An updated stratigraphic nomenclature for Late Jurassic-Early Cretaceous strata in the Alberta Deep Basin; Minnes, Monteith or Nikanassin?

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Three laterally persistent and mappable late Jurassic-early Cretaceous lithostratigraphic units are present in the Alberta Deep Basin, as first recognized by Stott (1998) and mapped in detail by Miles (2010). Variable application of stratigraphic frameworks and nomenclatures for these units has caused considerable confusion and hindered a broader understanding of associated, extensive tight gas sandstone reservoirs. The objective of this presentation is to provide a refined, informal nomenclature to accout for these units in the Deep Basin of Alberta.

The strata conformably overlie the Late Jurassic Upper Fernie Formation and are unconformably overlain by Early Cretaceous conglomeratic deposits of the Cadomin Formation (Stott, 1998). The lithostratigraphic units in and adjacent to the Deep Basin study area have variably been assigned to the: (1) Nikanassin Formation, the type area of which is ~200 km to the south of the Deep Basin near Cadomin, Alberta (Fig.1); and (2) Minnes Group, a portion of which was originally named at Mt. Minnes (Minnes Formation), ~50 km to the southwest of the Deep Basin (Fig. 1). The basal formation of the Minnes Group is the Monteith Formation, and at Mount Minnes, it is overlain by the Gorman Creek Formation (Fig. 2; Stott, 1998). The type section of the Monteith Formation is located in the Carbon Creek Region ~200 km to the northwest of the Deep Basin, where it is overlain by the Beattie Peaks, Monach and Bickford formations, which are also defined in that area (Fig. 1; Stott, 1998). The subsurface units in the Deep Basin are distant from each of the areas where type outcrop sections were first defined, which has led to inconsistent application of stratigraphic nomenclature (Fig. 1).

Upon close investigation, it is apparent that the Beattie Peaks and Monach formations, as they were defined in northeastern British Columbia, do not correlate into the subsurface of Alberta as had been interpreted by Stott (1998) and Miles (2010) (Fig. 2). Careful review of cross-sections by Stott (1998) reveals that a key well location used to tie these upper formations of the Minnes Group into Alberta was interpreted differently in two sections, and therefore correlated inconsistently with surrounding wells (Fig. 3). In this well (i.e., 07-12-77-25W6 in Figs. 9 and 20 of Stott, 1998) the top of the Monteith Formation was defined lower than in surrounding wells, leading to erroneous correlation of the Beattie Peaks and Monach formations into the subsurface of Alberta (Fig. 2; see Fig. 20 of Stott, 1998). Effectively, this resulted in strata lithostratigraphically equivalent to the Monteith Formation in the type area (Carbon Creek) to be subdivided into the Monteith, Beattie Peaks and Monach formations in Alberta (Figs. 2 and 3).

Importantly, the lithostratigraphic units in Alberta identified by Stott (1998) and mapped by Miles (2010) are widespread, and correlatable from south of the area studied herein, north and westward into British Columbia (Fig. 2). Three lithostratigraphic units, including a lower sandy unit, a middle finer unit with local coal, and an upper sandstone dominated unit, correspond to sub-units of the Monteith Formation in British Columbia, as originally described in the type area by Stott (1998) (Fig. 1). We

propose the use of Monteith A to account for the upper sandstone-dominated unit (referred to as the Monach Formation in Alberta by Stott (1998) and Miles (2010)); the Monteith B for the middle heterolithic unit (referred to as the Beattie Peaks Formation by Stott (1998) and Miles (2010)); and the Monteith C, a lower sandy unit (referred to as the Monteith Formation by Stott (1998) and Miles (2010) (Fig. 2)). Correlation of Jurassic-Cretaceous Monteith units from the Carbon Creek area of British Columbia for > 370 km southward, beyond the Albertan study area, is demonstrated in Fig. 2. Of note is that the three Monteith Formation units can be readily identified in the southern portion of the study area, where Stott (1998) delineated the Gorman Creek Formation (Fig. 2). Therefore, the use of Gorman Creek Formation in the subsurface of Alberta is deemed unnecessary. The Nikanassin Formation, where it is defined to the south of the Alberta Deep Basin study area is considered to be lithostratigraphically equivalent to the Monteith C unit (Fig. 2).

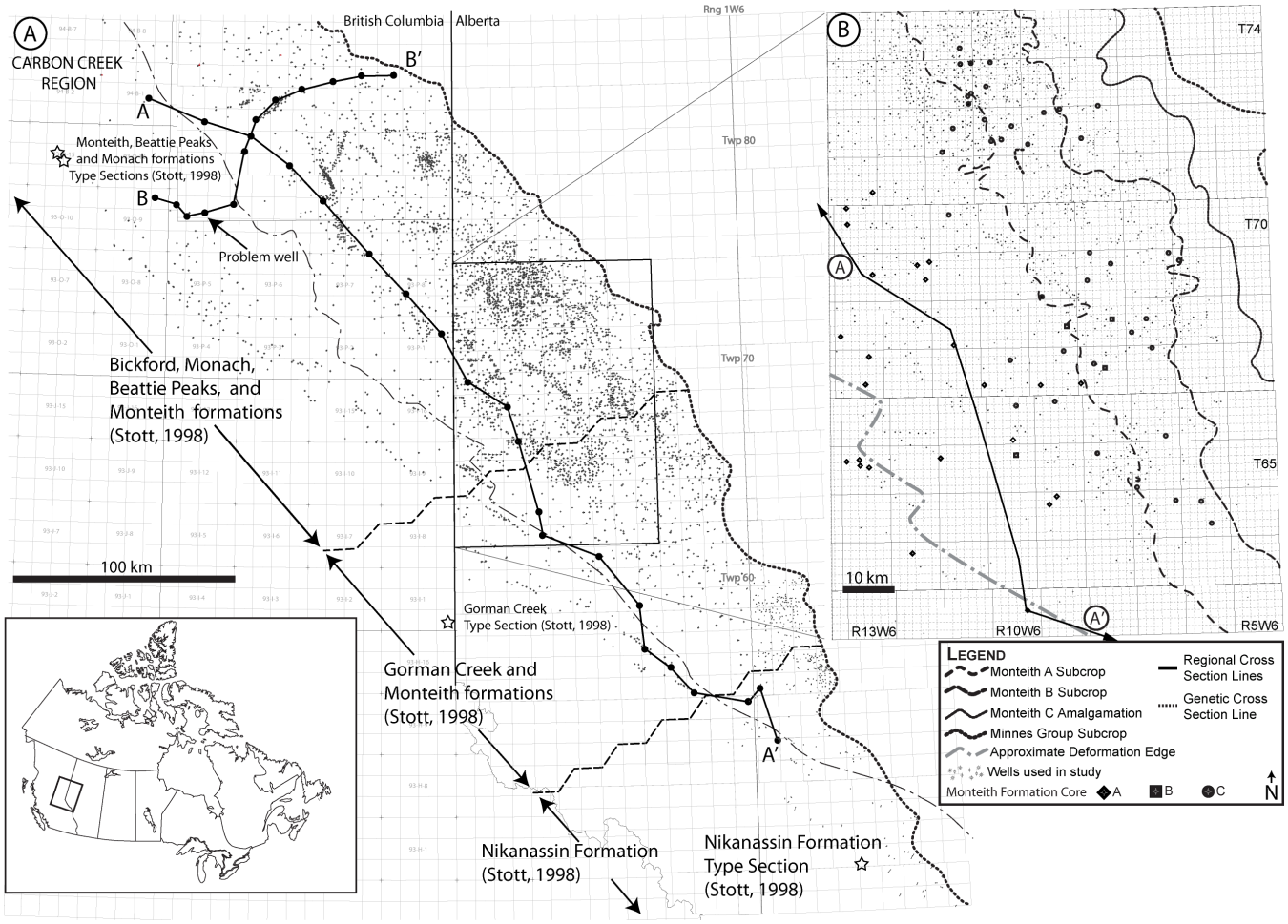

Figure 1: Overview of study area and regional stratigraphic nomenclature context. (A) Regional map of subsurface Late Jurassic-Early Cretaceous well penetrations, subsurface deformation front, and Minnes Group zero edge. Spatial extent of lithostratigraphic units defined by Stott (1998) and corresponding type sections in the foothills are shown. (B) Detailed study area map with wells used for mapping; locations of core and subcrop edges of the three Monteith Formation units are indicated.

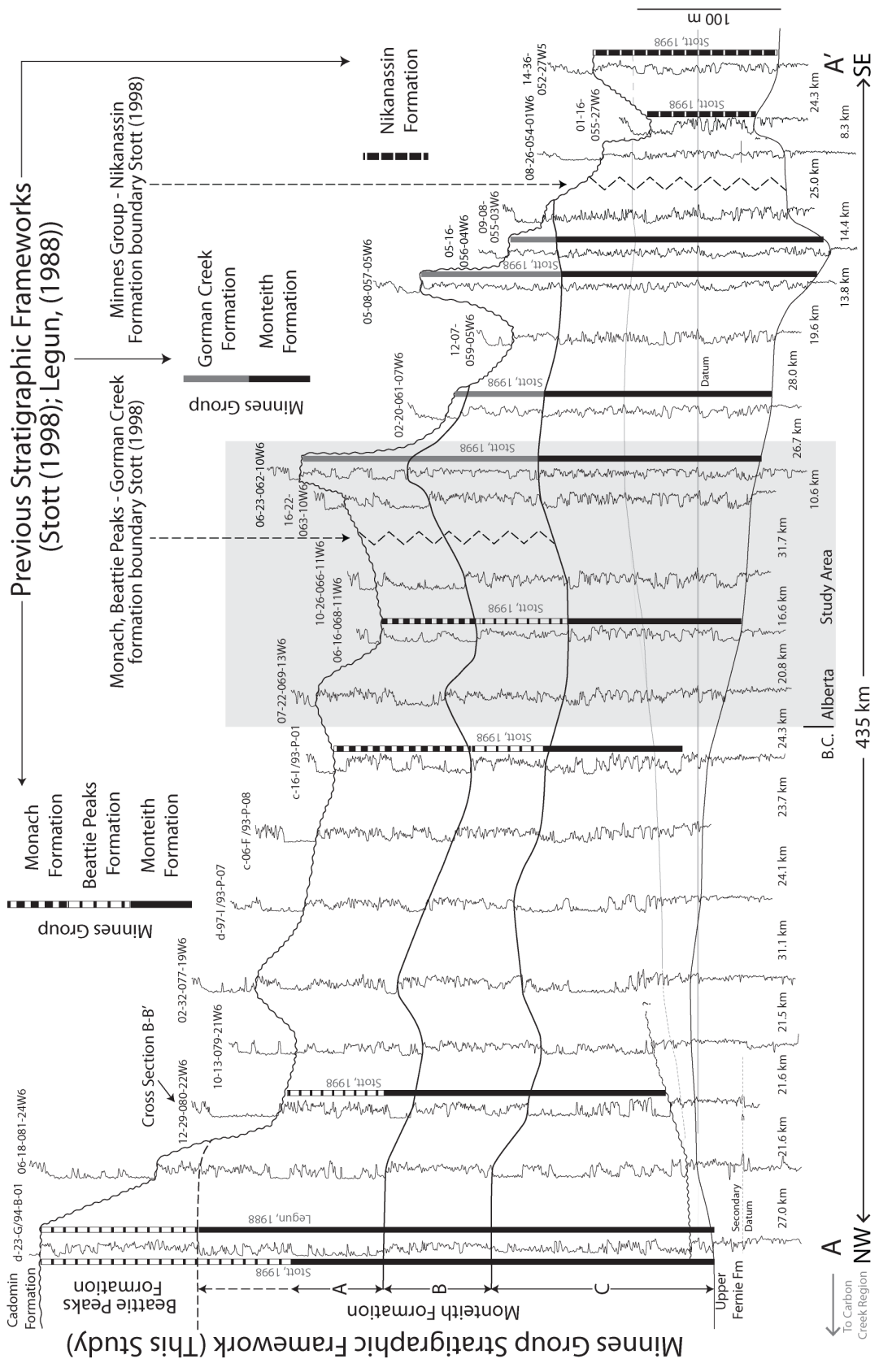

Figure 2. Regional strike oriented cross section (A-A') featuring the stratigraphic correlation scheme adapted in this study indicated by solid lines, as well as previous stratigraphic picks from Stott (1998) and Legun (1988), indicated by bars adjacent to gamma radiation curves. Complex stratigraphic architecture led to incorrect application of the Monach, Beattie Peaks and Monteith formation nomenclature, developed in northeastern British Columbia, to strata in Alberta by Stott (1998). It is apparent that Late Jurassic – Early Cretaceous strata in the Alberta subsurface is lithostratigraphically equivalent to the Monteith Formation in northeastern British Columbia. The Nikanassin Formation is apparently equivalent to the Monteith C. Extent of the Alberta study area is shown in grey.

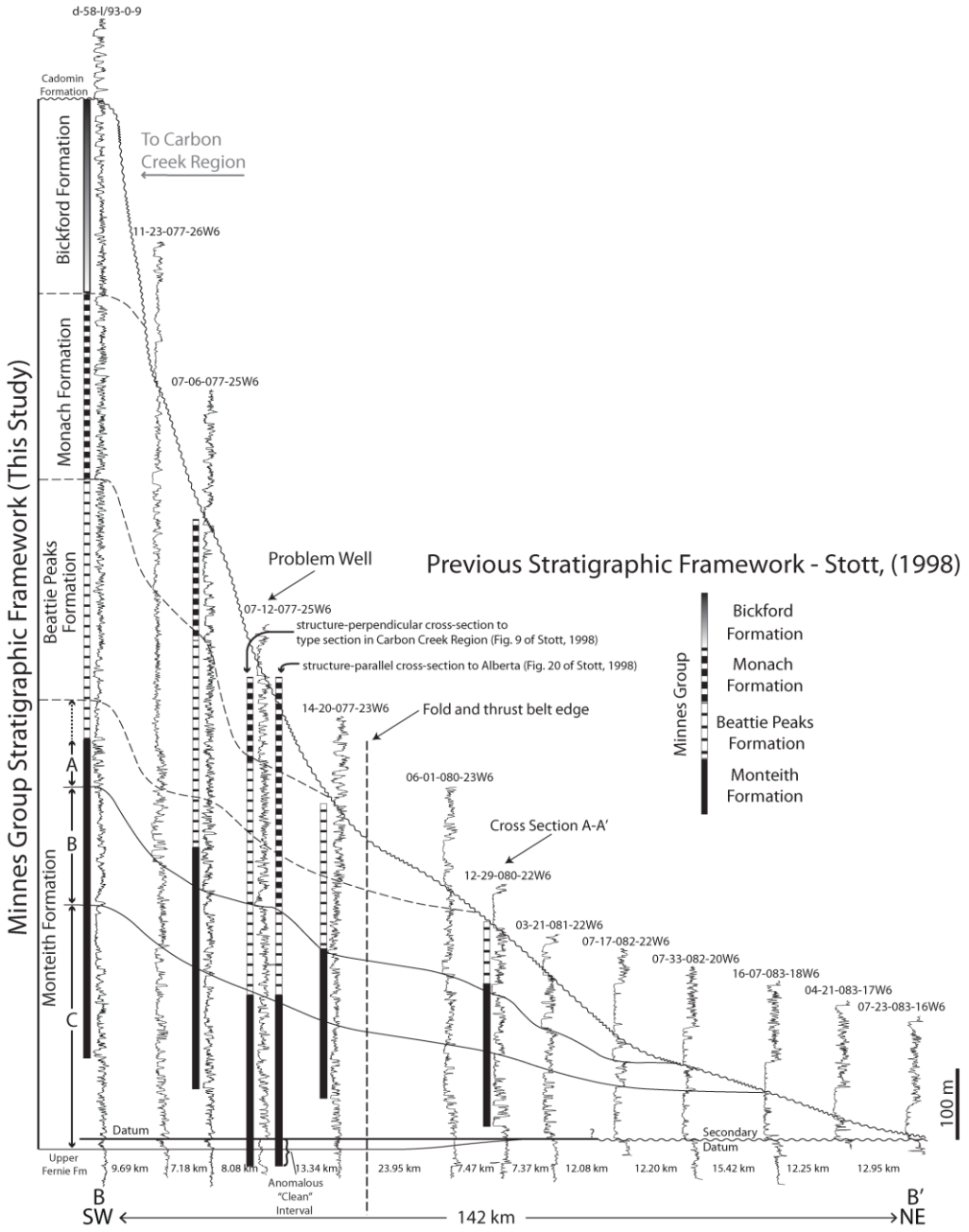

Figure 3. Regional dip oriented cross section (B-B') featuring the stratigraphic correlation scheme adapted in this study indicated by solid lines, as well as previous stratigraphic picks from Stott (1998) and Legun (1988), indicated by bars adjacent to gamma radiation curves. Progressive downcutting and erosion of the Minnes Group associated with the sub-Cadomin unconformity in northeast British Columbia was substantial. The differential application of stratigraphic picks in 07-12-077-25W6 in part, caused mis-correlation of units into the Alberta subsurface; note the very limited spatial extent of the Bickford, Monach and Beattie Peaks formations. The section location is shown in Figure 1A.

References

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Stott, D.F. 1998. Fernie Formation and Minnes Group (Jurassic and Lowermost Cretaceous), Northern Rocky Mountain Foothills, Alberta and British Columbia. Geological Survey of Canada Bulletin 516.