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Some Aspects of Conglomerates in the Taconics, Cossayuna Area, New York

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by

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I finished my mapping in the Cossayuna area a decade ago. When I returned this summer to look around for suitable stops for this guidebook, I found several aspects of the Taconic situation changed. When I started mapping, even the stratigraphic sequence was not certain. Certainly the status of the Taconic klippe was in doubt. Now, however, the sequence is well defined (Shumaker, 1967), and few doubt the existence of the klippe (Cady, 1968). Only the southern continuation of the allochthonous rocks remains to be established (Platt, 1962), although some progress is being made in this direction (Carswell, and others, 1968). Thus a tour to establish the stratigraphic sequence in this area seems uninteresting, in view of the remarkable progress made by Dale (1899).

My purpose in visiting these several outcrops in the Cossayuna area is to suggest a relation between the sedimentary and structural features and the paleotectonic setting during their formation. Two types of conglomeratic rocks will be examined, one within the allochthonous Taconic sequence, and one in the autochthonous shale west of the Taconic fault.

The Taconic sequence was deposited between a carbonate-quartzite sequence on the west flank of what is now the Green Mountains and a shaly and volcanic sequence on the east. The carbonate-quartzite sequence is approximately 5000 feet thick near the original home of the Taconic sequence (Thompson, 1967, p. 69), and the eugeosynclinal rocks on the other side are thicker (Skehan, 1961, p. 65-96). Yet the Taconic sequence is thinner than either of these, probably on the order of 3000 feet in the Cossayuna area. Why is it thinner?

Although various unconformities have been reported in the Taconic sequence, work of the last decade or so (Berry, 1959;Bird and Rasetti, 1968; Theokritoff, 1959) has been in the direction of removing the need for them and, in fact, encourages me to believe that the Taconic sequence is a comprehensive one. It extends from the Lower Cambrian, perhaps the Eocambrian, to the Middle Ordovician. As the number of fossil gaps was progressively reduced, the concept of a starved basin of deposition was considered. Another interpretation to emerge was that of a geanticline separating a basin of shale from a basin of carbonate deposition.

The interpretation that I favor is that the Taconic sequence was deposited on a slope sufficiently gentle and deep to permit the settling of clay-size material but sufficiently inclined to cause progressive sliding and slumping and general attenuation of the section. Evidence includes progressive eastward reduction in size of carbonate pebbles and in total carbonate, orientation and type of soft-sediment deformation features, western provenance of the carbonate in Lower Cambrian and Lower Ordovician rocks (stops 2 and 3) and of the quartz grains in the Upper Cambrian unit (stop 1). Thus during the Cambrian and Early Ordovician there was an eastward-facing slope between the carbonate bank and the shale area. This idea may have been put forward first by Bailey, and others (1928), and it seems supported on uniformitarian grounds by such recent data as that of Rona and Clay (1967) and Dickey, and others (1968), and on experimental grounds by Van der Knaap and Eijpe (1968).

The paleogeography during the late Middle Ordovician changed to an entirely different picture. The carbonate bank was covered by mud and then the Taconic slide came onto the mud. The mud and the Taconic slide came from the east, along with quite a variety of bits and pieces (Hawley, 1957; Ruedemann, 1930, p. 104-117; Zen, 1959, p. 8-9). Stops 5 and 6 examine some of these pieces.

Road log. Mileage cumulative from Saratoga turn-off, exit 14 on Interstate 87.

From motel go to Interstate 87 "Northway". Go on it approximately 30 miles to Saratoga. At 22 miles and thereafter roadcuts show the Middle Ordovician autochthonous shale. Take exit 14.

0.0 Keep right, joining NY Rte 9P north toward NY Rte 29. Even though the sign says you are going north on 9P and you know you are going west over the Interstate highway, this is the right way to go east to Schuylerville.

0.3 Turn right "to 29"

1.2 Stop sign. Turn right onto NY Rte 29 toward Schuylerville.

1.4 Pass under Interstate 87; now you are going east. Continue east on NY Rte 29 toward Schuylerville.

8.3 Pass through Grangerville as quickly as you can--observing the speed limit!

9.6 NY Rte 338 turns off to the right. Here note the view to the east. The near ground is underlain by autochthonous upper Middle Ordovician shale and Pleistocene deposits. The middle distance ridge line is underlain by Lower Cambrian shale and siltstone, part of the Taconic sequence which lies on the autochthonous shale. The high hills on the skyline are made of the high Taconic sequence, lithologically similar to the low Taconic sequence, but unfossiliferous because of higher metamorphic grade and a higher intensity of deformation.
Continue east on NY Rte 29.

10.3 Enter Schuylerville. The name reminds us of early Dutch influence here.

10.6 Meet NY Rte 4. Turn right onto "Broadway" keeping on Rte 29.

11.0 1st red light. Turn left with Rte 29 onto Ferry Street.

11.3 Hudson River, another Dutch name. We also here leave Saratoga County and enter Washington County, both names of historical interest.
Continue east on Rte 29.

13.9 Join NY Rte 40. Bear left.

14.2 Bridge over Batten Kill. To the left, under the trees, Lower Ordovician carbonate rests on Middle Ordovician shale, with the contact dipping east.

14.3 Bear half left. This back road has scattered along it several exposures of Bald Mountain Limestone, a unit with a long and involved history. The name, itself, has been in the literature for 125 years (Mather, 1843; Emmons, 1846). For further discussion of this unit, see Rodgers, this guidebook, stop 1.

15.9 Stop sign. Turn right.

16.2 Large dead elm is on the Taconic thrust. Exposed in the old orchard to the west is the parautochthonous Lower Ordovician Bald Mountain Limestone (not completely autochthonous because it is known to lie on the Martinsburg Shale just to the south at Middle Falls, yet not really allochthonous in the sense of far traveled because it is of the same general carbonate facies as rocks of equivalent age in the vicinity, thus parautochthonous or approximately in place). Immediately to the east is the Lower Cambrian Bomoseen Formation, seen in field exposures. The fault crosses this road three times in less than half a mile; thus here it is quite flat.

16.6 Stop sign. Intersect NY Rte 40. Turn left (north). View back into Hudson Valley from Taconic scarp.

16.7 Road cuts in Lower Cambrian Bomoseen.

17.0 On right, 9-foot dug well never ran dry until the road was widened. Then it never ran again.

17.2 Pencil-shaped pieces of Lower Cambrian Bull Formation. Various field exposures of this unit follow.

18.4 On right are exposures of Lower Cambrian West Castleton Formation. A fault, here putting the Bull Fm. onto the West Castleton, lies close to the road for a few miles.

21.5 South Argyle. Turn right toward Cossayuna Lake.

22.8 STOP 1. (Park on north side of road)

The roadcut shows the Upper Cambrian Hatch Hill Formation dipping steeply east. Although the outcrop is mostly resistant sandstone and siltstone, the formation is largely black shale, and approximately 350 feet thick. The distinctive well-rounded quartz grains in a dolomitic matrix, the coarse, frosted grains, the rusty weathered surface with quartz veins standing out in relief (not seen here) provide ready recognition of field outcrops.

The point of interest here is conglomerate of sandstone and siltstone similar to the matrix. Also note the thinning and thickening of a few beds of siltstone between beds of finer black shale, and the wispy and discontinuous nature of the finer laminae. Near the western end of the outcrop a miniature nappe showing eastward movement contrasts with the regional westward overturning in the Taconic sequence. These four features taken together with reasonable paleogeographic reconstructions and the probable source of the coarse, frosted sand grains in the Potsdam Sandstone to the west indicate an eastward slope on which this formation was deposited. Cross-lamination also shows eastward movement of material. This outcrop is near the western edge of the Taconic klippe; thus it does not indicate the length of the paleoslope. A similar conglomerate in this unit is exposed 0.4 miles north of West Hebron, on the eastern edge of the Cossayuna quadrangle, a few miles across strike.

The Middle Ordovician deformation is also shown in this outcrop by the little folds accompanied by gash veins, and by a nearly flat fault cutting the two thick sandstone beds at the eastern end of the outcrop.

Continue east.

23.3 STOP 2. (Park on north side of road. Please do not block driveway)

This pause at the Lower Ordovician Schaghticoke or Lower Poultney will be a short one because it is not very convincing for my story. The unit is upside down, though this is not easy to demonstrate here. Note the fine grain of both the carbonate and the shale, surely an indication of quiet water, yet some grading and some cross-lamination and a few tiny stylolites can be found. There is also some irregular thinning of carbonate beds. Because the thinning is irregular and irregularly distributed in the outcrop, I believe it was caused penecontemporaneously with deposition. Elsewhere in the unit, as far east as the Pawlet quadrangle, the limy layers have been completely pulled apart and appear as conglomerates, in some places with angular pieces (Shumaker, 1967, p. 26).

Continue east.

24.2 Excellent roadcut in pseudo-conglomerate of the Lower Cambrian West Castleton Formation. The way the soft, limy blebs compacted and fitted together can be seen here.

24.7 STOP 3. (Park on left before intersection)

At the southwest end of Cossayuna Lake, the roadcut is on the west, overturned, limb of a large anticline mapped from the northeast corner of the Cossayuna quadrangle south-southwest to the southern edge of the quadrangle and cored with 1000 feet of Bomoseen Grit of Ruedemann (1914, p. 69), part of the Bull Fm. of Zen (1959). This unusually good exposure is at the same stratigraphic level as the roadcut two thirds of a mile west, on the other limb of a small syncline. Similar but thinner conglomerates are exposed near the Vermont line in the eastern part of the Salem quadrangle on the north side of Dry Creek and at Buttermilk Falls Brook, where I have been mapping.

Features suggesting soft-sediment slumping include the limy blebs, flakes of dark shale and dark siltstone, puckering of several thin layers of siltstone with a sense of motion to the east (outcrop overturned), curling of the shale flakes, the fitting together of the limy blebs--rather like pillow lavas, and the lack of some coarse matrix such as one might expect from violent turbidity currents. The impression I receive is that quiet deposition of limy mud and clay mud and some silt was disturbed by occasional gentle slipping down a gentle slope. Perhaps the slipping was more or less constant, so that the beds were continuously being attenuated. This might be invisible in clays with no coherence, but the calcium carbonate mud may have rapidly become sticky enough to retain some coherence (Hathaway and Robertson, 1960) when pulled by the force of gravity down a very slight eastward slope. Thus there are more or less even rows of blebs in undeformed shale. If this were tectonic boudinage, calcite veins might be found between the pulled-apart blebs. There is, in fact, abundant calcite veining, but preference for limy layers is not evident.

Turn left (north) up the west side of the lake.

25.9 Several outcrops of Lower Cambrian Bomoseen.

27.2 Turn left (west) at Billiken.

28.3 From crest of hill note the view in each direction. To the east the high Taconics--to the west the Hudson Valley and the Adirondacks.

28.6 At base of hill join County road 47. Continue west.

28.8 Corner between Dutchtown Rd. and Street Rd. This name seems redundant; actually it refers to The Street of the Argyle Patent, 1764. Continue west.

29.4 Bear left.

29.7 Bear right onto bumpy road.

29.8 On left good exposures of Bomoseen.

30.2 STOP 4. (Park across intersection. Snakes are fairly common around here.)

These interbedded limy and silty beds are Lower Cambrian because Dale (1899, plate 13) reported Olenellus from two places in this field. A search around the pasture will show the limy layers are pulled apart in places. It is not certain here whether the pulling apart was during Early Cambrian deposition or during late Middle Ordovician deformation. For example, one might propose that because the calcite veins go through between the calcite-rich pods in some cases (see chevron folds), the boudinage and the veining follow the same stress pattern and are of the same cloth. Or the places between pods may have been weak enough to localize the formation of veins. In fact, it is not certain everywhere at this stop what feature or features cause the weathering pits to have their present shape.

Continue west, down hill across the Taconic thrust.

30.9 Crossroads with NY Rte 40. Turn right toward Argyle.

31.0 Roadcuts on left are in the autochthonous shale but contain samples of Taconic rock types. In fact, we have here a different kind of conglomerate from that seen in the first few stops, for the source is to the east. Thus the slope faced west by the time this conglomerate formed (late Middle Ordovician).

31.7 Center of Argyle. Lunch stop in Fire House in case of bad weather. Gas, etc.

Continue north, now on NY Rte 197.

32.5 Keep straight ahead. Then turn right.

33.1 Ledge of typical Martinsburg Shale. I use that name because it really does fit reasonably well. The name Snake

Hill has been abandoned following Berry's paper (1963), and this fairly fine-grained unit is not typical of the Austin Glen Graywacke. Note the prominent cleavage and the difficulty of seeing bedding. About 200 feet along the ledge, the rock suggests pieces of shale in shale.

33.7 Intersection with NY Rte 40. Turn left.

34.1 Turn right.

34.6 STOP 5.

Field to right has ledges of conglomerate in the Martinsburg Shale. But the conglomerate is carbonate pebbles, and there is no shale matrix. Few if any of the pebbles are definitely attributable to the Taconic sequence. The rock is identical to outcrops near Bald Mountain called the Rysedorph Hill Conglomerate by Ruedemann (1914), and it seems to present a paradox in provenance because it is immediately west of and beneath the Taconic klippe. The Taconic sequence covered the carbonates in the area from which these pebbles came at the time they came!? Such lenses of carbonate conglomerate seem to be confined to a narrow zone close in front of the klippe, so one might suggest that they were entrained by the klippe. But entrained how, and from where, if the autochthonous shale blanketed the carbonate sequence? Alternatively, the conglomerate may have been formed earlier, near the top of the slope on which the Taconic sequence was deposited; when the slope was reversed, the conglomerate would have moved as single big blocks. No doubt there are other possible explanations, but the lack of shaly matrix must be accounted for.

Continue east.

34.8 Intersection. Turn right approximately on the Taconic thrust, for the hill to the east is Lower Cambrian Bull Fm. and the lowlands to the west are Martinsburg Shale, here late Middle Ordovician.

35.4 Road joins from left.

35.5 Crossroad. Turn right.

36.6 At NY Rte 40, turn left (south) into Argyle.

37.5 Turn left with NY Rte 40.

38.3 Crossroad. Turn right (west).

38.7 STOP 6. (Turn into driveway, but please do not block it)

West of the patch of trees are several exposures of the Martinsburg Shale and of pieces of various rocks in it. Several resemble rocks in the Taconic sequence. This stop is right on strike with the last one. Several miles to the south is Bald Mountain.

As I have a long drive back to Washington, this is the end of the trip. To return to Albany, return east to NY Rte 40. Go south to NY Rte 29. Go west to Interstate 87, and south.

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