Eocene Volcanic Stratigraphy of the Nechako Region, Central British Columbia

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1. Introduction

A new volcanic stratigraphic framework is presented for the Eocene period in the Nechako region of central British Columbia (**Fig.1**) based on field data collected in 2010 and 2011.

Eocene volcanic stratigraphy is constrained from:

- Field observations
- Petrography
- Physical properties (density, magnetic susceptibility)
- Geochemistry
- Geochronology
- Interpretative maps & stratigraphic logs (**Figs. 2 to 6**)

Variable thicknesses of Eocene volcanic rocks are interpreted from:

- oil and gas wells
- magnetotelluric sections
- seismic reflection lines (located on **Fig.3**)

The resulting stratigraphic framework will support interpretation of volcanic processes and timing of volcanic activity, as well as syn- and post-volcanic deformation in the Nechako region. Spatial and temporal relationships between the different magmatic and structural elements will constrain the role played by tectonics in the structural, magmatic and metallogenic evolution of the central Canadian Cordillera during the Early cenozoic.

2. Geological Setting

The Nechako region is bounded to the east by the Fraser fault, to the west by the Coast Mountains and Yalakom fault, by the Skeena arch to the north and the Tyaughton Basin to the south (**Fig.1**; Ferri and Riddell, 2006).

The Nechako region is underlain by the accreted Paleozoic to Mesozoic terranes of Stikinia (island arc), Cache Creek (subduction-related accretionary-complex) and Quesnellia (island arc) (**Fig.1**; Monger and Price, 2002).

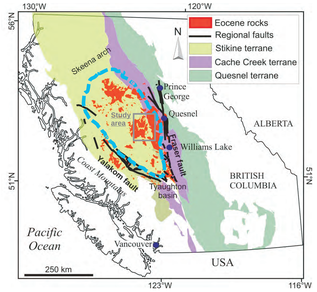


Fig 1. Location of the Nechako region in central British Columbia and position relative to the accreted terranes and regional structures (simplified from Massey et al., 2005).

Nechako region volcanic rocks erupted from the Late Cretaceous until the Holocene (**Fig. 2**) in a post-accretion, dominantly extensional tectonic setting (Struik, 1993; Struik and MacIntyre, 2001). These rocks formed during a period of regional northwest-directed extension associated with movements along major north-northwest-trending structures, such as the Yalakom and Fraser dextral strike-slip faults (Struik, 1993; Umhoefer and Schiarizza, 1996).

3. Study Area Geology and Volcanic Stratigraphy

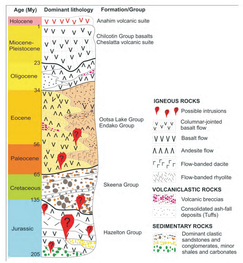


Fig 2. Generalized regional stratigraphy for the Nechako region

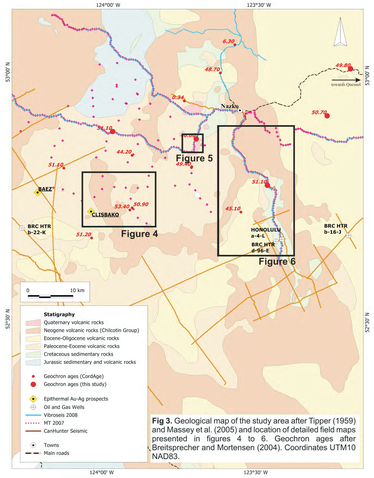


Fig 3. Geological map of the study area after Tipper (1959) and Massey et al. (2005) and location of detailed field maps presented in figures 4 to 6. Geochron ages after Breitsprecher and Mortensen (2004). Coordinates UTM10 NAD83.

Thickness constraints on Eocene volcanic rocks

• Oil and gas wells: locally intersected up to 4000m of Eocene volcanic rocks (Well b-22-K; **Fig. 3**)

• Magnetotelluric datasets: a shallow conductive layer ranging in depth from 0 to 4000m is regionally correlated with the surface-mapped Eocene volcaniclastic rocks (Spratt and Craven, 2011)

• Seismic interpretations suggest the development of fault-bounded pull-apart basins during the Eocene infilled with the products of extensive volcanism (Hayward and Calvert, 2011)

4. Field Observations and Data from the Clisbako Prospect area

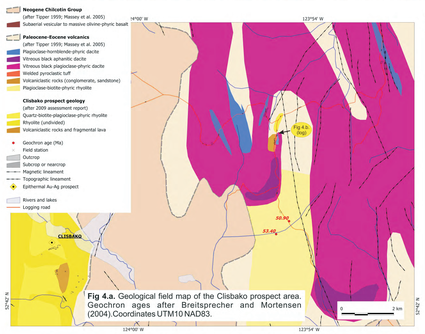


Fig 4.a. Geological field map of the Clisbako prospect area. Geochron ages after Breitsprecher and Mortensen (2004).Coordinates UTM10 NAD83.

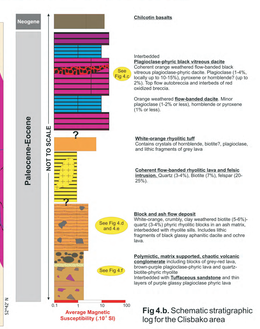


Fig 4.b. Schematic stratigraphic log for the Clisbako area

Fig 4.c. Flow-banded purple-grey plagioclase-phyric vitreous black dacite

Fig 4.d. Outcrop of poorly welded, grey-white, crumbly, block and ash flow deposit (see thin section Fig 4.e)

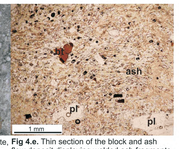


Fig 4.e. Thin section of the block and ash flow deposit displaying welded ash fragments (ash), broken biotite (bt) and plagioclase (pl) crystals

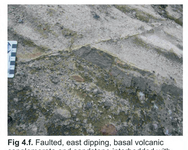
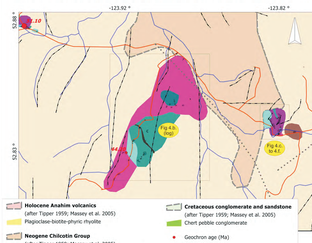
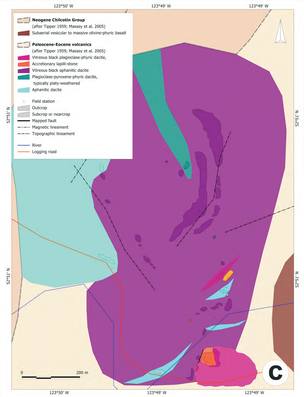


Fig 4.f. Faulted, east dipping, basal volcanic conglomerate and sandstone interbedded with cm-scale beds of purple rhyolitic lava.

5. Field Observations and Data from the Baezaeko Area





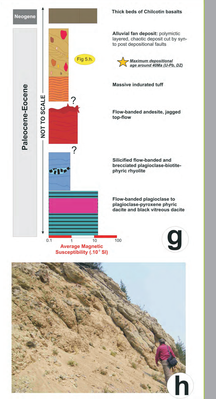


Fig 5.a. Geological field map of the Baezaeko area. Geochron ages after Breitsprecher and Mortensen (2004). Coordinates UTM10 NAD83.

Fig 5.b. Schematic stratigraphic log for the western Baezaeko area

Fig 5.c. Detail of the geological field map for the central Baezaeko area. Coordinates UTM10 NAD83.

Fig 5.d. Schematic stratigraphic log for the central Baezaeko area

Fig 5.e. Field photograph of the chaotic, non sorted fragmental unit comprising vesicular and non vesicular vitreous dacite blocks in a pale yellow lapilli-tuff matrix
with variable amounts of pyroxene and quartz crystals

Fig 5.f. Field photograph of the layered accretionary lapilli-tuff

Fig 5.g. Schematic stratigraphic log for the eastern Baezaeko area

Fig 5.h. Epiclastic alluvial fan deposit with internal layering and blocks of various nature: Biotite-quartz-phyric flow-banded rhyolite, red vesicular rounded lava blocks, light grey vesicular aphanitic lava, dark grey biotite-feldspar-phyric lava, highly vesicular grey aphanitic lava and crystalline flow-banded vitreous dacite

6. Field Observations and Data from the Nazko River Valley

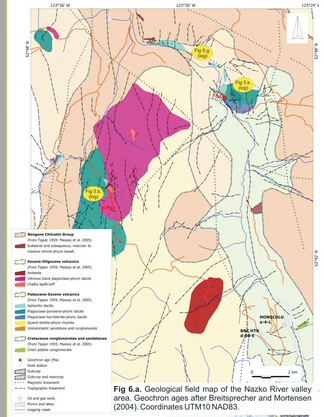


Fig 6.a. Geological field map of the Nazko River valley area. Geochron ages after Breitsprecher and Mortensen (2004). Coordinates UTM10 NAD83.

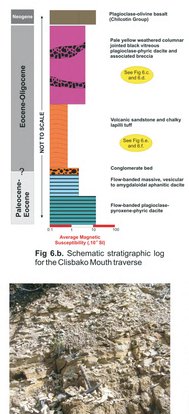


Fig 6.b. Schematic stratigraphic log for the Clisbako Mouth traverse

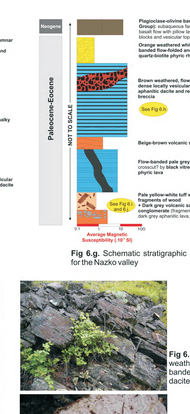


Fig 6.g. Schematic stratigraphic log for the Nazko valley

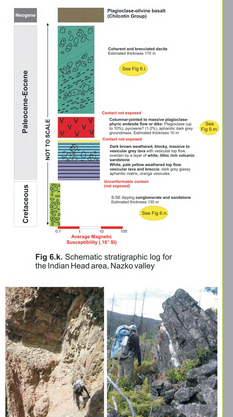


Fig 6.k. Schematic stratigraphic log for the Indian Head area, Nazko valley

Fig 6.c. Outcrop of subhorizontally columnar-jointed plagioclase-pyroxene-phyric vitreous dacite

Fig 6.d. Hand sample of vitreous black plagioclase (5%)-phyric dacite

Fig 6.e. Outcrop of flow-banded chalky lapilli-tuff and volcanic sandstone

Fig 6.f. Hand sample of volcanic sandstone-conglomerate and chalky light white-grey lapilli-tuff. Contains blocks of glassy dacite, ash pods and lithics.

Fig 6.h. Brown weathered flow-banded aphanitic dacite

Fig 6.i. Ash tuff with fragments of wood

Fig 6.j. Volcanic conglomerate and sandstone

Fig 6.l. Thick coherent and brecciated dacitic lava, probably part of a lava dome complex

Fig 6.m. Columnar jointed plagioclase-phyric andesite flow or dike

Fig 6.n. Southeast-dipping Cretaceous conglomerates at the Indian Head promontory.

7. Conclusions and Future Work

The Nechako region of central British Columbia is covered with a range of coherent volcanic and volcaniclastic rocks of various ages, compositions and textures, reflecting a long-lived and complex history of tectonomagmatic events.

In the Nazko River valley, Eocene volcanic rocks overlie the deformed Cretaceous clastic rocks, which have also been intersected by two oil exploration wells. According to previous mapping by Tipper (1959), two volcanic sequences exist in this area. A Paleocene-Eocene sequence includes basal volcanic conglomerate beds, m- to m-scale ash tuff and volcanic sandstone deposits, and interlayered coherent dacitic lavas. A younger Eocene-Oligocene sequence may include a columnar-jointed vitreous dacite facies.

In the Clisbako deposit and Baezaeko areas, evidence of explosive felsic volcanism is characterized by exposures of accretionary lapilli-stone, chaotic volcaniclastic deposits, and welded pyroclastic deposits. Coherent lava are commonly represented by flow-banded aphanitic to plagioclase and hornblende phyric dacites.

Eocene rocks in the Nechako region are locally unconformably covered by thick subhorizontal beds of massive to blocky or columnar jointed, vesicular to non vesicular basalts of the Chilcotin Group.

The preliminary stratigraphic framework proposed here will be improved by a series of U-Pb and Ar-Ar dates. This framework will also support a regional scale 3D thickness model for the Eocene volcanic rocks.

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