GEOLOGICAL SURVEY OF CANADA

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Correlations in the Lower Cretaceous Parsons Group in the vicinity of Parsons Lake, Beaufort-Mackenzie Area, N.W.T.

J. Dixon[1]

2006

[1] Geological Survey of Canada (Calgary), 3303-33rd Street, N.W., Calgary, Alberta, Canada T2L 2A7

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INTRODUCTION

The Lower Cretaceous Parsons Group (Dixon, 1982) consists of the Martin Creek, McGuire and Kamik formations and ranges in age from Berriasian to Hauterivian (Fig. 1). It is present in the subsurface of the southern Tuktoyaktuk Peninsula (Fig. 2) and south Mackenzie Delta, and in outcrop in the Richardson Mountains and northern Yukon (op. cit.; Dixon, 1991). In the subsurface, large volumes of gas are present in the Parson Lake gas field ($51.7x10^9m^3$, National Energy Board, 1989 – cited in Morrell, 1996). This gas field is one of three whose reserves form the basis for the present application to build a gas pipeline from the Mackenzie Delta to northern Alberta where it will link with the extensive pipeline infrastructure already in existence.

This brief report presents detailed correlations within the Parsons Group of the southern Tuktoyaktuk Peninsula, illustrating the internal stratigraphy of the group and distribution of major sandstone bodies within the succession.

REGIONAL SETTING

The Parsons gas field is a large anticline adjacent to the bounding faults of the Eskimo Lakes Arch. It is extensively faulted and can be divided into two distinct parts, the North and South Parsons (Fig. 3), each with its own structural culmination (Cote et al., 1975; Morrell, 1996). Although two structural culminations are present there is a common waterline (op. cit.). Figure 3 illustrates that the Parson structure persisted through the Early Cretaceous and continued to be active, although at a lesser scale into the Tertiary.

RESULTS AND INTERPRETATION

In an earlier publication (Dixon, 1991) I suggested that an unconformity was present within the Kamik Formation of the Parson Group and placed it near the division between the Lower and Upper members of the formation (op. cit., fig.13). The presence of an unconformity was based on two aspects of the geology:

1) In outcrops of the northern Yukon and adjacent Northwest Territories, there is a very distinct lithological change between the Lower and Upper members, where a widespread thick shale interval in the basal part of the Upper member rests abruptly on sandstone of the Lower member. Using sequence stratigraphic principles this relationship was interpreted to represent a basin-wide maximum flooding surface, in turn used to infer that a basin-margin unconformity was likely to be present.

2) Subsurface correlations between wells in the Parsons Lake area to the Tuk F-18 and Tuk L-09 wells indicate a loss of section in the Lower member (Dixon, 1991, fig.13).

In the same publication (Dixon, 1991), it was also noted that two other unconformities are associated with the Parsons Group, one between the Martin Creek and McGuire formations and the other at the base of the overlying Mount Goodenough Formation. These two events are well documented in the surface and subsurface stratigraphy (Dixon, 1982, 1991, 1992).

Figures 4, 5, 6 and 7 show detailed correlations within the Parsons Group and several sandstone-rich intervals within the Kamik Formation are highlighted in order to illustrate the geometric relationships more clearly. An interpreted maximum flooding surface above the pre-Mount Goodenough unconformity is used as the datum. The correlations clearly show that there is an intra-Kamik unconformity and that truncation of the Lower member is widespread and significant. The pre-McGuire unconformity does not truncate significant amounts of strata in the Parsons Lake area, although the erosional nature is well documented in core from the Parsons N-10 well (Dixon, 1991, p.17). Truncation at the pre-Mount Goodenough unconformity also is minimal although there is some locally significant truncation at the Parson N-10 well (Figs. 4 and 6).

The correlations presented here support the division of the Parson Group into three major transgressive-regressive sequences, first identified by Dixon (1991; although at that time he used

depositional sequences in his sequence analysis). The oldest sequence consists of the Upper member of the Husky Formation and the overlying Martin Creek Formation; the middle sequence contains the McGuire Formation and approximately the Lower member of the Kamik Formation, and the youngest sequence is approximately the Upper member of the Kamik Formation. As is obvious in the correlation diagrams (Figs. 4, 5, 6 and 7), the intra-Kamik unconformity does not coincide with the boundary between the Lower and Upper members of the Kamik Formation, rather the contact between the two members is interpreted to be a maximum flooding surface located slightly above the unconformity.

Also, the correlations illustrate that there was some structuring of Parsons strata prior to the development of the intra-Kamik unconformity, as well as before the pre-Mount Goodenough unconformity. Structural growth prior to the pre-McGuire unconformity was minimal. The structural culmination of the intra-Kamik unconformity was centred around the Parsons F-09 and D-20 wells, whereas the pre-Mount Goodenough culmination was located in the vicinity of the Parson N-10 well, a few kilometres north of the F-09 and D-20 wells. The division into a North ans South Parsons was initiated prior to the deposition of the Mount Goodenough Formation (Fig. 5) and was probably a result of tectonism that formed the unconformity at the base of the Mount Goodenough Formation.

The fact that the Parsons Lake anticline had its origins in the Early Cretaceous and that there were several phases of growth, some younger than illustrated here, has been a major factor in its development as a large gas field. Early structural development and subsequent gas migration has produced a gas field with a single waterline (Cote et al., 1975; Morrell, 1996) and all porous sandstones above the waterline are full of gas. The source rock for the gas remains unresolved, although Langhus (1980) suggested that the underlying shales of the Husky Formation may be the source rock.

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