PALEOZOIC INLIER OF THE PEEKSKILL VALLEY

S. Schaffel
The City College

Trip 1-A, 1-B and 1-E

Introduction

The problem involved in the area covered by this trip is a stratigraphic-structural one. Portions of two valleys and a ridge which occur north of Peekskill comprise the problem area, (see Plate 13).

Peekskill Hollow, the southernmost valley is approximately 1/2 mile wide and trends in a northeasterly direction from the Hudson River for a length of 5 1/2 miles. Canopus Creek (formerly Sprout Brook) Valley trends in a north-northeast direction, is narrower but has a length equal to that of Peekskill Hollow. The two valleys are separated by Gallows Hill. Intersection of the two divergent directions of these two lows occurs at the Hudson River. The stream pattern is that of the letter "V" with the apex (developed as an inlet) pointing at the Hudson. The two lows as well as the central high are unquestionably an expression of the resistance of the lithologic units underlying the topography.

Lithology (in chronological sequence)

Highlands Gneisses:

There are many varieties of igneous and metamorphic rocks found within and composing the Hudson Highlands. This large group of Pre-Cambrian rocks is placed under the general heading of Highlands Complex. The reader is directed to the description of Trip D for treatment of these rocks.

Poughquag Quartzite:

The exposure seen on this trip (Stop 1-1) can be considered typical. The formation is up to 600 feet thick in this valley representing the maximum found in the region.

The rock is a dense, hard, fine to medium grained quartzite. Normal color ranges from white to tan and brown to red. The latter colors depend upon the concentration of limonite or hematite. Elsewhere in the Highlands and in the Paleozoic Great Valley to the north, other variations of this rock occur. A feldspathic type is commonly found as the basal member. Conglomeratic facies with distinctive blue pebbles have been reported.

The Poughquag is generally considered lower Cambrian in age. The formation unconformably overlies the Highlands crystallines and is in conformable contact with the Wappinger limestone above.

Wappinger Limestone:

The rock ranges in color from white to gray. Fresh exposures exhibit a bluish cast. Pure white and black colored members, although present, are rarely encountered. Grain size varies from fine to medium. Clay, silt and sand impurities generally determine the color. The amount of darkening is directly proportional to the impurities. The formation is sufficiently rich in magnesia locally to be called a dolomite.

At Peekskill the rock is massive in appearance and strata (where not deformed) range from two or three inches to approximately 18 inches in thickness. The only primary structures which can be observed are bedding planes. Fossils which are common in this limestone elsewhere have not been reported from this locality.

Intercalated shale and sandstone facies are found in this formation. These are not prominent and the individual thickness of the beds is quite small. At times, the Wappinger is sufficiently rich in impurities so that it can be described as a shaly or sandy limestone.

Although the apparent thickness of the Wappinger in Peekskill Hollow is on the order of 3000 + feet, it is the result of repetition of beds. The true thickness is normally taken as approximately 1000 feet in this region.

The Wappinger conformably overlies the Poughquag quartzite and is Cambro-Ordovician in age. It is conformably overlain by the Annsville phyllite (Hudson River pelite group).

Annsville Phyllite:

Gallows Hill lying between Peekskill Hollow and Canopus Greek Valley has been carved out of this formation (Stop 1-2).

The rock is generally dark bluish gray although it may be black upon rare occasions. Weathered pyrite crystals very often cause limonitic staining. Essential minerals appear to be simply muscovite and quartz as seen in thin section. Megascopically, the rock is fine-textured with the characteristic sheen on freshly broken foliated undulatory cleavage surfaces. Intercalated, discontinuous, augen-like stringers of quartz are common, probably representing thin sandy beds in the original shale. Ptygmatic folds as a consequence of plastic deformation of these beds can be observed. Original bedding planes appear to have been obliterated by metamorphism.

The true thickness of the formation at this location is uncertain, because the extent of isoclinal folding (which is undoubtedly present) is not known.

The Annsville phyllite is Cambro-Ordovician in age and conformably overlies the Wappinger limestone. It is the youngest rock unit of Paleozoic age preserved in the Peekskill valley.

Structure and Stratigraphy

Faults:

One major longitudinal and several cross faults have been mapped in the Peekskill valley (Berkey, 1919). Although the longitudinal fault is roughly parallel to the principal thrust faults in the Hudson Highlands to the north, it is a normal fault (Plate 2). It represents the continuation of the border fault southwest of the Hudson River where it separates the sedimentary red beds of the Triassic basin from the Pre-Cambrian crystallines of the Hudson and New Jersey Highlands (Plate 13 and Trip C, Stop 6). The fault crosses the Hudson River between Tomkins Cove and Peekskill, passes along the northwestern border of Gallows Hill and finally crosses over into the Peekskill Hollow valley continuing northeastward into the Highlands crystallines. Indirect evidence of its presence in the form of a limestone flow breccia may be seen at Stop 1-5.

The longitudinal fault is displaced by a number of high-angle cross faults which divide the inlier into several blocks (Plate 13).

The age of faulting is not known, but cannot be older than middle Ordovician.

Folding:

The fundamental structure of the inlier is interpreted as a large, tight synclinal fold overturned to the northwest (Plate 2). Gallows Hill marks the center of this fold with the trace of its axial plane parallel to the ridge crest. The position of the slaty cleavage in the Annsville roadcut (Stop 1-2) indicates the attitude of the axial plane.

The fault pattern and folded structure of these Paleozoic units are believed to have developed at the same time. The Paleozoic rocks must have existed at a higher level within this area, possibly covering the Highlands crystallines completely (Trip C, Stop 7) and were infolded and infaulted into the Highlands basement during one of the Paleozoic orogenies (possibly the Taconic).

The Paleozoic inlier at Peekskill is a classic example of the preservation of the younger rocks within an older terrane.

Fossil Record

The occurrence of fossils in the Paleozoic inliers here and elsewhere in the Highlands is negligible. Bucher has reported the presence of cystoid plates in the limestone in Canopus Creek. The author collected Scolithus erectus from the Poughquag quartzite in the northern part of the Highlands.

There is, however a rather good fossil record from the Paleozoic rocks in the Great Valley north of the Highlands with which the rocks of the Peekskill inlier are correlated.

Pleistocene Deposits

During and/or following the retreat of the ice these two valleys were flooded and active sedimentation in the form of glacial-fluvial deposition occurred. Typical glacial delta deposits (Stop 1-2) may be found on flanks of the valleys where they have provided a source of sand and gravel for road construction.

The following are controversial topics which bear upon the stratigraphy and structure of this inlier.

Controversey #1

The Age of the Limestone in Canopus Creek Valley

Berkey + Rice (1919) indicated Grenville age for this limestone belt. They based their conclusion upon the highly flow-deformed nature of the rock and the presence of serpentine, diopside, and graphite in many of the exposures along Canopus Creek.

The author would like to enumerate several arugments which tend to disagree with this interpretation.

1) The occurrence of this belt of Grenville limestone must be unique, if its dimensions are considered. It is approximately six miles long and varies from 500 to almost 2000 feet in width. There is no example of another pre-Cambrian limestone unit of this size or one even remotely approaching these dimensions that has been recorded in the Highlands of New York or New Jersey.

2) The normal sequence of Paleozoic rocks indicate that the Wappinger limestone should occur on both sides of the phyllite of Gallows Hill as it does at Stop 1-4. This would fit the structural picture of a syncline.

3) A discontinous fault is indicated by Berkey along the length of the Grenville body. There is good evidence for the existence of this fault (Stop 1-5). If the Wappinger limestone occupied the Canopus Creek Valley and if it had been involved in a major fault movement, it is entirely likely that the unit would have acquired the structural and mineralogical characteristics observed in the field.

Bucher reexamined the problem and came to some new conclusions (Plate 2, Fig. B). He does not apply the name Wappinger to the limestone occurring in either valley. The term Early Ordovician dolomite-limestone series is given to that part of the Wappinger which lies directly above the Poughquag quartzite. He then designates the upper portion of the Wappinger as Trenton.

Subdivision of the Wappinger in the Poughkeepsie Quadrangle was made by Gordon (1911). He assigned the lower portion of the unit to the Upper Cambrian (Potsdam). Beekmantown and Trenton age were given for the remaining upper part.

Bucher believes that the Trenton portion of the limestone was deposited upon an ancient Early Ordovician erosion surface developed on the Highlands crystallines and the Poughquag in the general vicinity of the present Canopus Creek. The transgressive sea then deposited limestone directly upon this surface enclosing crystalline rock talus. He refers to the resulting rock as a sedimentary breccia. The speific example which he cites is a critical outcrop on route 9 at Stop 1-5. Here all the rocks older than the limestone occur as inclusions within the limestone. The brecciated material ranges from fine silt to coarse boulders in an intensely flow-deformed calcareous matrix. He agrees that the plastic deformation must have been the result of later compression.

The author believes that the rock at Stop 1-5 can more readily be explained as a flow breccia in a fault zone. Since the fault cuts across both Paleozoic and Pre-Cambrian rocks, fragments representative of the several types would be expected to be present.

<u>Controversey # 2</u>

<u>Correlation of the New York City Series (Manhattan-Inwood-Fordham formations) with the Cambro-Ordovician rocks (Poughquag-Wappinger-Hudson River Series)</u>

Several attempts have been made at this particular correlation. One of the latest is by Paige (1956). The reader is referred to Plate 3 which summarizes this work in the form of a geologic map and two cross-sections.

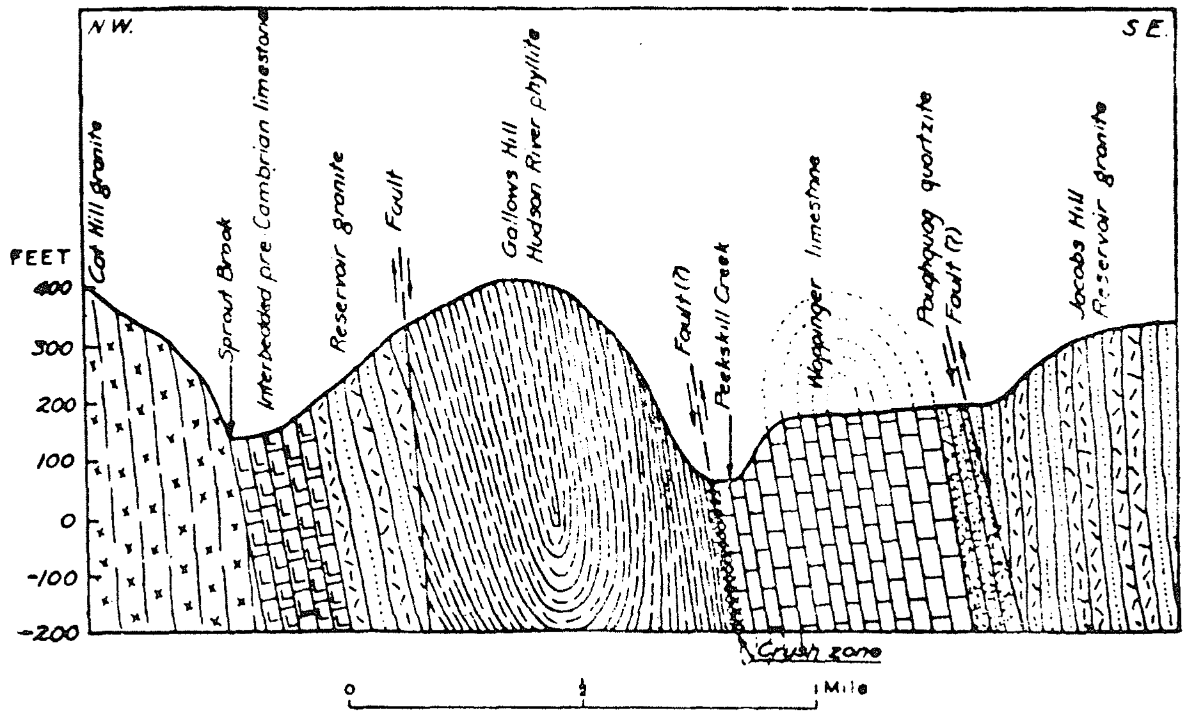

FIG. A PEEKSKILL HOLLOW SECTION
(AFTER C. P. BERKEY, 1933)

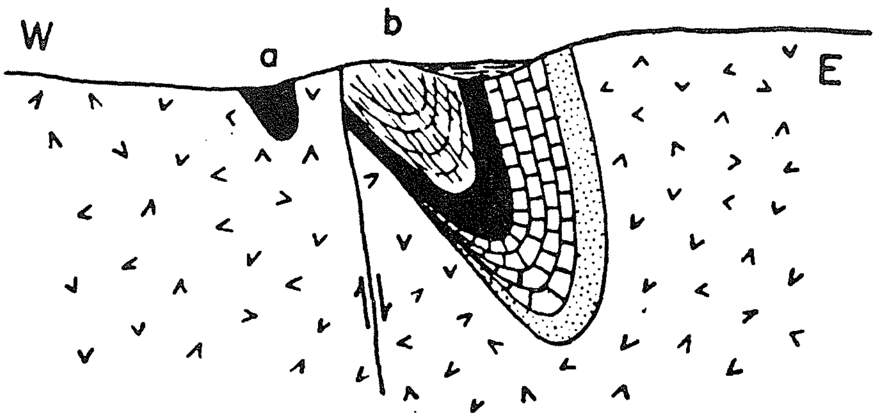

FIGURE B —DIAGRAMMATIC CROSS SECTION OF THE PALEOZOIC SEDIMENTS INFOLDED IN THE PRE-CAMBRIAN GNEISS NORTHWEST OF PEEKSKILL

Shows the westward overlap of the young Trentonian limestone and shales (eroded on left) onto the gneiss. At "a", US-9 roadcut, Stop 1-5 ; at "b", the Annsville cut. Poughquag ss., dotted; E-O dol.-ls. series, cross bars; Trenton ls., black; black sh. in center of syncline. (AFTER W. H. BUCHER, 1957)

Paige attempts this correlation between the Cambro-Ordovican sequence present in the inlier at Peeksill Hollow with the New York City Series at Verplanck Point. The Poughquag quartzite and Fordham gneiss are omitted from consideration. The series at Verplanck Point is then correlated with the Cambro-Ordovician Wappinger limestone at Tomkins Cove quarry on the west side of the Hudson River.

A single large anticline is indicated with the trace of its axial plane passing through Peekskill Hollow west of the Inwood Marble at Verplanck Point and thence to the Wappinger at Tomkins Cove. Compare discussion of this problem in connection with Trip 2 (Stop 2-3).

References

Berkey, C.P. (1911) Geology of the New York City (Catskill) aqueduct, N.Y. State Mus., Bull. 146.

______ and Rice, Marion (1919) Geology of the West Point quadrangle, N.Y. State Mus., Bull. 225-226.

______ and Colony, C.P. (1933) Structural geology between New York and Schunemunk Mountain, Int. Geol. Congress, guidebook No. 9, New York City and Vicinity, p 40-41.

Bucher, W.H. (1957) Taconic klippe: A stratigraphic-structural problem, Geol. Soc. Am., vol. 68, p 657-674.

Gordon, C. E. (1911) Geology of the Poughkeepsie quadrangle, N.Y. State Mus., Bull. 148.

Paige, Sidney (1956) Cambro-Ordovician age of the "Inwood" limestone and "Manhattan" schist near Peekskill, New York, Geol. Soc. Am., vol. 67, p 391-394.

PALEOZOIC INLIER OF THE PEEKSKILL VALLEY

Trips 1-A, 1-B and 1-E

Route Description

Mileage

0 Shustin's Locust Manor (headquarters) - left (N) on Locust Ave.

.9 left (SW) on Oregon Rd.

2.2 pass under Bear Mt. Pkwy.

2.3 right (W) on Pemart Ave.

2.5 park cars along Pemart Ave. near intersection with Highlands Ave.

STOP No. 1-1:

Walk right (N) on Highlands Ave. and right (E) on approach road to Bear Mt. Pkwy. (approx. 500 ft.). Outcrop of Poughquag quartzite (Cambro-Ordovician) in unconformable contact with Highlands gneiss (Pre-Cambrian). Dips of bedding and foliation are nearly vertical. This relation is considered typical of that between Paleozoic sediments and Pre-Cambrian crystallines along the southside of the Peekskill inlier.

2.5 right (N) on Highlands Ave. passing under Bear Mt. Pkwy.

2.9 right (NE) on Dogwood Rd. - park cars on lot along left (N) side of road.

STOP No. 1-2:

Southwest extension of Gallows Hill underlain by Annsville phyllite (Cambro-Ordovician Hudson River pelite group) and mantled by Pleistocene delta deposits. Interesting consolidation and solifluction structures have been collected at base of hill. Walk through US-9 roadcut following left (W) side of cut only. Take care to stay OFF roadway. Observe prominent slaty cleavage (axial plane type), diagonal shear planes, flow folding of quartzite bands and later quartz veins.

2.9 continue (NE) on Dogwood Rd.

3.9 right (SE) on Pump House Rd. crossing bridge over Peekskill Hollow Creek

4.0 park cars beyond bridge

STOP No. 1-3:

Wappinger limestone (Cambro-Ordovician) outcrops on north side of west abutment of bridge. Observe gradational contact with Annsville phyllite outcropping along steep west bank of creek. Specimens from this transition zone are identical with those from the Wappinger limestone outcrop at stop 1-4.

4.0 continue (SE) uphill on Pump House Rd.

4.2 left (NE) on Oregon Rd. (traffic light)

6.2 Putnam Valley - left (N) on Oscawanna Lake Rd. (traffic light at right side of road)

6.4 straight (N) at 2nd traffic light

6.6 park cars at right (E) - entrance to Putnam Valley Lodge

STOP No. 1-4:

Outcrops along left (W) side of road, Cambro-Ordovician sequence exposed from S to N (dipping east)

Annsville phyllite (approx. 100 ft.)

Wappinger limestone (10 - 15 ft.) is dark gray, fine-granular transition facies (same as in contact zone at Stop No. 1-3)

Poughquag quartzite, coarse granular (only a few inches exposed), in contact with granite pegmatite (Highlands crystallines). Is this an intrusive or unconformable contact?

Pre-Cambrian Highlands gneisses outcrop intermittently from this point northward.

Berkey (1919), on his geologic map of the West Point quadrangle
(1) shows the northern border fault of the Peekskill inlier passing between the Annsville phyllite and the Poughquag quartzite at this point;
(2) fails to indicate the presence of Wappinger limestone;
(3) indicates an unconformable contact between Poughquag quartzite and the Highlands crystallines.

This critical exposure does not yield clear evidence of faulting either within the sediments or between them and the crystallines. An orderly sequence of Cambro-Ordovician sediments appears to be present here lending support to the concept of the synclinal structure of the inlier (Plate 2). The much reduced thicknesses of the Poughquag and Wappinger support the interpretation of Bucher (1957) (Plate 2, Fig. B).

6.6 return (S) on the Oscawanna Lake Rd. through Putnam Valley

7.0 right (SW) on Oregon Rd.

9.0 pass Locust Ave. - continue on Oregon Rd.

10.3 pass under Bear Mt. Pkwy.

10.4 right (W) on Pemart Ave.

10.6 right (N) on Highlands Ave.

11.1 roadcut through Gallows Hill (earlier stop No. 1-2)

11.4 pass under US-9 and turn sharp left on approach road to US-9

11.5 straight (W) on US-9

11.9 park cars along right (N) side of road past roadcut and curve

STOP No. 1-5:

South side of roadcut shows Annsville phyllite and Highlands gneiss with intervening limestone flow breccia (relations are somewhat obscured by grading). Breccia appears to be tectonic and represents the continuation of highly deformed and metamorphosed marbles along Canopus Creek (to NE) called Grenville by Berkey (1919). Its stratigraphic position, however, makes its correlation with the Wappinger limestone a likely alternative. In that case, the Canopus Creek carbonate belt may be infolded and infaulted Cambro-Ordovician rather than Pre-Cambrian marble.

11.9 continue (SW) on US-9

12.4 left (SE) on US-6-202 crossing bridge to S-side of Peekskill Hollow Creek

12.7 left (NE) on Bear Mt. Pkwy.

15.6 leave Pkwy. at US-6 exit (right) turning left (NE) on US-6

15.9 left (N) on Locust Ave.

16.1 left at headquarters.