

TOC and Calcite Content in Utica and Marcellus Shale Gas Plays, New York State



A Grant Proposal from the Reservoir Characterization Group at the New York State Museum



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With the heightened interest in shale gas reservoirs of New York we are launching a study of the TOC and calcite content of the Utica and Marcellus shales. Questions we hope to address in this study include: What is the vertical and lateral distribution of TOC in the Utica and Marcellus Shales? What is the vertical and lateral distribution of limestone within these plays? Is the TOC only found in shales or does it also occur in calcareous shales, argillaceous limestones and limestones? What is the cutoff for carbonate percentage above which the rock can no longer be considered part of the reservoir? Is the upper Onondaga (which appears to have some TOC) part of the Marcellus play? How about organic-rich intervals in the Ordovician Trenton, Dolgeville and Flat Creek Formations? This data could also help to calculate the gas in place in the Utica and Marcellus.

We have purchased a carbon coulometer to measure total organic carbon (TOC) in sedimentary rocks. We are planning to run the new machine full time for at least the next eighteen months, primarily on well cuttings but also from core and outcrop samples. This will require manpower, equipment and supplies that we hope to fund through industry and NYSERDA support. If the program is successful, the first item we would like to purchase is a second machine with an auto-sampler which would enable us to run the machine all night and analyze two or three times as many samples per day.

We will start our TOC analysis for each well 20 or 30 feet above the organic-rich sections of the Marcellus and Utica and run every sample (typically every 10 feet) to 20 or 30 feet below any potentially organic-rich section. In the Marcellus wells (Figure 1), we will also include analysis of the underlying Onondaga and Esopus Formations in eastern NY where they appear to be organic-rich. In the Utica, we will analyze all shale and interbedded shale and limestone in the Indian Castle, Flat Creek and Dolgeville Formations and also in within organic-rich intervals in the Trenton Formation where applicable (Figure 2). Most of the wells we have planned right now are in the central and eastern parts of the basin where the shale plays appear to have the greatest potential. Many of these wells in eastern NY do not have density logs (See Figure 1) or modern logs of any kind and this work will help to more clearly delineate both the Utica and Marcellus Trends in these areas. We plan to sample at least 50 wells in the Marcellus and 50 in the Utica/Dolgeville/Flat Creek/Trenton (Figure 3).

At the same time we plan to analyze the same sample sets for calcite content. Some intervals in the Marcellus and Utica have limestones or shales with high carbonate content. The goal of this study is to help to discriminate which limestones or calcareous shales might produce gas and which should be considered ineffective. We hope to be able to plot TOC vs. calcite content for each formation and each well to see if there is a relationship between the two.

In an effort to more clearly understand the impact of limestones we are going to micro-sample some cores and outcrops to be sure to accurately capture the TOC and calcite contents of the limestones and shales. This data will also be made available to supporters of the study. TOC values in core will be compared to cuttings from the same wells to see if the core values are higher than the cuttings values as is the case in other shale plays.

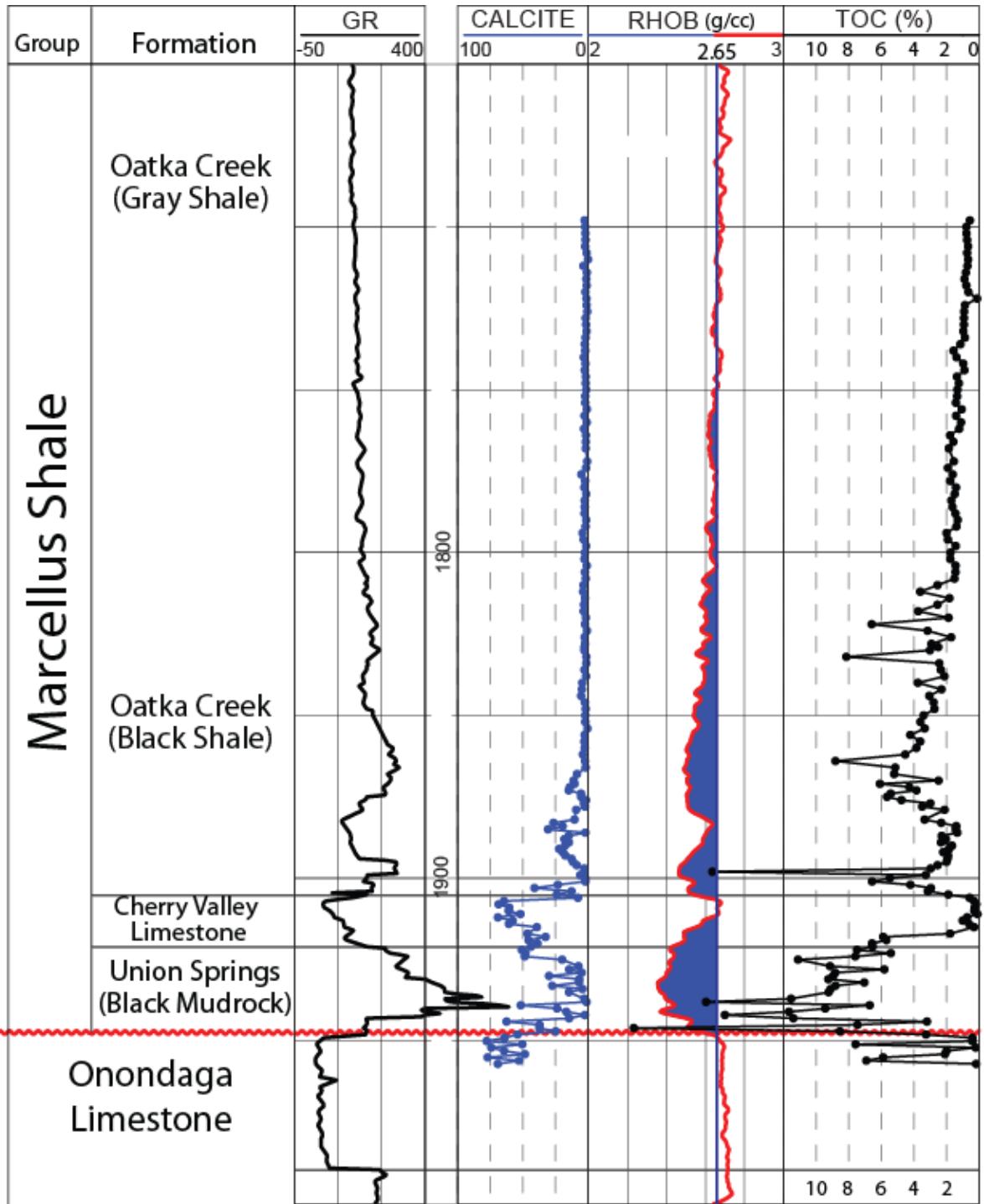


Figure 1. TOC and calcite percentage logs in Marcellus well with gamma ray and density from a cored well in the Marcellus. This well has very high TOC values in the Union Springs, low values Cherry Valley another high in the basal Oatka Creek and then progressively lower values upward. The highest TOC seems to occur where the shales are interbedded with limestone.

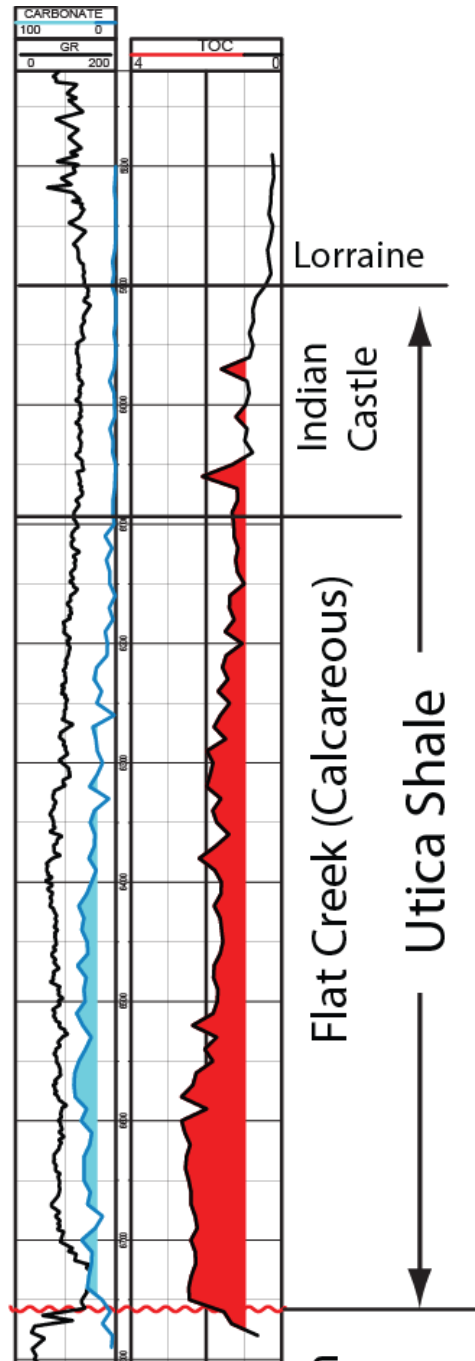


Figure 2. Lower Indian Castle, Dolgeville, Trenton and Flat Creek all have TOC values over 1%. Some Lower Indian Castle and Flat Creek samples are over 2%. Calcite percentage log closely matches gamma ray but will help to correlate from well to well and to determine fraccability.

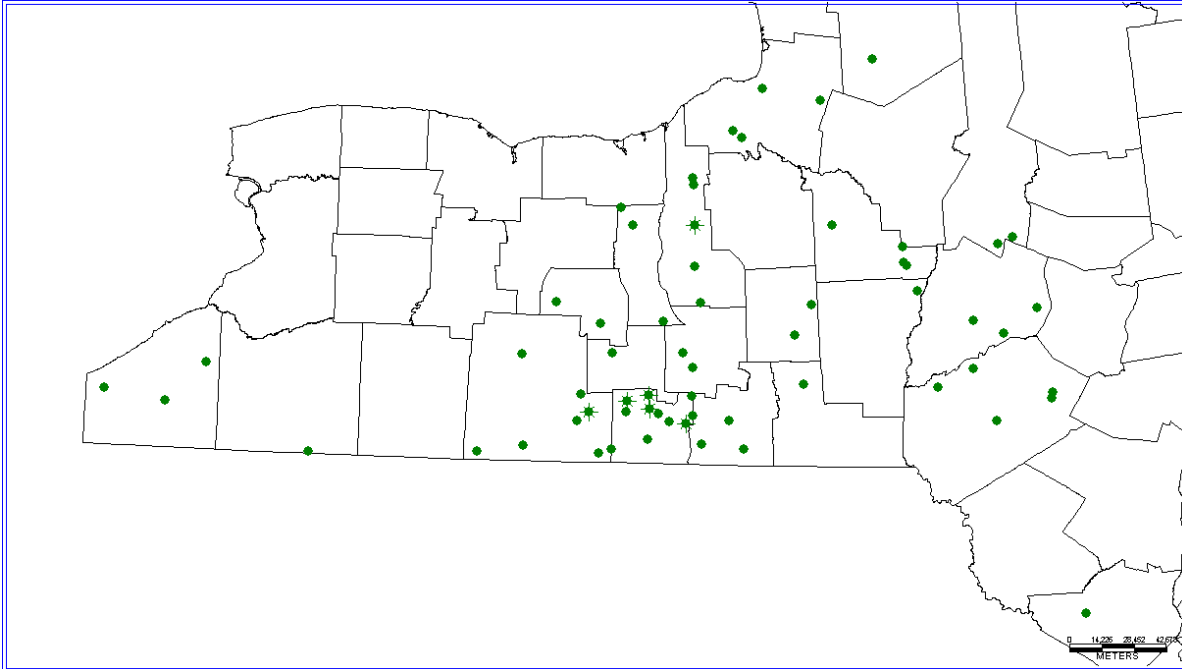


Figure 3. Locations of wells with cuttings in the Utica, Dolgeville, Flat Creek and Trenton that we plan to analyze for this study. Locations are limited by the number of wells and availability of cuttings. Earlier work suggests that organic content is very low in the northwestern part of the State. With the exception of the northernmost wells, the Marcellus samples will have a similar distribution.

We are going to make these analyses available as Microsoft Excel and .las files. The files should be posted online and emailed to supporters of the research soon after they are completed. If we are able to purchase the auto-sampler we should be able to finish as many as five wells per week. If not we should finish about two wells per week. Companies that support the project can also request to have the files emailed to them as they are completed. At the end of the project, a series of maps and cross sections will be developed that will be made available to companies that support the project and to NYSERDA.

COST

We are seeking approximately \$165,215.00 for the project. If we get more than that, we will do more wells. If we get less we will not purchase some of the equipment or cut the number of wells. We are looking for industrial partners to contribute between \$7500 and \$10,000 each and are seeking \$100,000.00 from NYSERDA.

Any company that supports the study will be able to request four specific wells for analysis. The analyses are subject to the availability of the cuttings and will be processed in the order the requests are received. All generated data will be made available to all of the supporters of the TOC Study as it is generated and will be made available to the public when the project is completed.

TIME NEEDED

The Study will start on July 1, 2009 and continue until June 30, 2011.