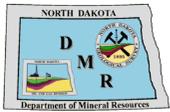# A Preliminary Evaluation of the Resource Potential of the Tyler Formation (Penn.) Based on a Combination of a Kinetically Based Maturation Index, Organic Carbon Content and Interval Thickness

Stephan H. Nordeng and Timothy O. Nesheim

Index Map showing the extent of the Tyler Formation (unshaded region) in North Dakota and an outline that corresponds to the location of the detailed maps in Figures 2 through 7. The extent of the Tyler Formation is from Anderson. (1974).
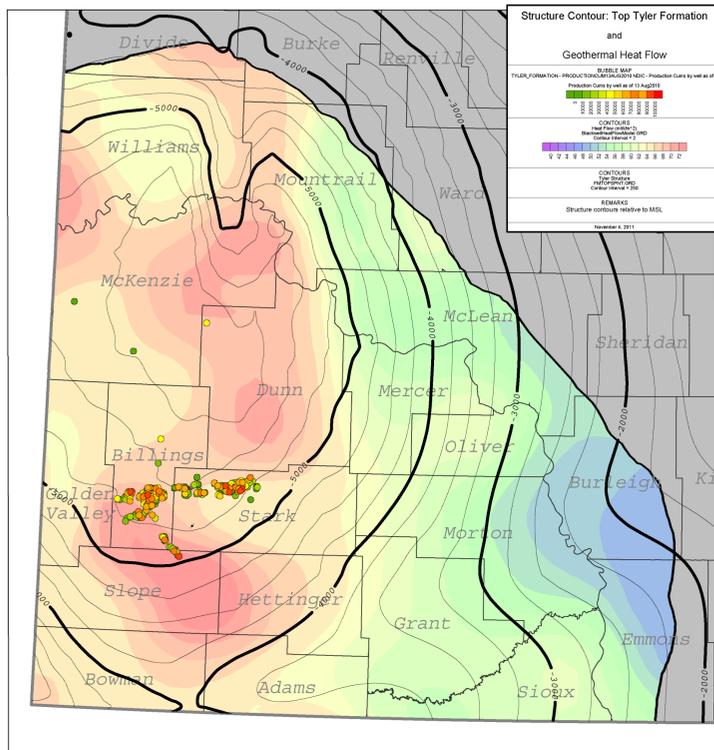

Figure 1. Structure contour and heat flow map of the western portion of North Dakota. The thermal history of the Tyler Formation is constructed from this map with the assumption that heat flow has been constant through time (from Blackwell and Richards, 2004).
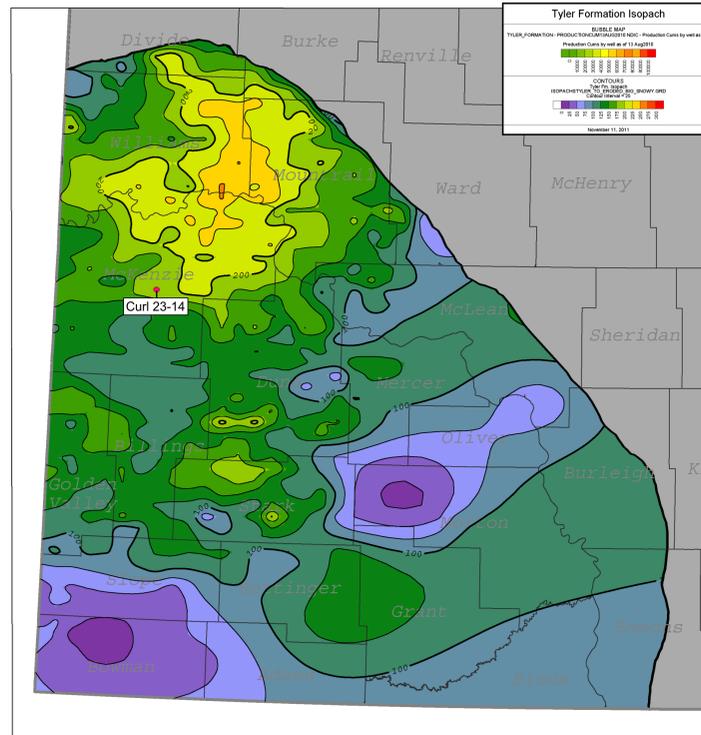

Figure 3. Isopach of the Tyler Formation with an apparent depocenter outlined by the thickest accumulation of Tyler sediments in McKenzie, Mountrail, and Williams counties.
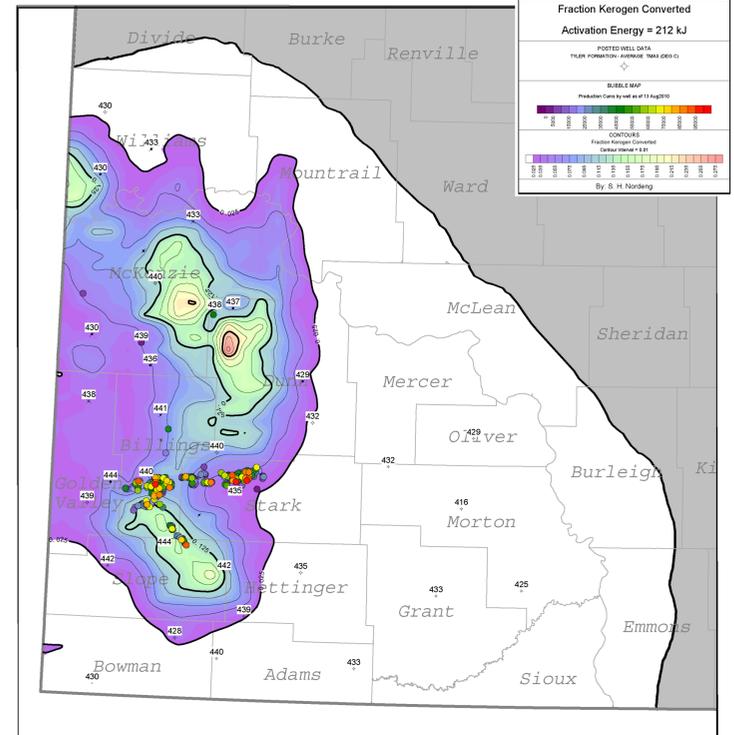

Figure 5. An enhanced version of a Time-Temperature Index map illustrating the expected fraction of the original kerogen (original fraction = 1) that has been converted to petroleum based on the assumption that the activation energy of the kerogen is 212 kJ/mol. See Nordeng and Nesheim, 2011 for methodology. The posted values are T_{MAX} (°C) temperatures from RockEval Pyrolysis of samples from the Tyler Formation.
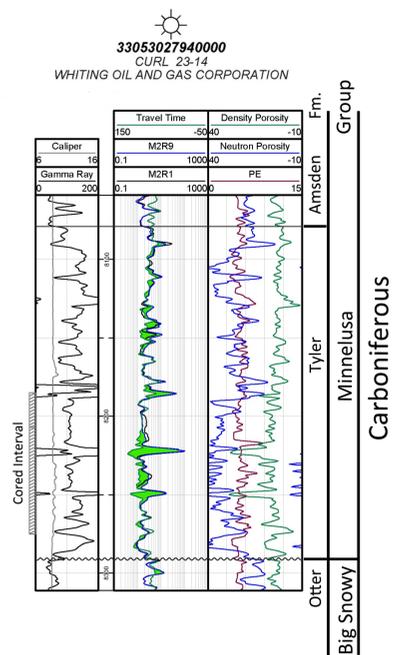

Figure 2. Typical wireline responses of the Tyler Formation found near the center of the Williston Basin. The logs include an overlay of the sonic and resistivity logs that illustrate the presence of organic-rich source rocks using the method proposed by Passey (1990). The log shown is from the Curl 23-14 (NDIC # 16581) drilled by Whiting Petroleum Company in Section 15, T 149 N, R 100 W, McKenzie County, North Dakota (see Fig. 3).
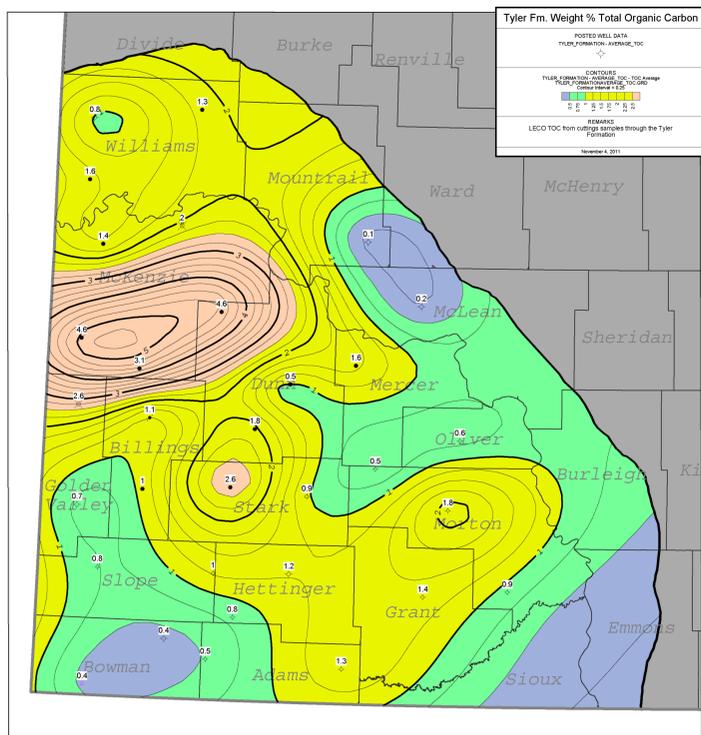

Figure 4. Map of the average Total Organic Carbon content (LECO TOC) of the Tyler Formation obtained from cuttings. Usually these samples were collected at ten-foot intervals. The posted average includes analyses of each sample from the Tyler Formation. The contours are shaded on the basis of the quantity of TOC present as follows: Tan > 2.5 Wt% TOC, Yellow 1.0 - 2.5 Wt % TOC, Green 0.5 - 1.0 Wt% TOC and Blue < 0.5 Wt% TOC.
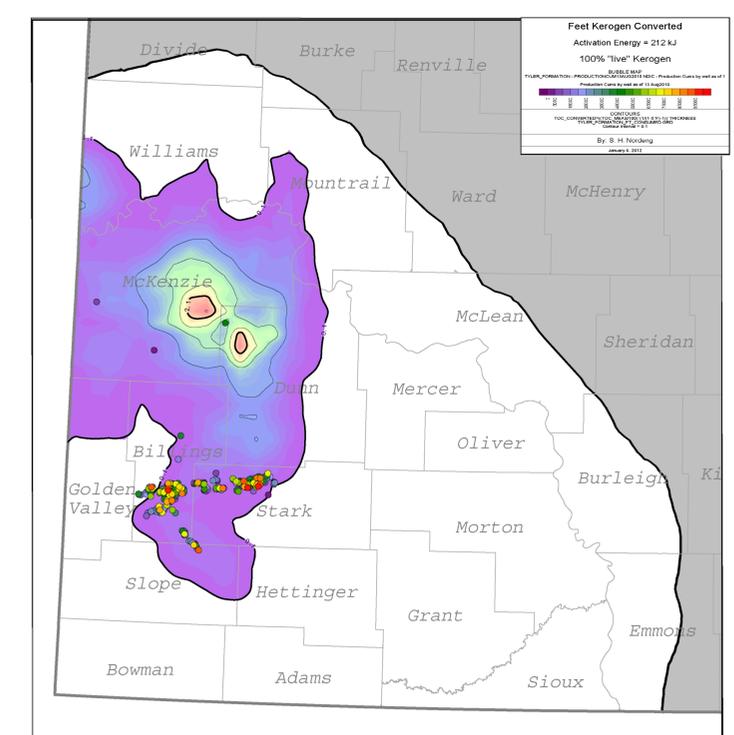

Figure 6. This map represents the fractional weight percent of the Tyler Formation that, theoretically, could be converted to petroleum. It assumes that all of the organic carbon (Fig. 4) is capable of being converted to petroleum and that the activation energy of the kerogen is 212 kJ/mol (Figure 5). The assumption that all of the TOC is capable of generating oil or that only one type of kerogen is involved is unrealistic. However, the trends that result are believed to be useful in outlining areas in which further work is needed in order to better define the resource potential of Tyler Formation.

References:

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Passey, Q. R., Creaney, S., Kulla, J. B., Moretti, F. J., Stroud, J. D., 1990, A practical model for organic richness from porosity and resistivity logs: American Association of Petroleum Geologists Bulletin, v. 74, p. 1777-1794.