

## The Application of Iodine Surface Geochemical Surveys in Exploration for Ordovician and Mississippian Reservoirs, Williston Basin

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The use of surface geochemistry as a first pass exploration tool is becoming more prevalent in petroleum exploration. This is the result of increased cost of land, drilling, 2-D and 3-D seismic surveys in exploration for Red River and Mississippian reservoirs in lightly drilled areas in Saskatchewan, North Dakota and Montana. Surface geochemical surveys can be very effective in pinpointing specific target areas to minimize seismic surveying and the amount of land to be acquired. The application of surface geochemistry relies on the theory of vertical migration (microseepage), which to date has not been well understood. The theory of vertical migration or microseepage is supported by empirical data and numerous wells drilled. The concept states that minute amounts of hydrocarbons leak vertically from the reservoirs at depth migrating upwards into the soil strata. Within the soil section, the hydrocarbons cause a variety of chemical changes that can be detected. As a result there are a wide variety of surface geochemical methods that can detect the presence of petroleum or the changes it causes. One method to detect these changes is analyzing for increasing amounts of iodine which is caused by the presence of petroleum in the soil.

An anomalous iodine level indicates the presence of petroleum in the soil and potentially an accumulation trapped at depth. However, no surface geochemistry can determine the economic viability or the amount of hydrocarbons accumulated at depth. The lack of iodine or any type of surface geochemical anomaly has a consistent history of resulting in either a dry hole or a petroleum reservoir of limited extent when drilled.

Surface geochemical surveys can be very effective when the areal extent of the target(s) and the purpose of the survey are clearly defined prior to implementation. Two types of iodine surveys will be presented representing both reconnaissance and detail layouts. Examples of how to design a grid will be shown. Specific examples of successful iodine surveys (with seismic and subsurface geology) from the Red River Plays in Southeastern Saskatchewan; Bowman County, North Dakota; Northeastern Montana; the Lodgepole Play in Stark County, North Dakota; and the Mission Canyon reservoirs of Western North Dakota.

Iodine surface geochemical surveys can be very effective in evaluating a geophysical or geologic concept while minimizing cost. They are useful ahead of land sales in eliminating large areas that have no potential and highlighting those areas that do. By determining which areas have microseepage and which areas do not, surface geochemistry is a very effective tool in helping to focus exploration efforts, maximizing exploration dollars and success rates.