

OPERATION OF THE WILSON CYCLE IN WESTERN NEW ENGLAND
DURING THE EARLY PALEOZOIC:
WITH EMPHASIS ON THE STRATIGRAPHY, STRUCTURE, AND EMPLACEMENT
OF THE TACONIC ALLOCHTHON

by

DAVID B. ROWLEY

A Dissertation

Submitted to the State University of New York at Albany
in Partial Fulfillment of
The Requirements for the Degree of
Doctor of Philosophy

College of Science and Mathematics
Department of Geological Sciences

1983
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ABSTRACT

This dissertation treats various aspects of the pre-Silurian history of the northern Appalachians. The primary focus is western New England, and the stratigraphy, structure, and emplacement history of the Taconic Allochthon. Detailed mapping in the Lake Bomoseen area (Plates 1-3) and previously completed mapping are used to discuss the stratigraphy (Chapter 3) and structure (Chapter 4) of the Allochthon. The lithostratigraphy of the Giddings Brook slice is revised. The Cambrian? Bull Formation (revised) of the Nassau Group (new) consists of the Mettawee Slate facies (revised), Bomoseen, and Truthville Slate Members. The Lower Cambrian to Middle Ordovician Browns Pond, Middle Granville Slate (new), Hatch Hill (revised), Poultney (revised), and Indian River Slate Formations constitute the Mount Hamilton Group (revised). The West Castleton and White Creek are now considered Members of the Hatch Hill Formation. The Mount Merino and Pawlet Formations comprise the Willard Mountain Group (new).

Chapter 3 also emphasizes along- and across-strike variability in the stratigraphy of the Giddings Brook slice. First-order facies-controlled variations are used to divide the Giddings Brook slice into a number of paleogeographically distinctive sequences (Nappes of Chapter 7) derived from different positions on the ancient continental rise.

The most important structural conclusions derived from the Lake Bomoseen area are that the northern end of the Allochthon is bounded by a folded, D_1 age thrust (the Basal Thrust) associated locally with melange and slivers of carbonate. Comparable D_1 thrusts with tectonic melanges are recognized within the Allochthon. Large-scale D_2 folds

with an associated axial surface slaty cleavage define the map pattern, fold the Basal Thrust, but show variability in amplitude, wavelength, and style within the Allochthon. An unfolded D_3 thrust fault (the Frontal Thrust) marks the western edge of the Allochthon. Similar age thrusts are prominent within the Allochthon. These D_3 thrusts also imbricate the structurally subjacent shelf, and may sole into the Champlain Thrust.

Biostratigraphic correlations of shelf and continental rise sequences are used to examine the relationship between transgressive-regressive history of the shelf with changes in type of sediment and mode of sedimentation on the coeval continental rise in Chapter 5. A close correlation is demonstrated.

Chapter 6 discusses the implications of (1) a completely conformable stratigraphic relationship between the medial Ordovician Pawlet flysch and underlying Taconic sequence in the western Giddings Brook slice, and (2) Taconic-, metasedimentary-, and volcanic-derived clasts within the Pawlet greywackes. These observations suggest that the Allochthon was thrust-stacked from east to west in an accretionary prism environment prior to being emplaced onto the coeval shelf. Thrust stacking and obduction of the Allochthon is correlated with a medial Ordovician arc-continental margin collision.

Chapter 7 emphasizes the importance of recognizing the difference between nappes and slices. Nappes are paleogeographically distinctive stratigraphic assemblages, whereas slices are structural assemblages of nappes juxtaposed along thrust faults decorated with shelf-derived carbonate slivers. The stacking of nappes pre-dates obduction onto the shelf whereas the stacking of slices post-dates it. Models

accommodating this distinction are discussed.

The Champlain Thrust juxtaposes sequences of the early Paleozoic shelf that differ markedly in facies, total thickness, thickness per time interval, and age span represented by the sequences. Chapter 8 outlines three trigonometric models for estimating displacement on such thrusts based on the first-order, pre-thrusting geometry of modern Atlantic-type shelf sequences. Calculations of displacement for the Champlain Thrust using these methods suggest that the parautochthonous shelf sequence, Green Mountain anticlinorium, and Taconic sequence were transported westward 80 km or more. This estimate is supported by recently published seismic reflection data.

Chapter 9 analyzes the pre-Silurian stratigraphy of the northern Appalachians and defines about a dozen 'suspect terranes' (Plate 9.1). Particular attention is paid to terranes that record medial Ordovician tectonism. Plate tectonic scenarios are constructed to attempt to explain the stratigraphic, structural, metamorphic, and magmatic histories of these terranes.

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DEDICATION:

To my Parents and Grandparents -
Who through their example showed
me the pleasure and satisfaction
of hard work and scholarly pursuits

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