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Stratigraphic Analysis of Cretaceous Strata flanking the Southern Nechako Basin: Constraining basin Architecture and Reservoir Potential

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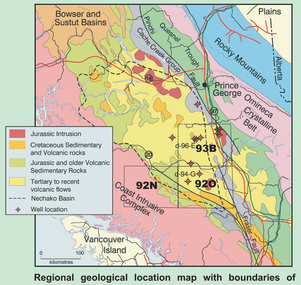
THIS STUDY

This multi-year year study will conduct a regional analysis of lateral and vertical variations in Early Cretaceous stratigraphic character along the southern margin of the Nechako Basin, which will be integrated with analysis of the isolated exposures within the basin to provide constraints on temporal and spatial variations in the subsurface. Field reconnaissance examination in late August 2006 identified the main focus areas for detailed analysis of Lower Cretaceous sedimentary successions in the southern part of the Nechako Basin and along its southern margins. Two M.Sc. students will conduct thesis research as part of this project, as outlined in panels to the right.

Our research builds on earlier studies, but with more detailed sedimentology and stratigraphic analysis, petrologic analysis (with porosity/permeability estimates), provenance studies (detrital mica and zircon, Nd analysis of fine-grained units, geochemistry of conglomerate clasts), biostratigraphic studies and hydrocarbon reservoir rock potential.

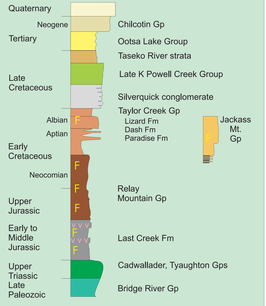
Our emphasis on the Jackass Mountain Group reflects our contention that this is probably the best candidate for a major reservoir system in the subsurface of the Nechako Basin. We suggest that the JMG are the closest surface analogue and most likely directly correlative to the "Skeena Assemblage" of the subsurface,

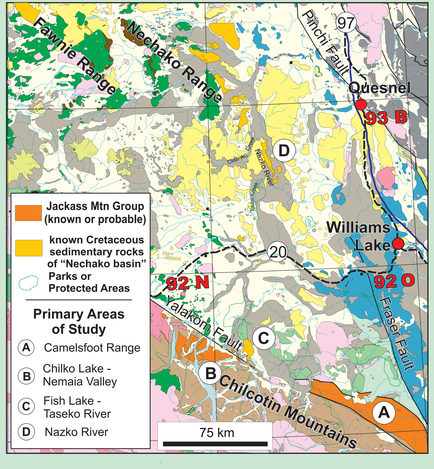


Regional geological location map with boundaries of relevant 1:250 000 map areas

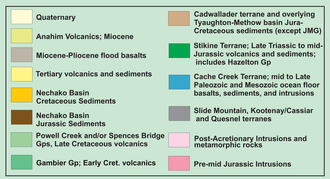
(modified from B.C. Ministry of Energy, Mines and Petroleum Resources, 2002, used with permission).

Simplified Stratigraphy of the Chilcotin Mountains





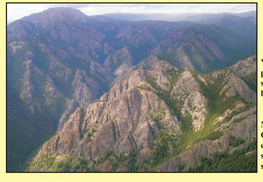
At the southern end of the Nechako Basin, Lower Cretaceous Jackass Mountain Group (JMG) strata are unconformably overlain by Neogene volcanic rocks. They are generally classified as part of the Methow Basin, but are clearly the surface expressions of strata that continue northward into the subsurface beneath the Tertiary rocks which form most of the exposed strata of the Nechako Basin (Hickson et al., 1994, Mahoney et al., in review). The JMG and associated strata include thick (1000's m), laterally extensive (10's km) marine sandstone successions that overlie and interfinger with marine mudstones. However, the three dimensional architecture of the stratigraphy is very poorly constrained, and therefore the subsurface facies distribution is unknown. Previous studies have interpreted them as the deposits of large submarine fan deposystems (e.g. Kleinspehn, 1982, 1985). However, these previous studies have been primarily "first order" stratigraphic assessments commonly associated with government regional mapping projects and precede a large number of studies over the last 15 years which have greatly enhanced the understanding of submarine fan sedimentation models (e.g. Bouma, 2000). 2000).



Regional geological framework and location of major areas of study

(modified from Ferri and Riddell, 2006 and Riddell, 2006, used with permission)

M.Sc. Project: Stratigraphy and Sedimentology of the Jackass Mountain Group, Camelfoot Range, B.C.

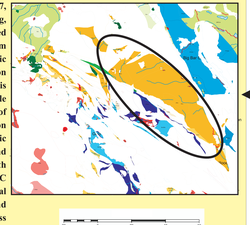


Exposures of Jackass Mountain Group in the Camelsfoot Range

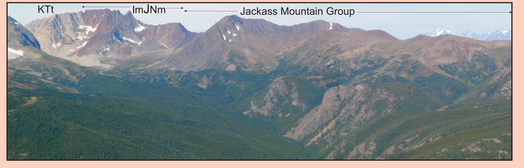
Left: looking northwest toward Yalakom Mountain (upper left of photo), showing several km thick successions dominated by thick-bedded sandstone turbidites.

Top: looking east from Yalakom Mountain area at eastern Camelsfoot Range ridges showing extensive sandstone and mudstone submarine fan facies associations of steeply south-dipping JMG strata

Russell Goodin will conduct an M.Sc. investigation of well exposed sections of the JMG in the Camelsfoot Range (regional geologic map, locality A). The JMG is well exposed on several ridges in this area and volumetrically the most significant unit in the central and eastern Camelsfoot Range (Hickson et al, 1994, Schiarizza et al., 1997, Mahoney et al., in review). It forms the central part of a ~150 km long, southward-tapering wedge of mainly medium- to coarse-grained sandstone and polymictic conglomerate exposed between the Yalakom and Fraser fault systems. It is part of a broad, asymmetric synclinorium; the base of the unit is exposed in steeply dipping beds on the western limb, east of the Yalakom River, and the upper part is exposed in moderately west-dipping beds in the eastern limb. Multiple stratigraphic sections will be measured with detailed examination of the facies associations and architecture on the ridges between section locations. Extensive sampling of rock types keyed to stratigraphic position will facilitate detailed petrologic, organic maturation, and porosity/permeability analyses (done mostly in conjunction with ongoing regional studies of these parameters by F. Ferri of the BC Geological Survey as outlined in Ferri and Riddell, 2006). Traditional sedimentologic measurements (paleocurrents, facies types and descriptions, conglomerate clast compositions, stratigraphic thickness variations and cyclicity and other sedimentologic parameters) will be supplemented with sampling for isotopic provenance studies. It is hoped that new fossil localities will add to biostratigraphic information available for these units.

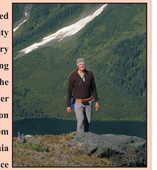


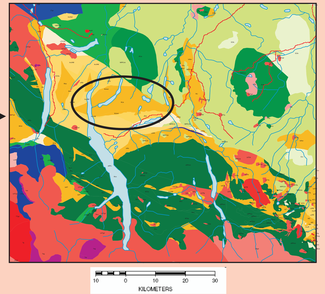
M.Sc. Project: Stratigraphy and Sedimentology of the Jackass Mountain Group, Nemaia Mountain area, British Columbia



Looking west at Nemaia Range ridges, showing extensive steeply NE dipping JMG strata, unconformably overlying Jurassic strata informally named Nemaia formation by Schiarizza (2002, labelled lmJNm on photos). KTj is an unnamed and undated pluton of probable Cretaceous or Tertiary age (Schiarizza, 2002). Dashed lines within JMG indicate the general dip of strata, with tops to the NE.

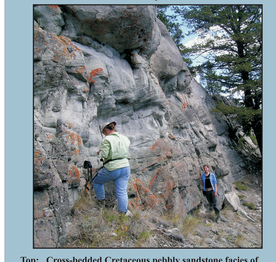
Kate MacLaurin (right), soon to be an SFU M.Sc. student, will conduct a detailed stratigraphic study of JMG and related strata in the Chilko Lake – Namaeia Valley area (locality B on main geologic map figure). JMG and other Jurassic and Cretaceous sedimentary successions are well exposed in this area, especially on Namaeia Mountain and surrounding ridges (photo above, Schriazzia et al., 2002). These strata occur immediately southwest of the Yalakom Fault and traditionally are considered part of the Tyaughton Basin, which Garver (1992) described as a sub-basin separate from the Methow Basin, with different sedimentation patterns and source areas. However, restoration of the ~115 km of dextral offset on the Yalakom Fault restores the JMG of the Camelsfoot Range directly adjacent to the Chilko Lake – Nemaia exposures, suggesting original depositional continuity. Detailed stratigraphy and provenance analysis of Cretaceous strata in both areas will document lateral and vertical depositional patterns and source regions, which will permit evaluation of the 'sub-basin' hypothesis of Garver (1991) and provide new and more detailed information to constrain the nature of the JMG along the southern margin of the Nechako Basin.

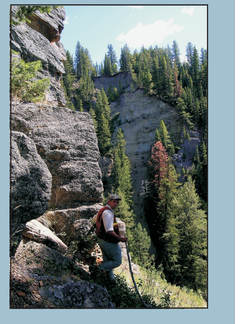




Regional Studies

In addition to the detailed M.Sc. project studies, Mustard and Mahoney have begun a regional study of these Cretaceous strata. Examination of Lower Cretaceous strata in well exposed areas (potentially all identified areas of Cretaceous strata on the geologic map figure) will permit regional evaluation of lateral variations in the stratigraphic successions. Paleocurrent and provenance data will be collected, including systematic sampling for isotope geochemistry, conglomerate clast geochemistry, and sandstone petrology. Detailed stratigraphic sections will be integrated with sections provided by the M.Sc. projects to provide a regional stratigraphic framework. For example, locality C (geologic map figure) includes several different areas of known lower Cretaceous sedimentary rock exposures south of hydrocarbon exploration site d-94-G. These are described from regional mapping projects, in most detail in Schiarizza and Riddell (1997) who refer to these strata by various locality names (Chaunigan Lake, Vick Lake, Fish Lake, Elkin Creek). Much of these strata have been tentatively correlated with either Relay Mountain Group or JMG strata, both by Schiarizza and Riddell (1997) (see also Schiarizza et al., 2002) and on the new Geological Survey of Canada geology map for map area 92O (Mahoney et al. in review). As part of this project, these areas will be re-examined and evaluated for their relationship to other Cretaceous units and role in overall basin development.





Top: Cross-bedded Cretaceous pebbly sandstone facies of Taseko River area (locality C on geologic map figure)

Right: Thick succession of Cretaceous cross-bedded pebble conglomerated and sandstone, Nazko River area of central Nechako Basin

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