Stratigraphic Relationships in the Middle Devonian (Givetian) Elk Point Group, Saskatchewan Sub-Basin

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The Winnipegosis Carbonate-Prairie Evaporite succession of the Middle Devonian Elk Point Group in the Saskatchewan Sub-Basin (Fig. 1) provides a unique opportunity to examine the transition from fully marine to desiccation in an ancient intracratonic basin. These rocks have been extensively studied since 1960 because of the hydrocarbon potential of the carbonate rocks and high-grade potash deposits in the evaporite. There is good understanding of the deposition and distribution of the carbonate including development of the carbonate bank and pinnacle reefs, recognition of different lithologic units. Many important aspects of evaporite formation and diagenesis are still poorly understood because of the lack of modern analogs of large evaporite deposits and their susceptibility to post-depositional diagenesis. There is considerable debate surrounding: 1) formation of vadose diagenetic features in the Winnipegosis reefs and their chronological relationship with the formation of the Ratner Member, 2) depth of deposition of the Ratner laminite, 3) spatial relationship between the Winnipegosis reefs and potash beds, especially the Esterhazy Member, and 4) spatial and temporal relationship between the Winnipegosis reefs and deposits of the carbonate-evaporite transition. Areal distribution and contour maps of Winnipegosis carbonate and Prairie evaporite have been previously published, however, with continued hydrocarbon exploitation and exploration in the Winnipegosis and potash in the Prairie Evaporite, many new wells have been drilled and the data sets have increased. There have been no contour or isopach maps of the lithologic units published in the Saskatchewan Sub-basin since 1960.

Using core and log data, regional cross sections from the top of the Ashern Formation to the top of the Prairie Evaporite Formation (Fig. 2) inside the study area have been made and isopach maps of each lithological unit have been drawn. The cross sections show that each lithological unit can be correlated between the Quill Lake Bank and Tableland area. In the Quill Lake Bank area, many reefs have been exposed to vadose diagenesis. Whitkow anhydrite and Quill Lake marker beds are mainly developed in the southeastern side of the reefs in this area.

Ratner Member are mainly developed among the reefs and atop of the drown reefs. The distribution of Whitkow anhydrite is well related to the distribution of the reefs. The distribution of the Shell Lake marker beds show northwest-southeast trend, which is coincident with the deep part of the Sub-basin.

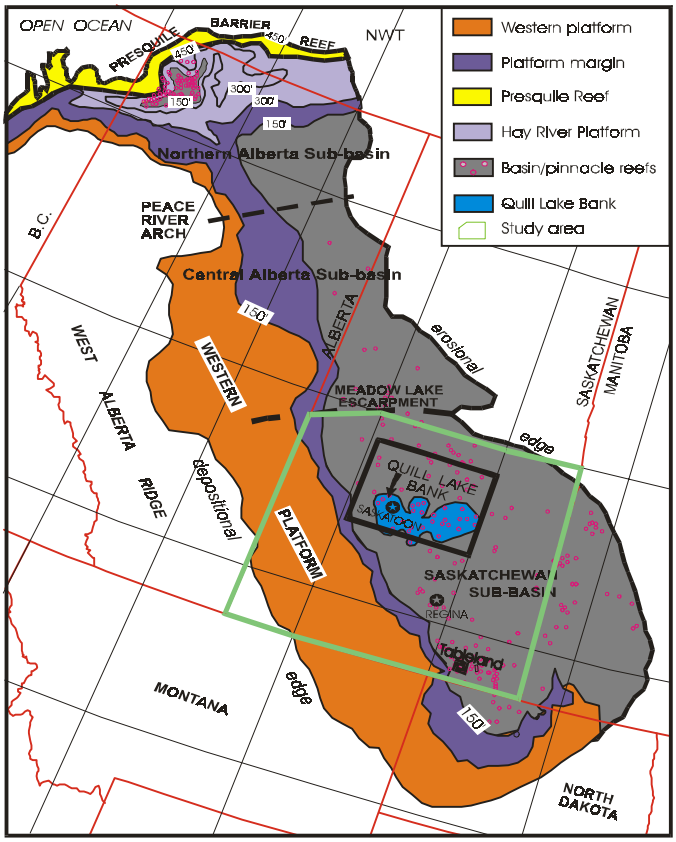

Fig. 1. Geological Map of the Middle Devonian Elk Point Basin. The study area is from the Meadow Lake Escarpment to US-Canada border (From Jin and Bergman, 1998)

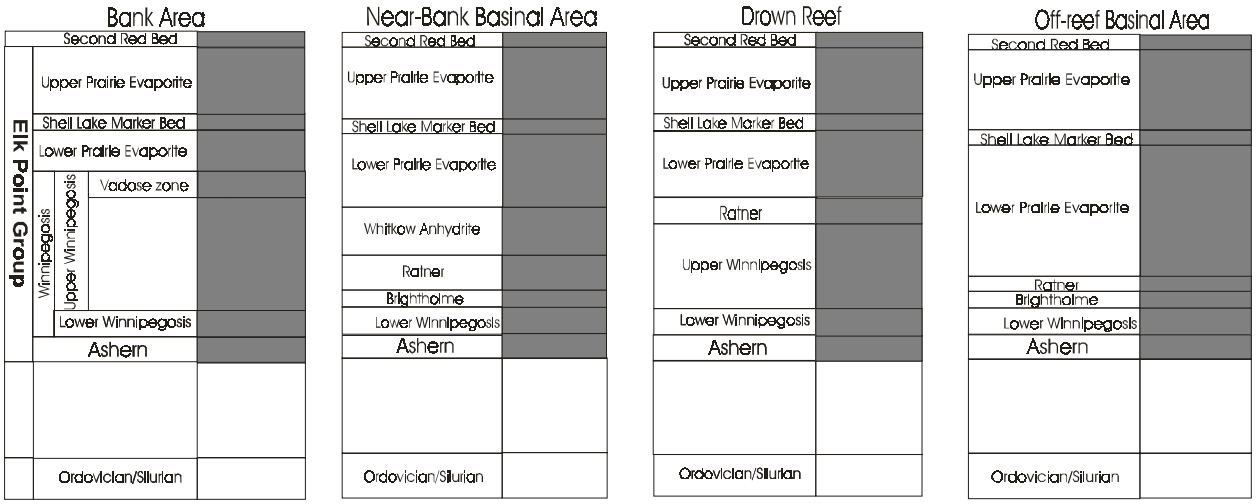

Figure 2 Lithostratigraphy and distribution of each lithological unit of the Middle Devonian Elk Point Group in Saskatchewan Sub-basin

The distribution of the lowest potash member, Esterhazy member, is also well correlated with the distribution of the Winnipegosis reefs. Most Esterhazy member exists in the southeastern part of the Quill Lake Bank reef complex.
The distribution of the Prairie Evaporite are parallel to the deep part of the basin. Prairie Evaporite is dissolved out in the southwest corner and north part of the province.