

# Newark Basin – View from the 21<sup>st</sup> Century

Field Guide and Proceedings

Edited by

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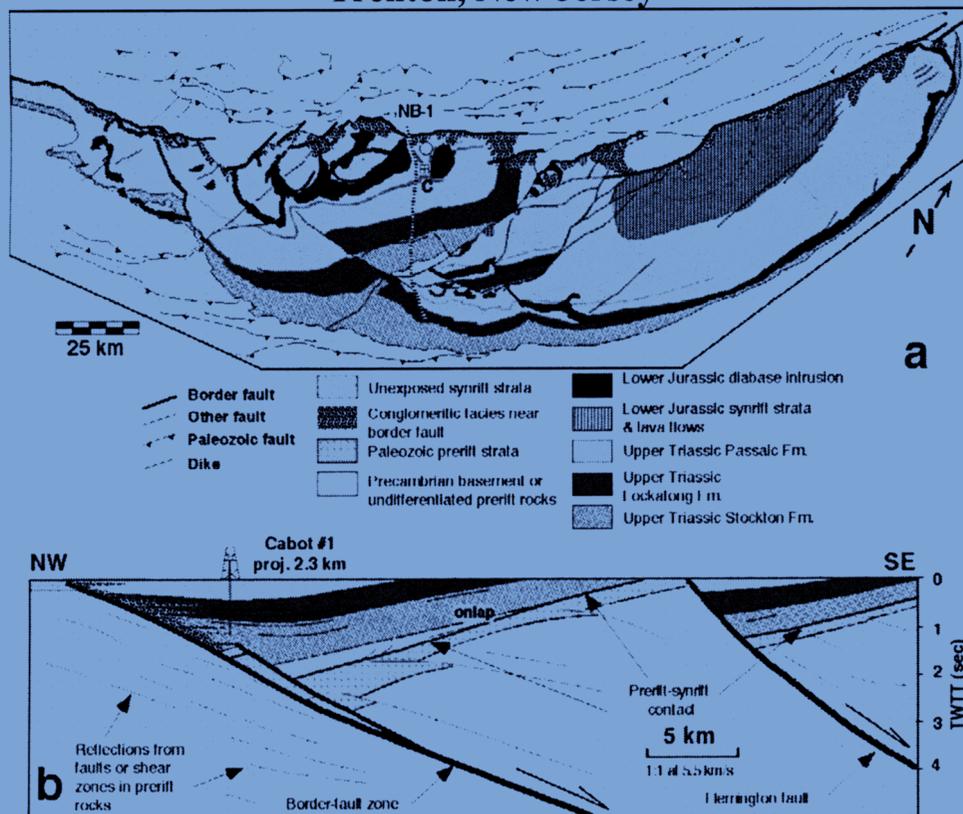
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P. E. Olsen, J. P. Smoot, and J. H. Whiteside, 2005,  
Stop 2. Upper Member L-M and Perkasie Member of the Passaic Fm., Pebble Bluff, Milford, NJ.  
p. 125-133.

## **Stop 2. Upper Member L-M and Perkasio Member of the Passaic Fm. Pebble Bluff, Milford, NJ.**

**P. E. Olsen, J. P. Smoot, and J. H. Whiteside**

Latitude and Longitude: (aprox.) 40°34.60'N, 75°08.27'W

Stratigraphic Unit: Passaic Formation

Age: Norian; ~215 Ma

Main Points:

1. Passaic Formation near border fault and coarse facies of interval at Stop 1.
2. Milankovitch cyclicity, and deeper water units extending into conglomeratic facies
3. Comparison to central basin facies
4. Fossiliferous outcrops
5. Reptile footprint faunules

These outcrops (Fig. 1), also described by Van Houten (1969, 1980), Arguden and Rodolpho (1986), Olsen and Flynn (1989), and Olsen et al., 1989) are less than 2.4 km to the southeast from the border fault and consist of thick sequences (>20 m) of red conglomerate and sandstones alternating with cyclical black, gray, and red mudstone and sandstone. Dips average 10-15° NW, and there several faults, downthrowing to the east, between the largest outcrops. These outcrops are part of the cyclical and quasiperiodic lacustrine to fluvial succession of the central Newark basin in which lake depth responded profoundly to Milankovitch climate forcing (Olsen, 1996; Olsen and Kent, 1996; Olsen and Kent, 1999). The thickest gray beds at this stop (see Figures 1 and 2) are the Perkasio Member, marking a 405 ky McLaughlin cycle within the wetter part of a 1.75 m.y. modulating cycle (P2) and a wetter part of a 3.5 m.y. Laskar cycle (La4). The red conglomerates in the lower parts of the section are the coarse lateral equivalents of the red mudstones seen at Stop 1.

The Perkasio Member consists of Van Houten cycles and compound cycles showing the same pattern as the Lockatong (Olsen, 1986; Olsen and Baird, 1986). It consists of two sequential 100 ky year cycles, each containing two well developed ~20 ky Van Houten cycles and weakly developed red and purple Van Houten cycle, succeeded upwards by red clastics (Figure 2). McLaughlin named the lower set of gray beds member N and the upper member O, which I have renamed short modulating cycle N and O, respectively. Underlying strata at these outcrops comprise the drier parts of member L-M, and these are largely conglomeritic at this site.

Conglomerates at Pebble Bluffs occur in three basic styles. 1) Poorly-bedded boulder-cobble conglomerate with pebbly sandstone interbeds. Matrix rich conglomerates are in places matrix-supported. These appear to define lenses that are convex-upward and bounded by the largest clasts at their edges and tops. These lenses appear to be debris flow lobes, in which some of the matrix may have been partially washed out by rain during periods of non-deposition. If correctly identified, the flow lenses are typically less than 30 cm thick and less than 5 m wide, similar to debris flows formed on mid to lower portions of steep fans. Pebbly sandstone and muddy sandstone include "trains" of isolated

cobbles often oriented vertically. These cobble trains represent thin, low viscosity debris flows that are stripped of their matrix by shallow flash-flood streams. The sandstones appear to be broad, shallow stream deposits that may include hyperconcentrated flow as indicated by flat layering defined by the orientation of granules. At this locality, this style of conglomerate occurs in the upper part of member M-L.

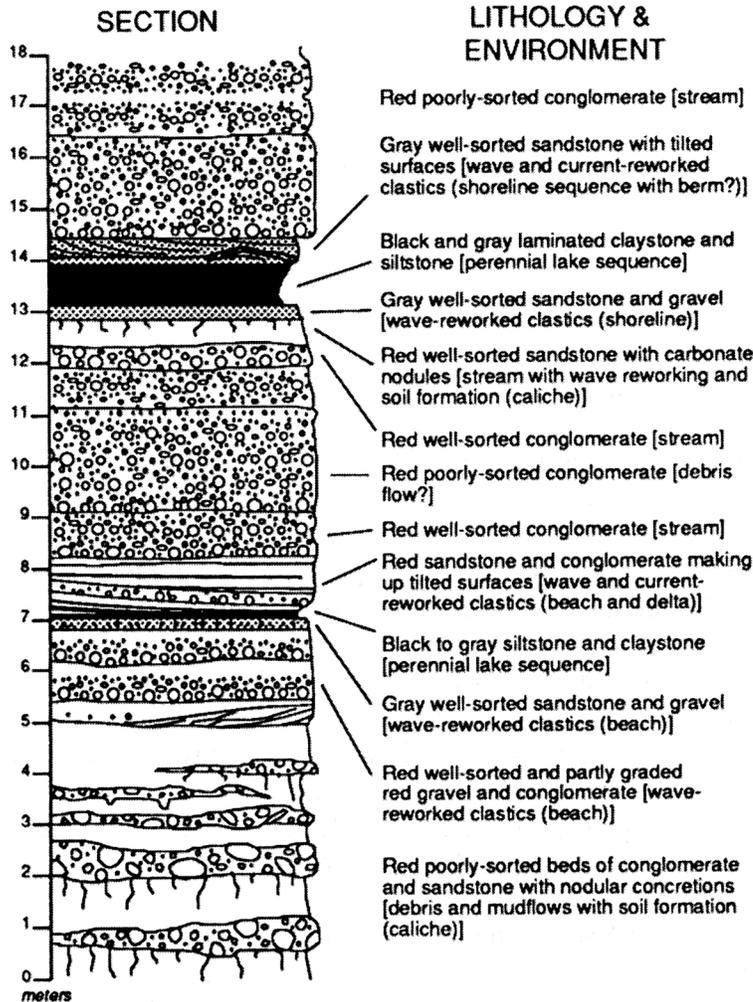


Figure 1 Measured section of the Passaic Formation at Pebble Bluff, Stop 2, showing the interfingering of debris flow, shoreline, and perennial lake deposits. (Olsen et al., 1989).

2) Well-defined lenticular beds of pebble-cobble conglomerate separated by pebbly muddy sandstones with abundant root structures. The conglomerate beds are channel-form with abundant imbrication. Some internal coarsening and fining sequences are consistent with longitudinal bars (Bluck, 1982). Finer grained deposits resemble less-incised channels and overbank deposits. There are some hints of thin debris flow sheets. Abundant root structures filled with nodular carbonate suggest soil caliche. Again these types of conglomerates are here almost entirely within member L-M although some occur in the gay parts of the Perkasio Member.

3) Grain-supported cobble-pebble conglomerate with sandy matrix. Granules and coarse sand show high degree of sorting suggesting wave reworking of finer fractions

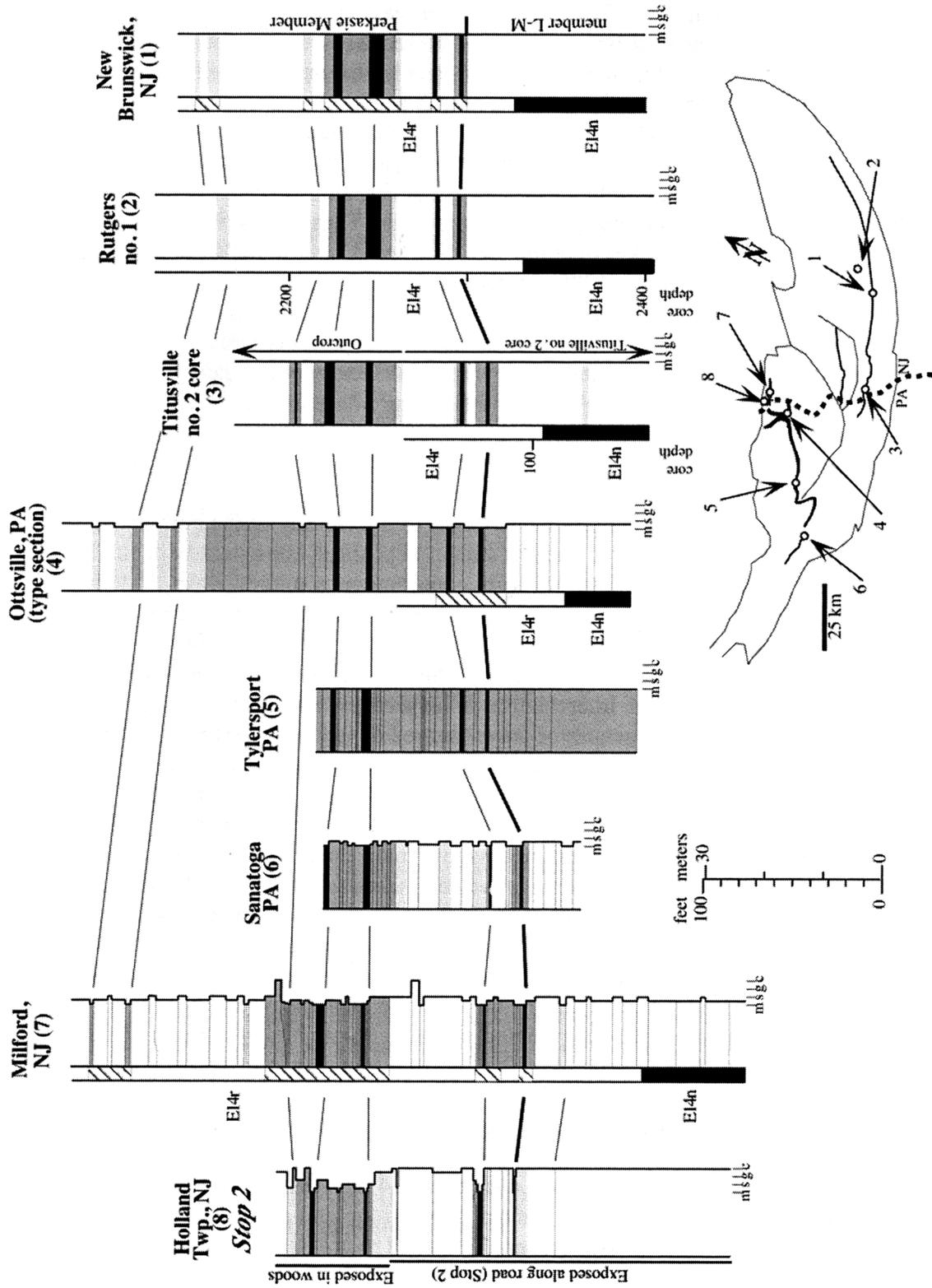


Figure 2. Lateral correlation of the lower part of the Perkasie Member in outcrops and cores. Locations of sites are: 1, Rt. 18, New Brunswick, NJ ; 5, NE extension, PA Turnpike, Tylersport, PA; 6, quarry, Sanatoga, PA; 7, road outcrops in and near Milford, NJ; 8, Pebble Bluff, Holland Township, NJ (Stop 2) (from Olsen et al., 1996). For lithologies: white represents red; light gray, represents purple; gray, represents gray; and black, represents black. For magnetic polarity: black is normal and white is reverse.

The central basin facies of the Perkasie Member, consisting largely of fine-grained playa deposits is remarkably devoid of fossils. However, at localities such as these, closer to the border fault, fossils of many kinds are actually quite common. This we believe to be due to two factors: 1) desiccation patterns; and 2) variability of accumulation rate. In the central facies of the Newark basin the Passaic (and Lockatong) are profoundly mud dominated. On the flat playas during dry phases of Van Houten cycles, the high frequency of wetting and drying events produce a desiccation breccia fabric that destroys most trace and aquatic fossils. Second, and probably more importantly, the accumulation rate in the center of the Newark basin was probably extremely even with a precompaction rate of only 1 mm or so a year. Such evenness of accumulation means that remains of plants or animals are not buried quickly enough to remove them from the high recycling rate part of the terrestrial ecosystem. In contrast, closer to the border fault, accumulation rates were much more erratic both vertically and horizontally. This is evident from the scale of individual deposition events, which is both on average larger and more erratic near the border fault than at the center of the basin. Hence, there is a much higher potential for swift burial and escape from ecosystem recycling

