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FORT SHEPHERD TOWNSEND'S BIG-EARED BAT PROJECT GEOLOGICAL SETTING

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Prepared for:

Columbia Basin Fish and Wildlife Compensation Program
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Introduction

A field investigation was undertaken on 23 October 2003 by Marc Deschênes, geological consultant, at the request of Mr. John Gwilliam of the Columbia Basin Fish and Wildlife Compensation Program to assess the geological setting and physiographic features which form the Townsend's Big-Eared Bat roosts located south of Trail, B.C.

Bedrock Geology

The regional geology of the Trail-Rossland area is underlain by a suite of rocks belonging to the Rossland Group of early Jurassic age (185-205 million years). It comprises a basal succession of dominantly fine-grained clastic rocks of the Archibald Formation, volcanic rocks of the Elise Formation and overlying clastic rocks of the Hall formation. The Rossland Group in the Trail – Rossland area is intruded by a number of different plutons including the Middle to Late Jurassic Nelson intrusions (145-175 million years), the Middle Eocene Coryell intrusions (45 million years) and numerous felsic and mafic Tertiary dikes (5-65 million years) (Hoy and Andrew 1991).

The project area's geologic setting is characterized by volcanic rocks of the Lower Elise Formation, comprised essentially of basaltic (augite +/- plagioclase) flows and flow breccias. These rocks are in contact with an andesite tuff and plagioclase, augite crystal tuff unit exposed on the upper slopes (Hoy and Dunne 1990). To the north of the project area, the volcanic rocks are intruded by granite and granodiorite rocks of the Nelson intrusions (Dunne and Hoy 1991).

Tectonic and Structural History

The rocks in this region originated as a collage of off-shore arcs forming a terrane known as Quesnellia. Volcanism and subvolcanic intrusive activity followed and formed the Rossland Group. Tectonic plate movement caused the Quesnellia terrane to converge with the ancient continental North American margin causing compression, substantial uplift and erosion. Further volcanic outpourings and the emplacement of granitic intrusions occurred during the early period of mountain building. These processes and their accompanying stresses resulted in extensional tectonics, strike-slip faulting and substantial erosion, followed by a notable heating event. The resulting geologic structure of the project area is characterized by rocks typically striking north and dipping to the west. The area is also marked by a number of north trending faults (Fyles 1970, Poulton and Aitken 1989).

Glacial History and Physiography

The study area lies within a region that has undergone four major glaciations. During the last major ice advance, about 15,000 years ago, the ice probably covered much of the area, leaving only the peaks above 7000 feet exposed. The last glaciation ended approximately 11,000 years ago. Ice flow direction was generally S-SE (Ryder et al. 1991). Following glacial erosion, the landscape was modified by fluvial, mass wasting and other erosional processes.

Description of the Geological Setting and Geomorphological Features

The field assessment of the project area via a foot traverse included the investigation of eight identified Townsend's Big-Eared Bat roosts.

The upper slopes are characterized by discontinuously exposed cliffs and bluffs of dark colored bedrock composed of volcanic basalt flows and flow breccias. The bedrock in some areas appears massive while in other areas the rock is highly fractured. The rock also displays a prominent joint set (60-120 degrees), characteristic of rocks which have undergone magmatic cooling along with structural deformation. These volcanic rocks are also more erodible than the intrusive rocks due to their mineral composition.

The lower slopes are mainly underlain by talus comprised of angular rock fragments (a mixture of blocks and rubble > 2 mm in size) (Figure 1) with a lesser and variable thickness of glaciofluvial material composed of mainly gravelly sands. Occasional outcroppings of glacially eroded bedrock of volcanic origin are also exposed. Overlying and partially imbedded in the talus are significantly large blocks, 4-6 m in height, of volcanic rock which likely originated from the cliffs in the mid-slope area. (Figure 2). It is suspected that natural erosional processes such as the freeze-thaw cycle, fracturing and rockfall, would explain how these large blocks were displaced from their place of origin and reached their present location by probable means of gliding or tumbling. Some blocks occur as isolated features while others are intricately stacked against each other in clusters of two or more (Figure 3). Their square-like shape reflects the well-defined fracture pattern of these volcanic rocks. One particular zone displays a higher density of these large blocks forming a down slope linear fan-like configuration, suggesting a significant rock slide event (Figure 4) possibly following the last deglaciation period when the landscape was particularly unstable.

Most of the bat roosts are located in caves, inside fracture systems or in cavities associated with the large talus blocks. The caves are generally formed by stacked blocks of rock which in some cases have fractured and collapsed in place, forming irregularly shaped caves. The caves typically have two or more narrow openings, commonly formed by the random stacking of the blocks (Figure 5). Smooth fracture planes along the side of a block often form one side of an opening. The inside of the cave can measure up to 3 m in height and 7 m in length (Figure 6). Some of the bat roosts are found in sub-vertical fractures formed by the natural fracture pattern of individual blocks. Others are found in natural cavities formed on the underside of blocks resting on an irregular rocky (talus) surface. Two of the bat roosts are actually located in old mine adits excavated horizontally into the bedrock (Figure 7). The rock is composed of altered basaltic flows intersected by sub-horizontal shear zones. The mine adits are typically 1-2 m wide by 1.5-2 m high and 2-4 m in length.

Conclusion

Townsend's Big-Eared Bats (Figure 8) appear to have selected a site for their roosts within an area characterized mainly by an array of large, stacked blocks comprised of dark volcanic rock, and forming a complex system of caves, fractures and cavities. However it is uncertain whether this is coincidental or if a possible correlation exists between the location of the roosts and the geologic setting and geomorphological environment. A question which needs to be addressed is: Are there further occurrences of Townsend's Big-Eared Bat roosts in the West Kootenays associated to a similar type of geological and geomorphological environment? An exploratory reconnaissance within the region occupied by the volcanic rocks of the Elise Formation, which are exposed in an arcuate belt of rock that extends south from Nelson towards Salmo and west to Rossland (Andrew et al. 1991; Little 1985) (Figure 9) may prove the discovery of other sites.

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Figure 1. The lower slopes are mainly underlain by talus comprised of angular rock fragments which are a mixture of blocks and rubble > 2mm in size.

Figure 2. Large blocks four to six meters in height overly the talus. These blocks likely originated from the cliffs at mid slope which can be seen in the background of this photograph.

Figure 3. Some of the large blocks are intricately stacked against each other in clusters of two or more.

Figure 4. Evidence of a significant rock slide event which may have occurred following the last de-glaciation period when the landscape was unstable.

Figure 5. The caves typically have two or more openings, commonly formed by the random stacking of the blocks.

Figure 6. The inside of this cave measured three meters in height at the peak and seven meters in length.

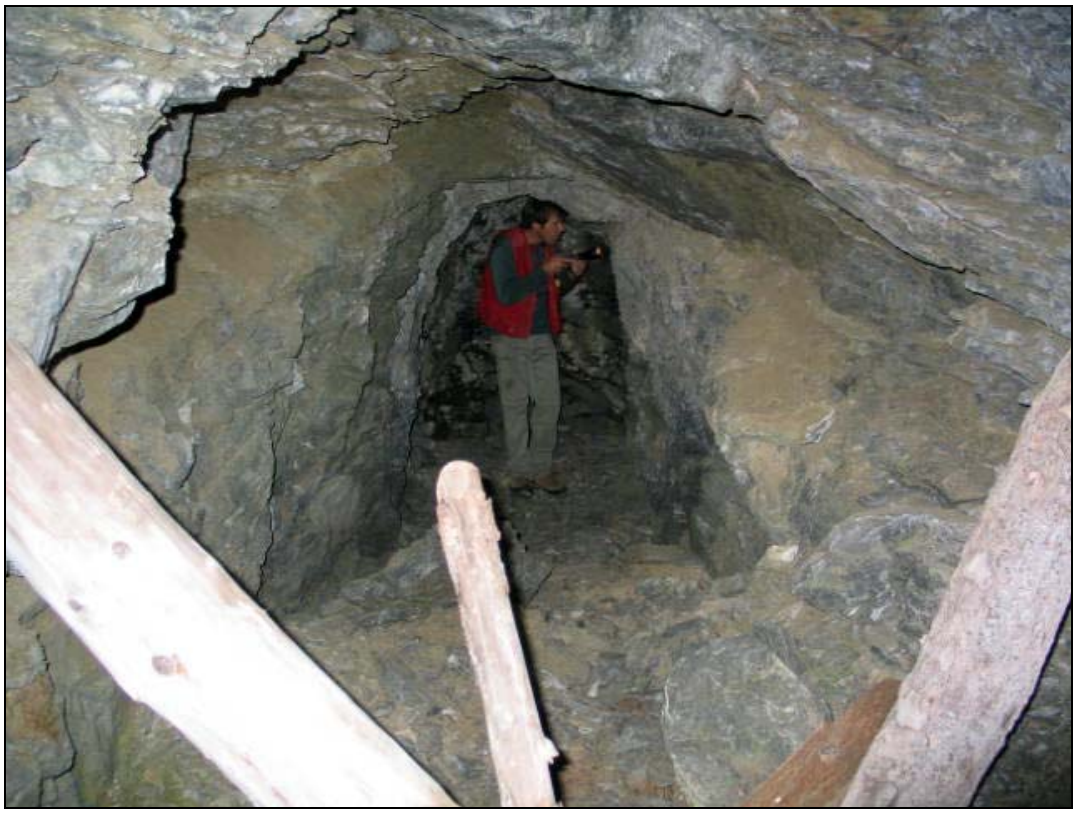

Figure 7. A mine adit that contained a large cluster of female Townsend's big-eared bats.

Figure 8. Townsend's big-eared bat *Corynorhinus townsendii).*

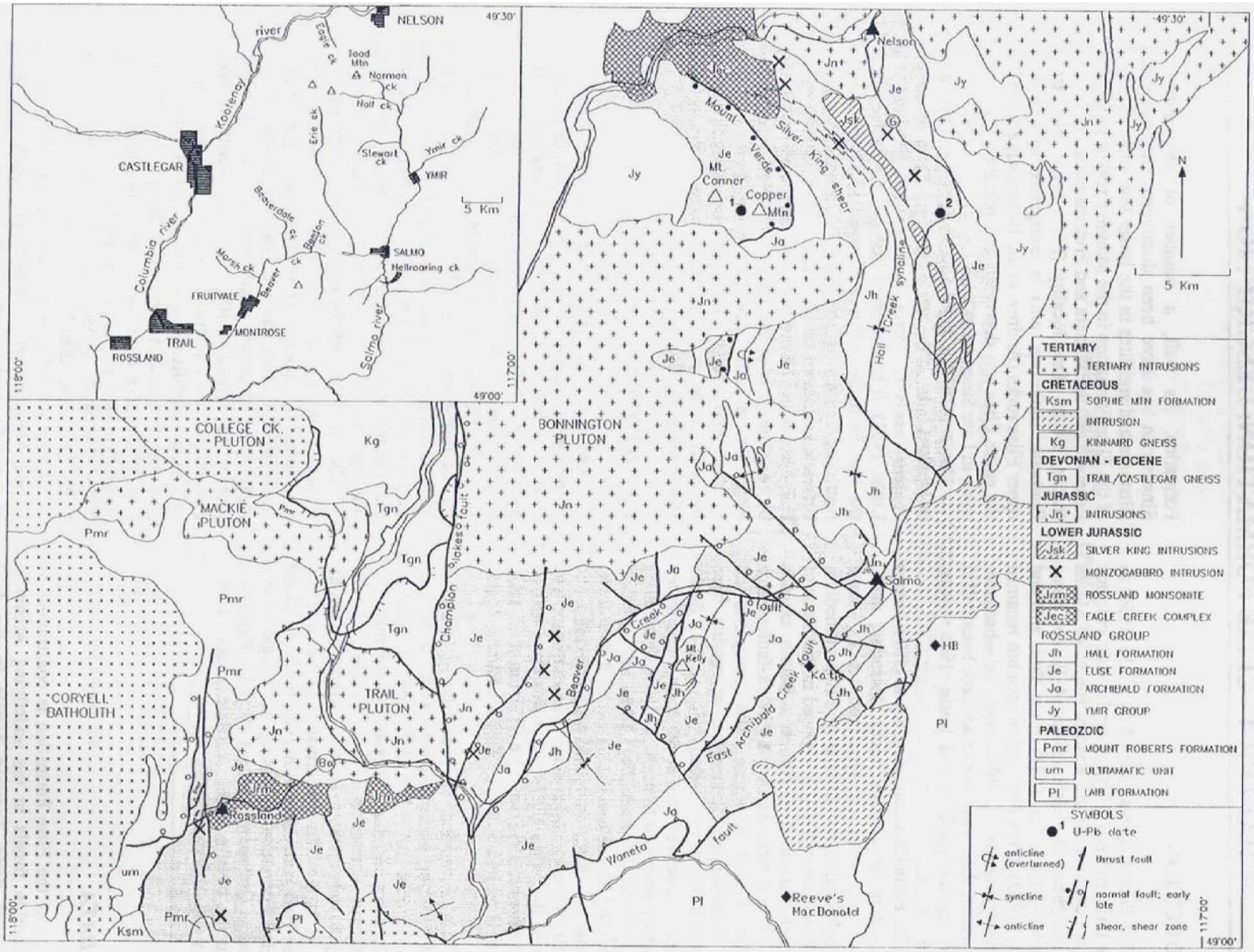

Figure 4-1. Map showing the distribution of the Elise Formation and locations of sections described in text; (after Andrew *et al.*, 1991; Little, 1985 and included references).