Vertical and Lateral Distribution of Middle and Upper Devonian Organic-Rich Shales, New York State

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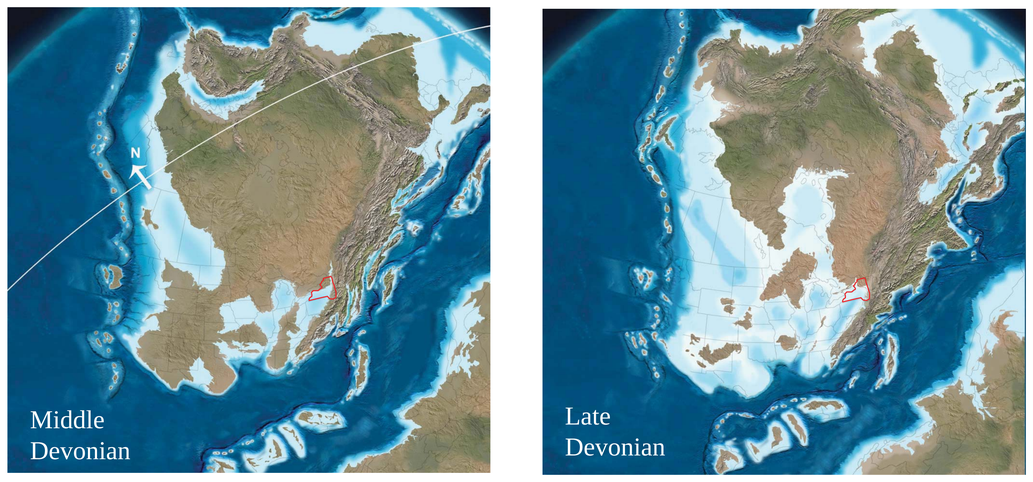
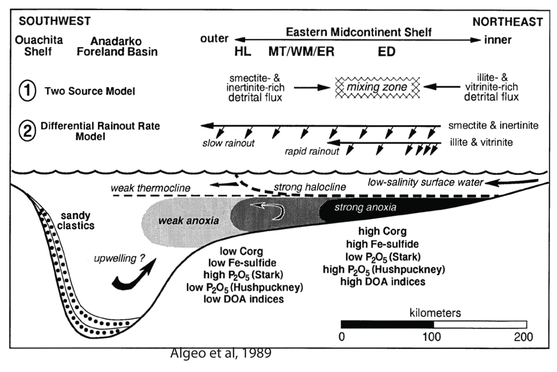
Abstract

While most of the focus is on the Middle Devonian Marcellus Shale, there are numerous other organic-rich shales in the Middle and Upper Devonian strata of New York State that might also produce gas or liquids. The purpose of this presentation is to show maps and interpreted cross sections of all of the Middle and Upper Devonian organic-rich black shales in New York. These organic-rich shales include from oldest to youngest the Marcellus, Levanna, Ledyard, Geneseo, Renwick, Middlesex, Rhinestreet, Dunkirk and Pipe Creek Shales. TOC and calcite content measured from well cuttings will be presented along with wireline logs in the cross sections and maps of the thickness of each organic-rich shale. Density logs are calibrated to TOC data from cores and cuttings and used to map the net thickness of each of the organic-rich shale within each interval across the state. All of the shales grade from thicker, organic-poor gray shales in the east to progressively thinner and more TOC-enriched shales to the west. The organic rich shales commonly interbedded with limestones while the gray, organic-poor shales are commonly interbedded with siltstone and sandstone. Most of the organic-rich shales onlap and pinch out on unconformities that form on the tectonic high to the west. The maps and cross sections help to develop a depositional model for the organic-rich shales that shows them forming in relatively shallow water on the present-day western or cratonward side of the basin. They also show that there is significant potential not only in the Marcellus, but in several other black shales in New York.

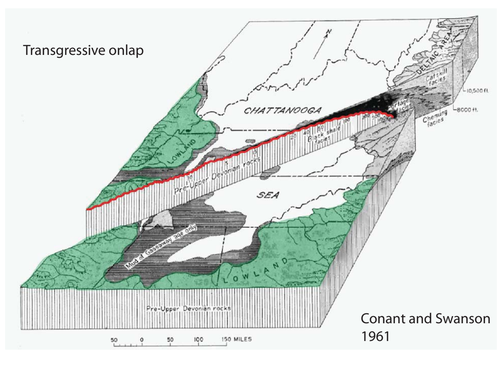
Middle and Late Devonian Paleogeography





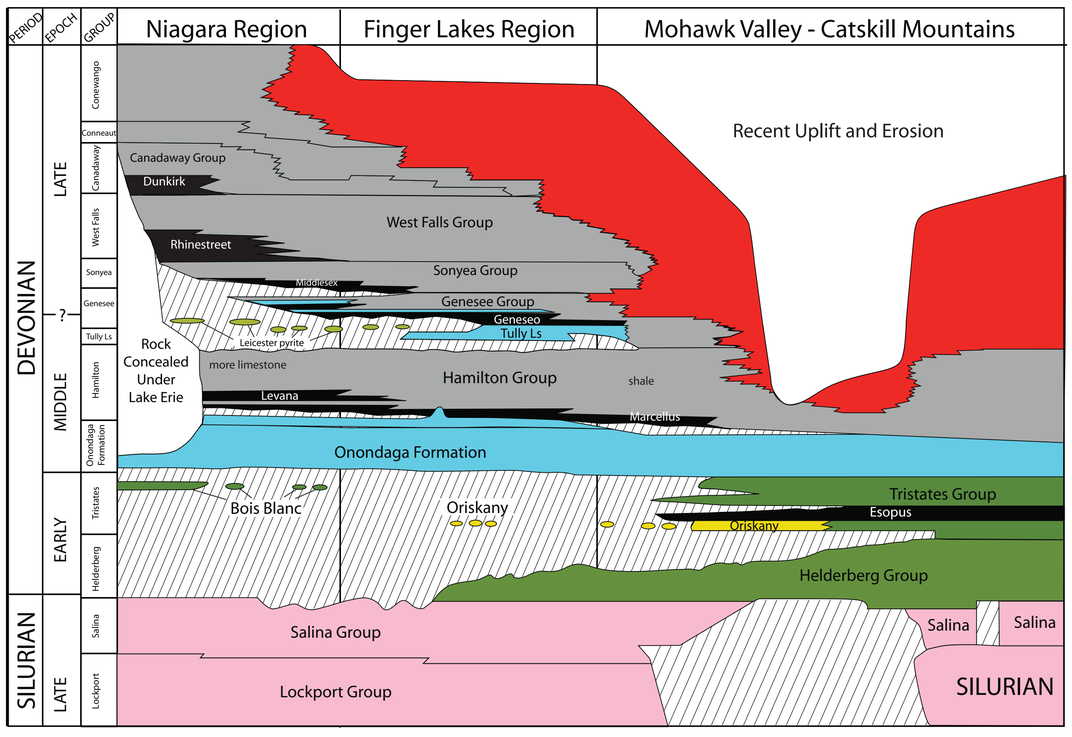
Algeo et al, 1989

Ouachita foreland basin model for Pennsylvian strata shows organic-poor clastics in deepest part of basin, progressively more organic-rich strata on opposite side of basin in progressively shallower water.



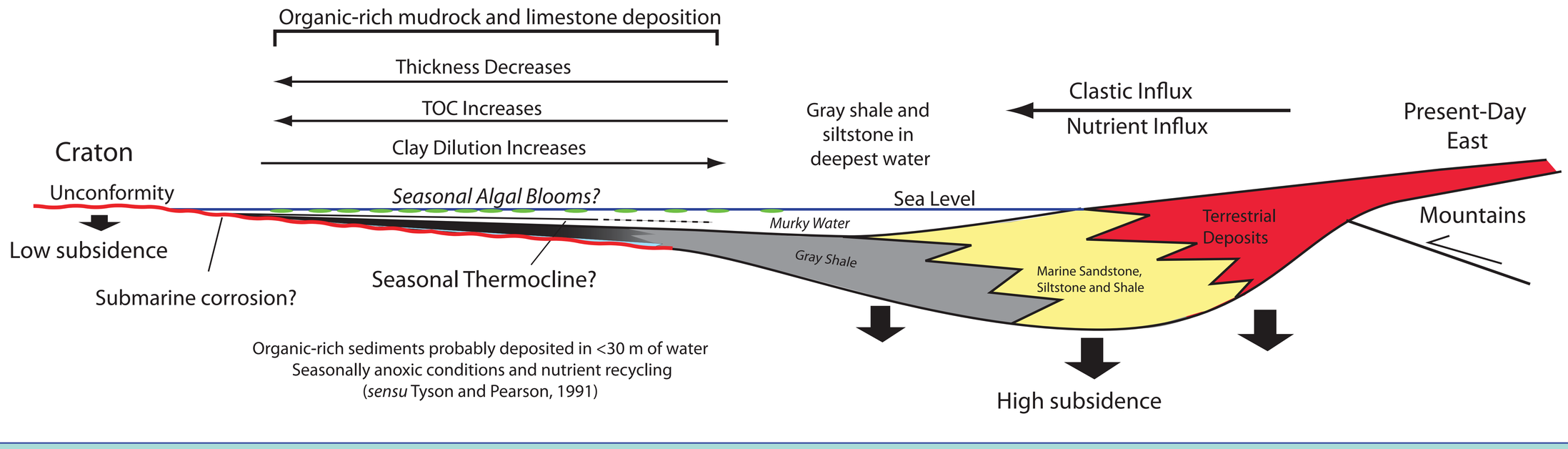
Organic-rich upper Devonian Chattanooga Shale overlies subaerial unconformity and is time-equivalent to nearby land - authors said no more than 100 feet deep (30m).

Devonian Stratigraphy

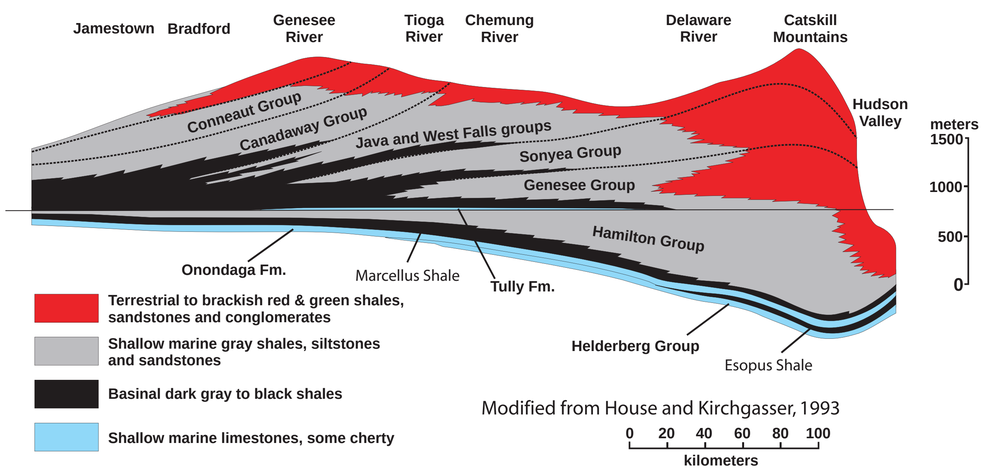


Depositional Environment of Organic-Rich Mudrocks, New York

Devonian Foreland Basin Model



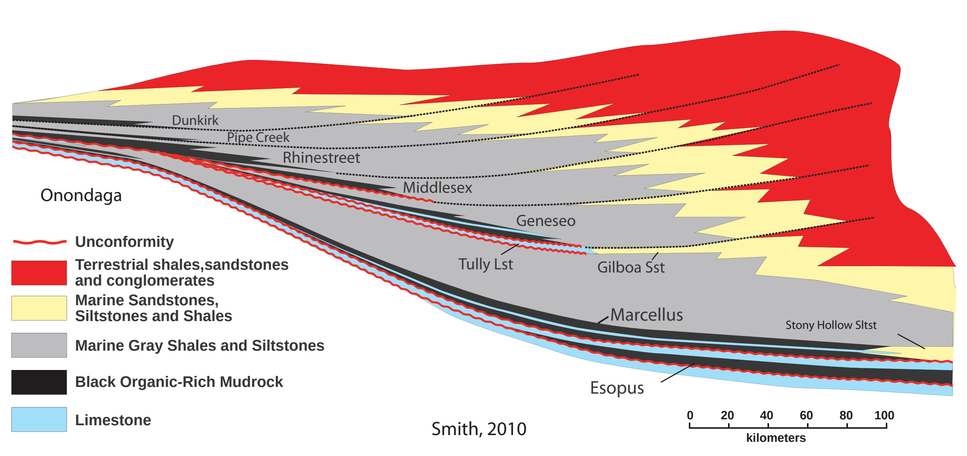
Deep Downlap Model



Modified from House and Kirchgasser, 1993

In the deep downlap model, black shale is deposited at toe of slope and in deepest part of basin. It is not clear what happens farther to the west in these models.

Shallow Transgressive Onlap Model



Smith, 2010

In the Shallow transgressive onlap model, organic-rich shale and limestone are deposited on craton-ward side of the basin in relatively shallow water. TOC increases and strata thin to the west until they onlap unconformities and pinch out.