carried out in specially constructed buildings which enable lower labor costs. One former cement mine (near Rosendale) is used for storage of records, sent chiefly from various company offices in New York City.

59.6 Turn right at the second of the two right turns of the clover leaf toward Rhinecliff Bridge on Route 199 going east.

60.1 Long road cut. First rock is Schoharie, followed by Esopus. Note that all of these cuts have the typical smooth face and closely-spaced drill holes of the pre-split blasting method. In the campaign to adapt the method to New York conditions a prominent role was played by New York Department of Transportation geologists.

60.4 Note long north-south lakes, probably developed along eroded thrust faults.

60.6 Port Ewen, Alsen, and Becraft formations in an anticline.

Miles

Miles	
60.8	Sequence: New Scotland, Kalkberg, Coeymans, Manlius. The scarp face on the east marks the end of the Helderberg beds.
61.1	Turn right toward Route 32.
61.2	Turn left (south) on Route 32.
61.5	West side. Contact of Rondout above the Normanskill. This is the major unconformity of the area and is probably a detachment fault.
61.6	STOP 1. (71.50 N - 59.82 E; Kingston East Quadrangle) Road cut on Route 32. 2,000 feet south of intersection of Routes 32 and 199 Time enough will be spent here for familiarization with the units from the Normanskill through the Kalkberg, so that they may be recognized from a distance in the quarry. Note well-marked east-dipping thrust faults and poorly-marked west-dipping thrust faults. Stromatoporids are uncommonly abundant in the Manlius formation.
62.2	West side. Note old vertical kiln used to burn Manlius for lime.
62.3	Turn left on road to East Kingston.
62.4	On west can be seen portals and airways of an old natural cement mine. Here the Whiteport member of the Rondout was mined. This is the northernmost of the many natural cement mines that flourishe from here to beyond Rosendale. Of the dozens of onetime operatio only the Century Cement Company still operates in the belt. Both the Whiteport and the Rosendale members were utilized by the vario s companies.
63.0	Turn left on John Street.
63.4	Approaching the Hudson Cement plant. On the left is the site of ar old brick plant which has been completely removed to make way for the cement facility. The red brick barns on the west of the road are all that remain; they are typical examples of the soft mud brick made in the valley.
63.8	STOP 2. (70.92 N - 60.00 E) Offices of the Hudson Cement Corporation, River Street, Kingston, New York. This is the most complex quarry in the valley, both because of geologic complicatios and because of the multiple products. Consequently, geologic control has been vital since the early days of operation. The highly folded (even overturned) beds and the abundant thrust faults, many of which are folded, combine to present the operators with ever-changing conditions. To the geologist they present an unparalleled opportunity to study thin-skin tectonics.

Stratigraphy

All units from the Normanskill through the Esopus can be seen, and of these only the Normanskill, the Connelly and the Glenerie are not currently utilized. In general, crushed stone is produced from the Broncks Lake and the New Scotland units. Cement is produced from various combinations of Manlius, Coeymans, Hannacroix, Becraft, and Alsen units. Both products come from the same working faces, so there is a shovel control problem. At times the products are blasted separately and at times together, with the separation made by control of shovel limits within the pile of broken stone. Wherever possible, the rocks are worked so that the faces are normal to the strike. Because chemical analyses are known for each distinctive layer in the quarry, it is possible to know the analysis of a blast within working limits even though the beds may be inclined or faulted.

Structure

In portions of the property, the rock lies in as many as three thrust sheets, with varying dips in each. It is a rare face that does not have at least one fault, generally an east dipping thrust fault, but possibly a west dipping thrust fault or an expanded crest that is criss crossed by obscure flat faults. Although the style of folding is flexural slip, a suggestion of "expanded crests" can be seen in some folds. Folded thrusts are seen, as well as all orders of bedding plane faults. The relation of beds to faults changes as the face is carried in the strike direction, and a constant watch must be kept on the analysis of rock being supplied to the cement plant. At Hudson the blast hole cuttings are not analyzed; instead the control is maintained by strike-quarrying and by matching production analyses with the sources. By having several faces available for shovelling, it is possible to change the mill feed by shifting to a face with higher carbonate, silica, or alumina analysis, whichever is needed.

Production

A special problem at Hudson arises from the fact that crushed stone, high analysis cement rock, and low analysis cement rock all must come from the same faces. They do not, however, occur in those faces in the same ratio as the plant requirements. This creates scheduling difficulties and in effect requires more working faces and longer haulages.

The associated lightweight aggregate plant utilizes Esopus siltstone, which comes from a separate quarry on the property.

Simply summarized, the geologist's job is to blend the geologic facts with the production requirements. He must know the quarrying methods and equipment, something of cement chemistry and production, and be familiar with the variations in the cement raw materials that do not come from his quarry. In this plant the latter are the pyrite "cinder," the coal, and gypsum. Above all, he must be able to communicate the geologic realities to the production staff.

END OF TRIP. Return to Thruway Hyatt House by way of New York Thruway.

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GENERALIZED STRATIGRAPHY OF THE MID-HUDSON VALLEY

With notes on economic uses

	Thickness	Lithology	Use
ONONDAGA FORMATION		Limestone with chert	
SCHOHARIE FORMATION		Limy shale	
ESOPUS FORMATION	150+	Shale and siltstone	Lightweight aggregate
GLENERIE FORMATION	25 ?	Limestone	Crushed stone
CONNELLY FORMATION	10	Conglomerate, sandstone	Crushed stone
PORT EWEN FORMATION	100	Argillaceous limestone	Crushed stone
ALSEN FORMATION	20	Limestone	Cement rock
BECRAFT FORMATION	50	Limestone	Cement rock
NEW SCOTLAND FORMATION	110	Argillaceous limestone	Crushed stone
KALKBERG FORMATION			
Broncks Lake Member			
Upper Broncks Lake	27	Silty limestone	Crushed stone
Lower Broncks Lake	15	Silty limestone	Crushed stone
Hannacroix Member			
Upper Hannacroix	11	Silty limestone	Crushed stone
Lower Hannacroix	17	Cherty limestone	Crushed stone
COEYMANS FORMATION			
Ravena Member	17	Limestone	High analysis cement rock
MANLIUS FORMATION			
Thacher Member			
M6	6	Magnesian limestone	"
M5	2	Magnesian limestone	"
M4	7	Limestone	"
M3	25	Limestone	"
M2	9	Magnesian limestone	
M1	5	Limestone	
RONDOUT FORMATION			
Whiteport Member	8	Dolomitic limestone	Natural cement
Glasco Member	10	Limestone	
Rosendale Member	5	Dolomitic limestone	Natural cement
Wilbur Member	14	Limestone	