Introduction

Shallow gas accumulations have been recorded in Manitoba for over a century. The goal of the project is to summarize the shallow shale gas prospects for Manitoba, in order to assist in the development of a modern exploration program. The project will be conducted in three phases. In Phase 1, detailed analysis of data from historical gas explorations will be conducted. In Phase 2, the drilling of three shallow wells will be conducted. In Phase 3, a multi-year investigation of shallow gas potential in Manitoba's upper Cretaceous shale sequences, particularly the Ashville, Favel, Carlile and Pierre Shale formations, will be undertaken. The project will provide an opportunity to validate the utility of modern exploration techniques and to evaluate the potential of shallow gas in Manitoba.

Project Details

The Shallow Unconventional Shale Gas Prospects Project is a multi-year investigation of shallow gas potential in Manitoba's upper Cretaceous shale sequences, particularly the Ashville, Favel, Carlile and Pierre Shale formations. The project will be conducted in three phases. In Phase 1, detailed analysis of data from historical gas explorations will be conducted. In Phase 2, the drilling of three shallow wells will be conducted. In Phase 3, a multi-year investigation of shallow gas potential in Manitoba's upper Cretaceous shale sequences, particularly the Ashville, Favel, Carlile and Pierre Shale formations, will be undertaken. The project will provide an opportunity to validate the utility of modern exploration techniques and to evaluate the potential of shallow gas in Manitoba.

Problem

Historical Gas Exploration

Gas exploration was active in Manitoba from 1906 to ~1933, after domestic waterwell drilling routinely hit gas pockets. From 1906 to 1933, 132 gas explorations were made in Manitoba. Most of these explorations were shallow, with only 18 explorations in the depth range of 400 to 1500 ft. Gas production was confirmed in 12 of these explorations, with a total production of 39.8 MMscf. The highest production was from the Skagway gas field, which was discovered in 1912 and produced 18.9 MMscf to a gas well with the attachment of gas nozzle; this well has an initial pressure of 221 kPa (Figure 4c and 4d).

Organic Geochemistry

Rock-Eval results grouped by member and formation for Cretaceous shales in southwestern Manitoba (Figure 5). The distributions of Hydrogen Index (HI), Oxygen Index (OI), and Rock-Eval T1 are shown in Figure 5. The HI values are high for all formations, indicating a high level of organic matter. The OI values are low for all formations, indicating a low level of oxygen. The T1 values are low for all formations, indicating a low level of total organic matter.

Inorganic Geochemistry

The best Cretaceous shale gas targets in Manitoba are the Carlile Formation, in the west, and the Pierre Shale Formation, in the east, as shown in Figure 6. The Carlile Formation is the most promising target, with the Pierre Shale Formation being less promising.

Mineralogy

Mineralogical analysis of the shales was conducted using X-ray diffraction (XRD) and petrographic microscopy. The mineral assemblage of the shales includes quartz, feldspar, mica, illite, kaolinite, chlorite, and carbonates. The quartz content ranges from 10% to 40%, with feldspar ranging from 10% to 30%. The mica content ranges from 20% to 40%, with illite being the dominant mica.

Gas Chemistry

Dissolved and free gas compositions were measured for all the water and gas samples collected. The dissolved gas compositions are shown in Figure 7. The free gas compositions are shown in Figure 8. The dissolved gas compositions show a high percentage of methane, with other gases such as ethane, propane, and butane also present. The free gas compositions show a higher percentage of heavier gases than the dissolved gas compositions.

Economic Considerations

Despite a history of oil and gas exploration in Manitoba, the current petroleum industry is relatively small. The province has a vast shale gas resource that has not been adequately explored with modern technology. Early results from the project suggest the potential for unconventional shallow shale gas in Manitoba, with biogenic gas the most likely source.

Figure 4:

The best Cretaceous shale gas targets in Manitoba are the Carlile Formation, in the west, and the Pierre Shale Formation, in the east, as shown in Figure 6. The Carlile Formation is the most promising target, with the Pierre Shale Formation being less promising.