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Middle to Late Pleistocene ice extents, tephrochronology and paleoenvironments of the White River area, southwest Yukon

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ABSTRACT

Sedimentary deposits from two Middle to Late Pleistocene glaciations and intervening non-glacial intervals exposed along the White River in southwest Yukon, Canada, provide a record of environmental change for much of the past 200 000 years. The study sites are beyond the Marine Isotope stage (MIS) 2 glacial limit, near the maximum regional extent of Pleistocene glaciation. Non-glacial deposits include up to 25 m of loess, peat and gravel with paleosols, pollen, plant and insect macrofossils, large mammal fossils and tephra beds. Finite and non-finite radiocarbon dates, and twelve different tephra beds constrain the chronology of these deposits. Tills correlated to MIS 4 and 6 represent the penultimate and maximum Pleistocene glacial limits, respectively. The proximity of these glacial limits to each other, compared to limits in central Yukon, suggests precipitation conditions were more consistent in southwest Yukon than in central Yukon during the Pleistocene. Conditions in MIS 5e and 5a are recorded by two boreal forest beds, separated by a shrub birch tundra, that indicate environments as warm or warmer than present. A dry, treeless steppe-tundra, dominated by *Artemisia frigida*, upland grasses and forbs existed during the transition from late MIS 3 to early MIS 2. These glacial and non-glacial deposits constrain the glacial limits and paleoenvironments during the Middle to Late Pleistocene in southwest Yukon.

1. Introduction

Beringia, the mostly non-glaciated area of Yukon, Alaska and eastern Asia, was a large area created by periods of eustatically lowered sea levels during cold stages of the late Neogene (Hopkins, 1967; Hopkins et al., 1982; Fig. 1). The area was seemingly cold enough to support extensive glaciation, but the pronounced aridity resulted in much of this area remaining ice-free during the Pleistocene (Guthrie, 2001). This non-glaciated region provides an exceptional sedimentary record dating back through the late Cenozoic, much of it dateable beyond the limit of radiocarbon by the presence of widespread distal tephra beds (*e.g.* Westgate et al., 1990; Froese et al., 2009). Because of the excellent stratigraphic exposures and the potential for dating and correlating these tephra beds, much of the paleoenvironmental research has focused on the non-glaciated areas of Yukon and Alaska (e.g. Anderson and Lozhkin, 2001; Goetcheus and Birks, 2001; Zazula et al., 2006a,b, 2007; Froese et al., 2009).

The glaciated eastern fringe of Beringia, beyond the limit of the last Cordilleran Ice Sheet, preserves a record of earlier glaciations and includes rare, interbedded non-glacial deposits (Froese et al., 2000; Ward et al., 2008). These deposits, including distal tephra beds, can be used to unravel the complex, poorly understood chronologies of earlier glaciations in the Middle to Late Pleistocene (e.g. Westgate et al., 2001; Froese et al., 2003). In addition, the tephra beds offer the opportunity to link glacial extents and non-glacial intervals to longer and more continuous records from the non-glaciated regions of Beringia (e.g. Jensen et al., 2008).

In this paper, we present a record of glacial and non-glacial deposits at the maximum extent of the Cordilleran Ice Sheet in

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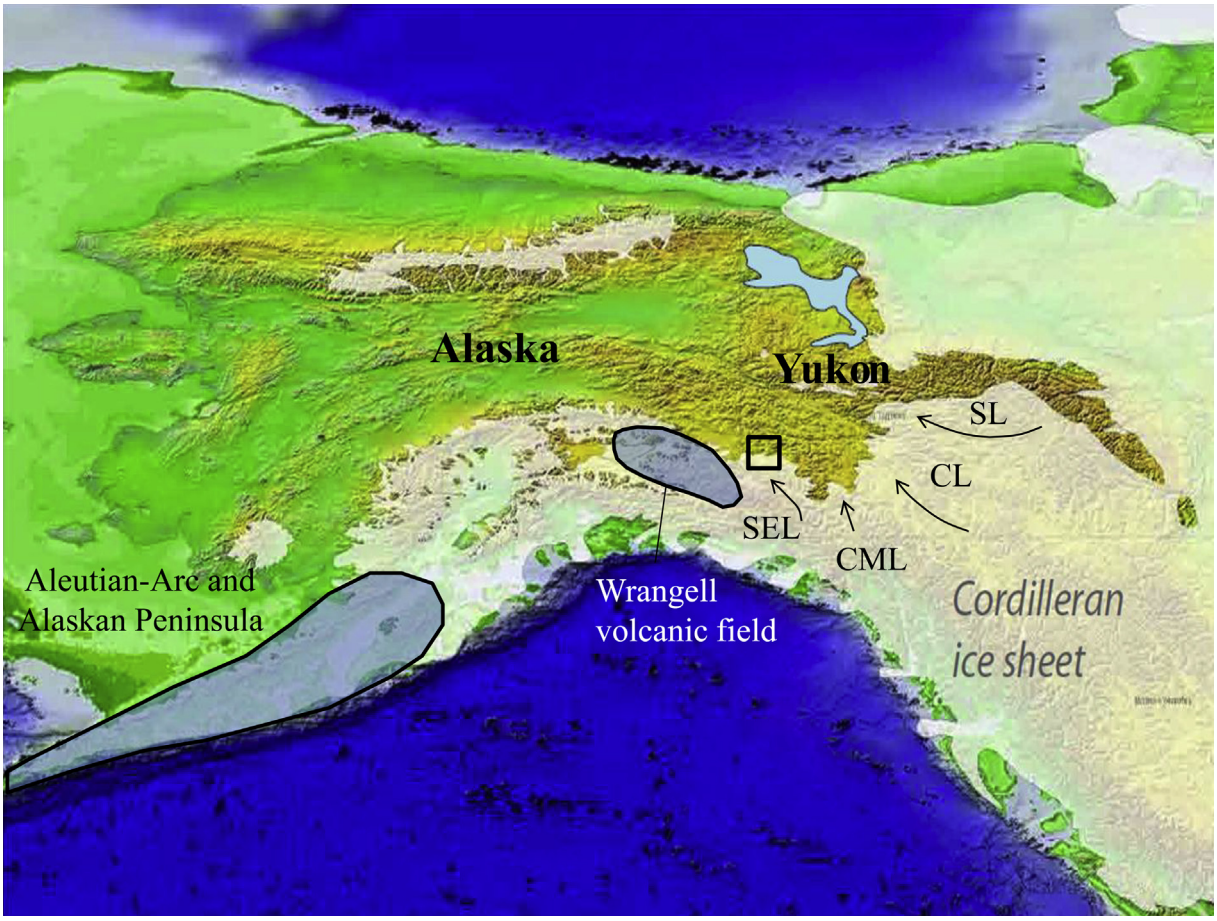

Fig. 1. Eastern Beringia with sea level at 120 m below sea level. MIS 2 ice extents are shown in white, including names of ice lobes of the northern Cordilleran Ice Sheet: St. Elias lobe (SEL), Coast Mountain lobe (CML), Cassiar lobe (CL) and Selwyn lobe (SL). Approximate locations of the sources for Type I (Aleutian-Arc and Alaskan Peninsula) and Type II (Wrangell volcanic field) tephras are outlined in blue. The study area is denoted by the black box. Glacial limits from Ehlers and Gibbard (2003). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

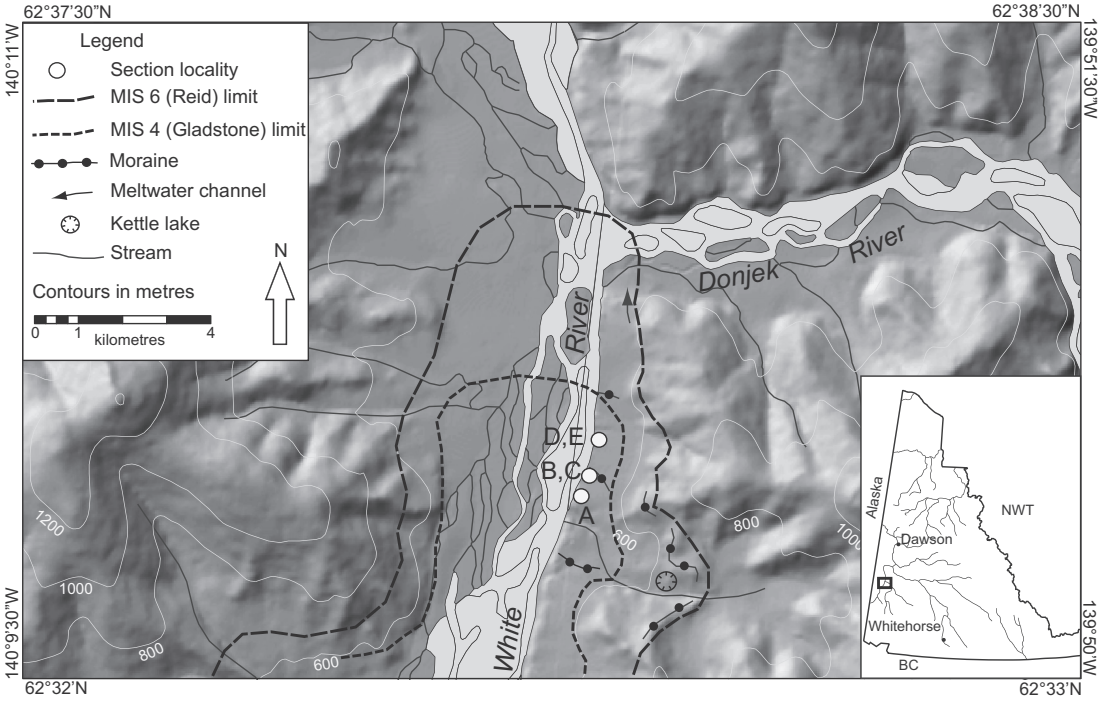

Fig. 2. Study area along the White River, near the confluence with the Donjek River. Two glacial limits extend beyond the MIS 2 extent <15 km to the south.