THE SOUTHERN CONTACT OF THE BOWSER LAKE AND SKEENA GROUPS: UNCONFORMITY OR TRANSITION?

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ABSTRACT

New geologic mapping in the west Hazelton map area and immediately adjacent areas has clarified both Bowser Lake Group stratigraphy in this area and the relationship of this strata to the overlying Cretaceous Skeena Group. The upper unit of the BLG in this area is a sandstone dominated shallow marine succession which can be lithostratigraphically correlated to the Muskaboo Creek assemblage known from central and northern Bowser Basin. In at least one area, this shallow marine succession appears to gradationally change upward into a nonmarine unit which has previously been considered as a stratigraphic unit of the Cretaceous Skeena Group. This suggests that at least in this area the Skeena Group is gradational from Bowser Lake Group and represents a southern nonmarine component of an originally contiguous Jura-Cretaceous Bowser Basin.

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INTRODUCTION

Recent efforts have been made by the BC Ministry of Energy and Mines (BCMEM) and the Geological Survey of Canada (GSC) to improve the structural and geological knowledge of the Jurassic-Cretaceous Bowser Basin of northeast BC (Figure 1), as well as to assess its integrated petroleum resource potential (Hayes *et al.*, 2004, Evenchick *et al.*, 2003). During the summer of 2004, this research focused on the southern and central parts of the extensive Bowser Basin NTS map sheets 93M and 104A (summarized in Ferri *et al.*, 2005, Evenchick *et al.*, 2005 respectively).

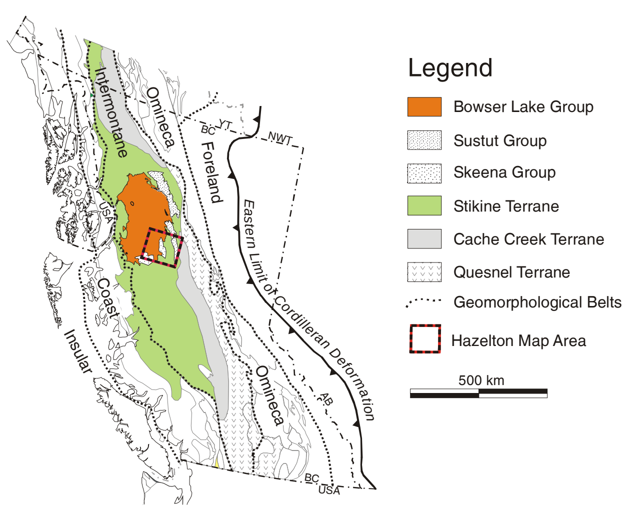

Figure 1. Location of the Bowser, Sustut and Skeena groups within the geological framework of the Canadian Cordillera (modified from Ferri *et al.*, 2005 and Evenchick *et al.*, 2003).

The Bowser Lake Group (BLG) consists of sedimentary rocks of late Middle Jurassic to mid-Cretaceous age and is the oldest of three major stratigraphic successions which comprise the Bowser Basin and related sedimentary rocks (Figure 2). The southern-most region of the BLG in the Hazleton map sheet (NTS sheet 93M) is dominated by shallow marine siliciclastics which on extant geologic maps are defined as "undivided Bowser Lake Group" (e.g. Richards, 1990). Outcropping south of the BLG, a second stratigraphic succession of Lower to Upper Cretaceous rocks is generally termed the Skeena Group (SG). This unit has been interpreted as predominantly deposited in nonmarine fluvial/floodplain and shallow marine environments with localized volcanic influence (e.g. Bassett and Kleinspehn 1997). The stratigraphic relationship between the undivided Bowser Lake Group and the nonmarine sedimentary rocks of the Skeena Group in the southern-most region of the Bowser Basin, remains unclear. Previous workers have suggested that the contact is unconformable, or a fault contact (Tipper and Richards, 1976), or that the Skeena Group sediments represent the Cretaceous continuation of Bowser basin deposition (Bassett and Kleinspehn 1997). Ferri *et al.*, (2005) summarizes previous studies in this area and the complex evolution of stratigraphic terms involving the stratigraphy now termed Skeena Group and Bowser Lake Group in this region.

PROJECT GOALS

This project aims to characterize the shallow marine siliciclastic unit which appears to be the upper stratigraphic unit of the BLG within the Hazelton map area and immediately adjacent regions. The aim is to describe this unit in terms of its sedimentological make up

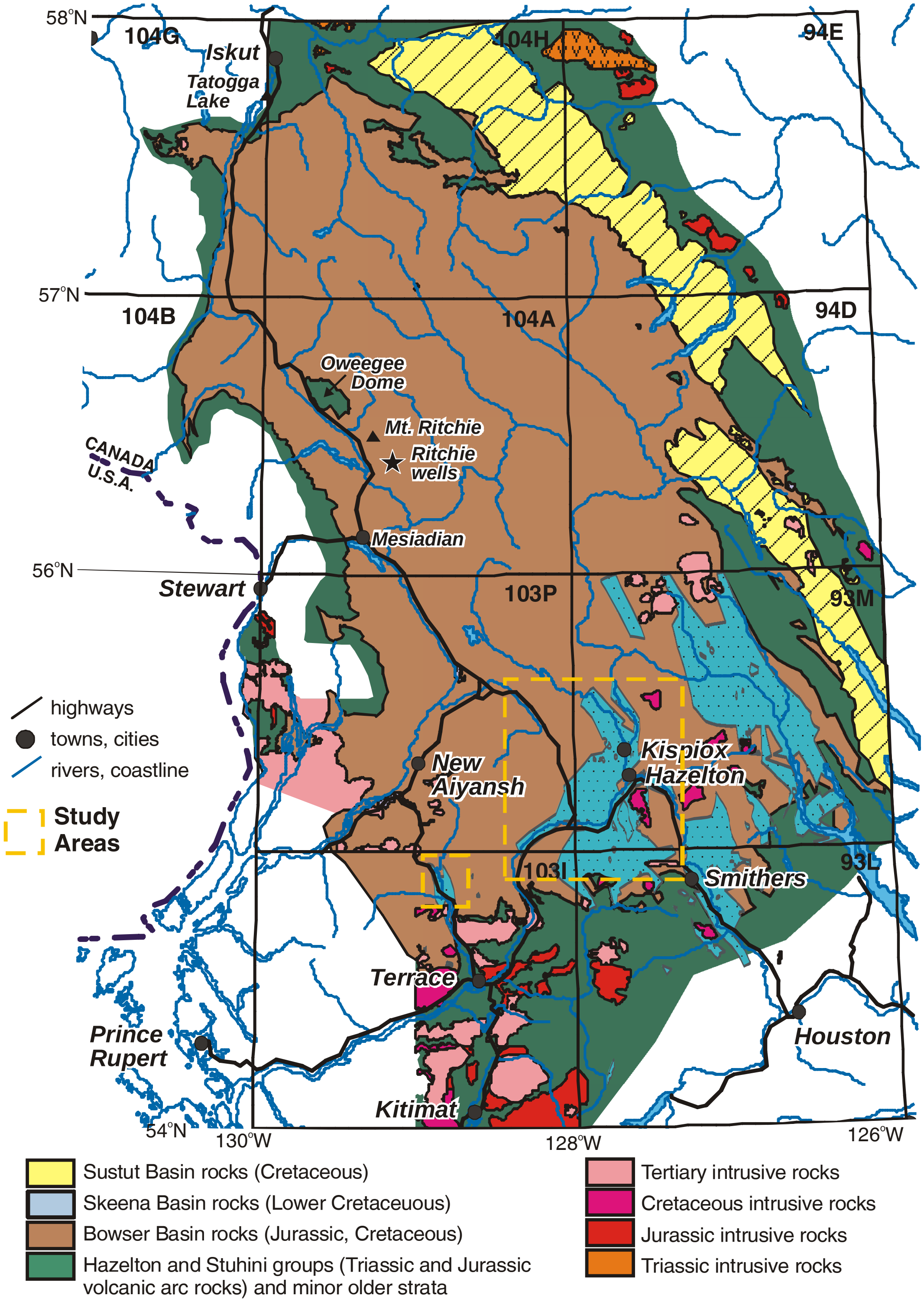

Figure 2. General geology of the Bowser Basin region, showing the distribution of the Skeena Group and the main areas of study for this project (modified from Ferri *et al*., 2005 and Evenchick *et al*., 2003).

and depositional history. This unit will be compared to previous studies of similar lithostratigraphic units in the BLG and Skeena Group to try to discern whether they are correlative. A second major goal of this project is to more clearly define and differentiate the BLG contact nature with the overlying Skeena Group.

WORK TO DATE

Much of the initial part of this project involved assisting in regional mapping of the west half of the

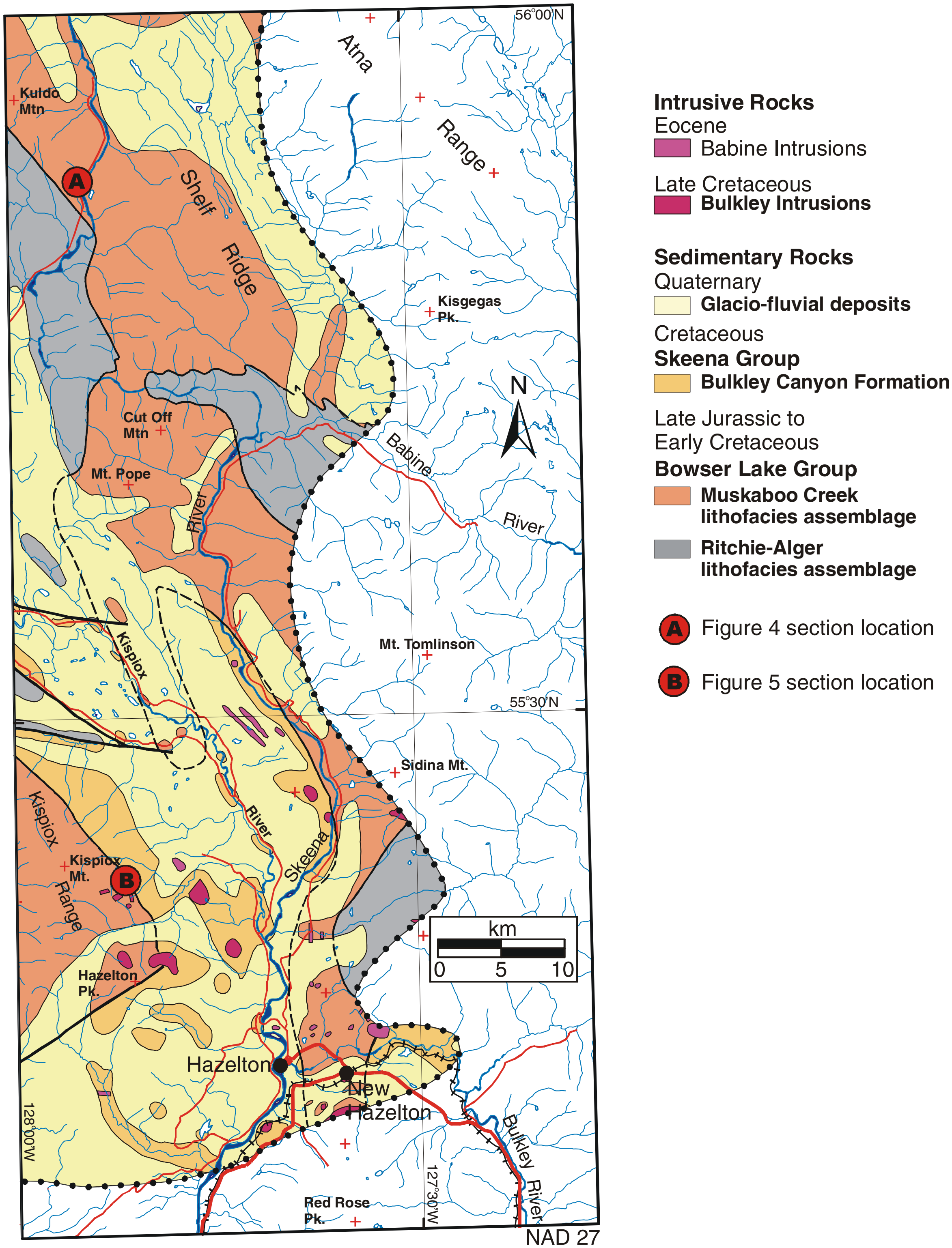

Figure 3. Simplified geological map of the study area with approximate location of measured sections shown in figures 4 and 5 (modified from Ferri *et al*., 2005).

Hazelton map area to define local and regional stratigraphic relationships as well as to view the lateral variance of the undivided BLG and their regional interrelationships. New geologic insights from this regional study are summarized in Ferri et al., (2005), with a simplified version of the new geologic mapping provided in Figure 3.

In conjunction with (and in part a result of) the geologic mapping, eight stratigraphic section localities were chosen, most within the study areas located on

Figure 2. Our selection of the localities were constricted to areas which were previously mapped as undivided Bowser Lake Group, Skeena Group, or areas which have been mapped to show transitional characteristics from possible BLG into Skeena Group. These selections were made as a result of the new geological mapping and from reference to previous work documented by Bassett (1995) and Tipper and Richards (1976).

At each location a detailed stratigraphic measured section was constructed. In the majority of cases, a basal contact was not identified and therefore measurement began from the clearest exposed surface and thus do not represent the total thickness of the stratigraphic unit. Each measured section comprises a detailed lithostratigraphic description, identification of internal sedimentary structures, internal gradational relationships and inference of sediment type and depositional nature. Suitable hand samples were taken at each site to allow for petrographical identification and thin section analysis, as well as maturation and palynology samples, from the more carbonaceous layers, to assist in possible age determination and reservoir potentiality. Figures 4 and 5 illustrate two of these sections.

Hazleton map area Muskaboo Creek Assemblage

In the Hazleton map area, the upper BLG consists of a shallow marine siliciclastic unit greater than 250 metres thick and thought to be Late Jurassic to Early Cretaceous in age. This unit is dominated by medium- to fine-grained lithic arenite with lesser siltstone and mudstone (Figure 4). The sandstones are generally well sorted and contain abundant sedimentary structures indicative, in general, of tidal and shoreface marine environments. These structures include extensive hummocky, swaley and trough cross stratification, flaser and lenticular bedding features, syn-sedimentary ball and pillow structures, as well as minor units of chaotic shell debris and coquina layers.

This assemblage is very similar to, and we correlate it with, the Muskaboo Creek (MBC) assemblage of the BLG, an extensively exposed lithofacies assemblage in map areas north and northeast of the Hazleton area

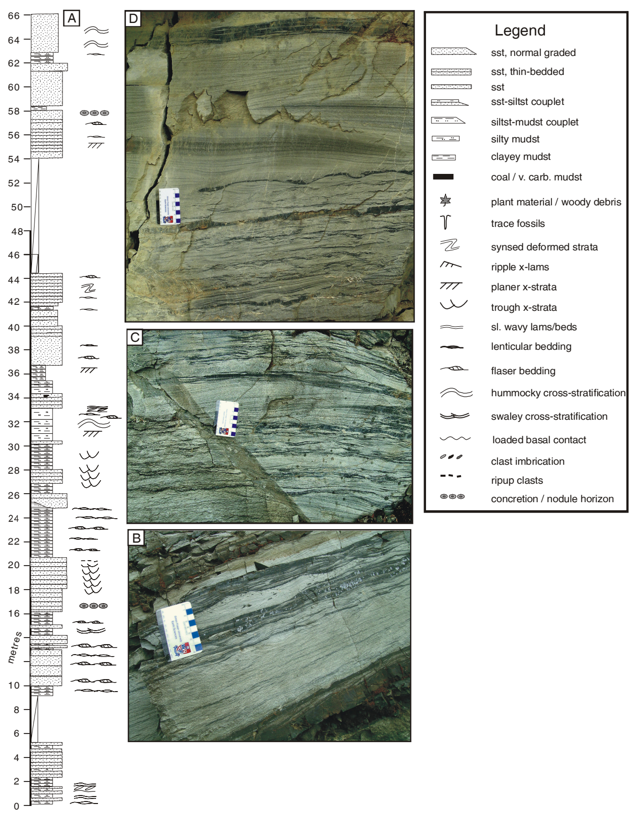

Figure 4. A. Simplified measured section through typical Muskaboo Creek assemblage in Hazelton map area (location A on fig. 3). B. Intercalated sandstone and siltstone showing variations in planar cross stratification types, combined flow ripples, plus minor flaser and lenticular ripple forms (scale in cm) C. Typical complex heterolithic stratification including flaser bedding forms, minor draped ripple laminiton, and minor remnant swaley cross-stratification (immediately above cm scale). D. Sandstone and minor silty mudstone showing lower wavy stratification and rippled sandstone with minor mud drapes changing upward to overlapping hummocky cross-stratified sets(above cm scale). Legend is common for this figure and Figure 5.

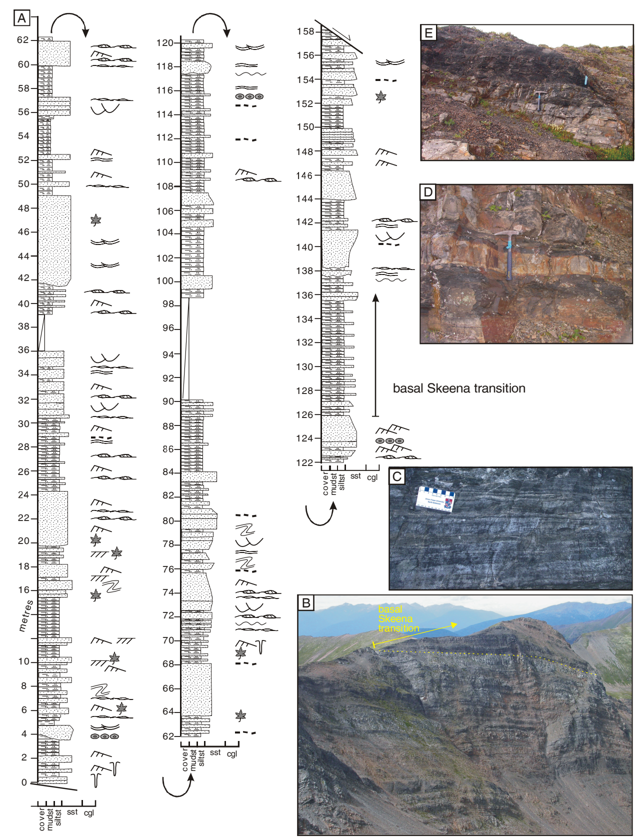

Figure 5. A. Simplified measured section through possible Muskaboo Creek assemblage transition into marginal to nonmarine facies of basal Skeena Group (location B on fig. 3). See figure 4 for legend. B. Looking NW at cliff and ridge of measured section. C. Typical Muskaboo Creek assemblage displaying wavy to heterolithic stratification of sandstone and silty mudstone from this section (scale in cm). D. Brown weathering siltstone and minor sandstone in transitional zone at about 130m in measured section (hammer is about 25cm length) E. Near top of section, illustrating dark grey brown, plant-bearing siltstone with intercalated sandstone of possible basal Skeena Group lithofacies (hammer is about 25 cm length).

(Evenchick and Thorkelson, 2005 and Evenchick *et al.*, 2003, 2005).

In several places, this MBC unit gradationally overlies a siltstone dominated sedimentary unit, which somewhat resembles the Ritchie Alger assemblage of the BLG. However, this siltstone unit lacks the abundance of sandstone turbidite beds typical of Ritchie Alger assemblage in other map areas. It is possible this is a transitional unit from the shallow marine (wave-dominated) MBC unit through deeper marine shelf and slope environments into the submarine fan complexes typical of the Ritchie Alger assemblage (also discussed in Ferri *et al.,* 2005, Evenchick *et al.,* 2005)

In at least one place, this BLG unit grades upward into non-marine fluvial and minor deltaic strata, previously mapped by Richards (1990) as part of the lower Skeena Group (Figure 5). A preliminary conclusion derived from this observation is that, at its southern extent, the Skeena Group is gradational, both laterally and vertically, from the underlying Bowser Lake Group. In turn this may imply that both units belong to a single continuous sedimentary basin, deposited during the latest Jurassic and early Cretaceous time.

Hazleton map area Skeena Group

In the southern part of the Hazelton map area, fluvial to non-marine Skeena Group sedimentary units have been identified by several previous workers. The most common strata consist of non-marine sandstone, mudstone and minor coal layers, which Bassett (1995) considered to be part of her proposed Bulkley Canyon Formation, previously referred to as the Kitsuns Creek Formation by Richards et al. (1990).

The Bulkley Canyon Formation consists of micaceous sandstones with lesser conglomeratic beds which grade upward into coal, with a rich abundance of macroflora and pollen. (Bassett 1995). A basal section of this unit appears to conformably overlie the Muskaboo Creek assemblage is exposed on Kispiox Mountain (figure 3, location B). As shown in figure 5, at this locality a gradational change is suggested from shallow marine sandstone into finer fluvial siltstone containing repeated thin sandstone units lacking in marine sedimentary structures. Further up section this unit appears to interfinger back and forth into marine then fluvial characteristics suggesting periods of transgression and progradation of a shoreline succession. This unit as it occurs in the Hazelton map area is described in more detail in Ferri *et al*. (2005).

CONCLUSIONS AND CONTINUED STUDY

The evidence from the 2004 field season indicates that the Muskaboo Creek Assemblage known from northern parts of the Bowser Basin can also be recognized in southern areas. In addition, in at least one place, this assemblage appears to gradationally change upward into nonmarine strata typically considered part of the Skeena Group, suggesting a conformable contact between these major successions. To support this preliminary conclusion, more examples of this contact need to be identified and documented. In addition, detailed sampling of the existing contact section and any new examples of this contact for palynology and any other paleontologic constraints will be undertaken to try to define the age relationships of the transition.

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