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LATE QUATERNARY LANDSCAPE HISTORY AND ARCHAEOLOGY IN THE 'ICE-FREE CORRIDOR': SOME RECENT RESULTS FROM ALBERTA

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Multidisciplinary research programs conducted within the Alberta portion of the 'Ice-Free Corridor' since 1986 as part of the Archaeological Survey's 'First Albertans' project have used studies of palaeogeography and palaeoenvironments to formulate archaeological search strategies. This approach has resulted in the discovery of two new important sites — Saskatoon Mountain (GhQt-4) and the James Pass Meadow Complex (EkPu-3 to 9) — that are yielding information on terminal Late Wisconsinan/Early Holocene human occupation of the corridor. Both sites are dated by AMS or conventional radiocarbon dates to the millennium 10,000–9,000 BP. In the fifteen years since the 1978 AMQUA Conference on the Corridor, other researchers have identified four additional significant Paleo-Indian sites in this region. So far, none confirm human occupation of the 'Ice-Free Corridor' region before about 11,000 BP. Copyright © 1996 INQUA/Elsevier Science Ltd

INTRODUCTION

In 1986, the Archaeological Survey, Provincial Museum of Alberta, initiated a study, called the 'First Albertans' project, to search actively for Late Wisconsinan/Early Holocene archaeological sites in the Alberta portion of the 'Ice-Free Corridor' (Magne and Ives, 1991). For the purposes of this paper, we define this interval as about 12,000–9,000 BP. This is approximately equivalent to the term Paleo-Indian, as defined by Ellis and Deller (1990). The research has used studies of palaeogeography and palaeoenvironments in the eastern slopes of the Rocky Mountains to formulate archaeological search strategies. These studies suggested landforms and areas that would have been ice-free relatively early and where archaeological field reconnaissance might best be employed. Our search has focussed on elevated landforms in resource-rich settings that held the best potential for preserving Paleo-Indian occupations. Similar landscape-based search strategies have proved successful in other areas, for example, in the Tanana River area, Alaska (Hoffecker, 1988; Powers and Hoffecker, 1989). As a result of regional surveys, two significant new Paleo-Indian sites — Saskatoon Mountain (GhQt-4) and the James Pass Meadow Complex (EkPu-3 to 9) — have been discovered (Fig. 1). This paper presents some preliminary results of the multidisciplinary research program focussing on the two new sites.

REGIONAL PALAEOENVIRONMENTAL CONTEXT AND DEVELOPMENT OF THE SEARCH STRATEGY

The starting-point for the search strategy was a consideration of Late Wisconsinan glacial history. Ideas about Late Wisconsinan glaciation of Alberta — and particularly the significance and configuration of the 'Ice-Free Corridor' — are changing rapidly (Bobrowsky and Rutter, 1992; Mandryk, 1992; Rutter *et al.*, 1993). The regional pattern of glaciation that is emerging from recent geological and geomorphological research is spatially and temporally heterogeneous. For example, research in northwestern Alberta by Liverman *et al.* (1989) shows one major Late Wisconsinan glaciation, but with mountain and Laurentide ice advancing at different times and therefore not coalescing. In contrast, Rains *et al.* (1990) suggest that mountain and Laurentide ice must have coalesced in most major valleys in central Alberta. Dyke and Prest's (Dyke and Prest, 1987) reconstruction of ice limits also shows coalescence of Late Wisconsinan ice along the eastern slopes of Alberta. However, lack of adequate chronological control clouds much of the discussion on timing and correlation of Late Wisconsinan events. Based on an exhaustive survey of the literature, Bobrowsky and Rutter (1992:36) were only able to conclude that, although the extreme ends of the 'Ice-Free Corridor', in southwest Alberta and the Yukon, were ice-free in the Late Wisconsinan, "it may be possible that the Corridor was closed in the central region".

The very concept of the 'Ice-Free Corridor' has been the subject of much debate and misunderstanding (Mandryk, 1992) and in consequence Beaudoin (1989) suggested using the term 'Western Corridor', defined strictly on geographic grounds (Fig. 1), as a less emotionally-charged term. This region is one of two hypothetical routeways from Beringia to the conterminous United States at the close of the last glaciation, the other being along the British Columbia coastline and continental shelf (Fladmark, 1989). From an archaeological perspective, arguments about the timing of the Late Wisconsinan glacial maximum and whether

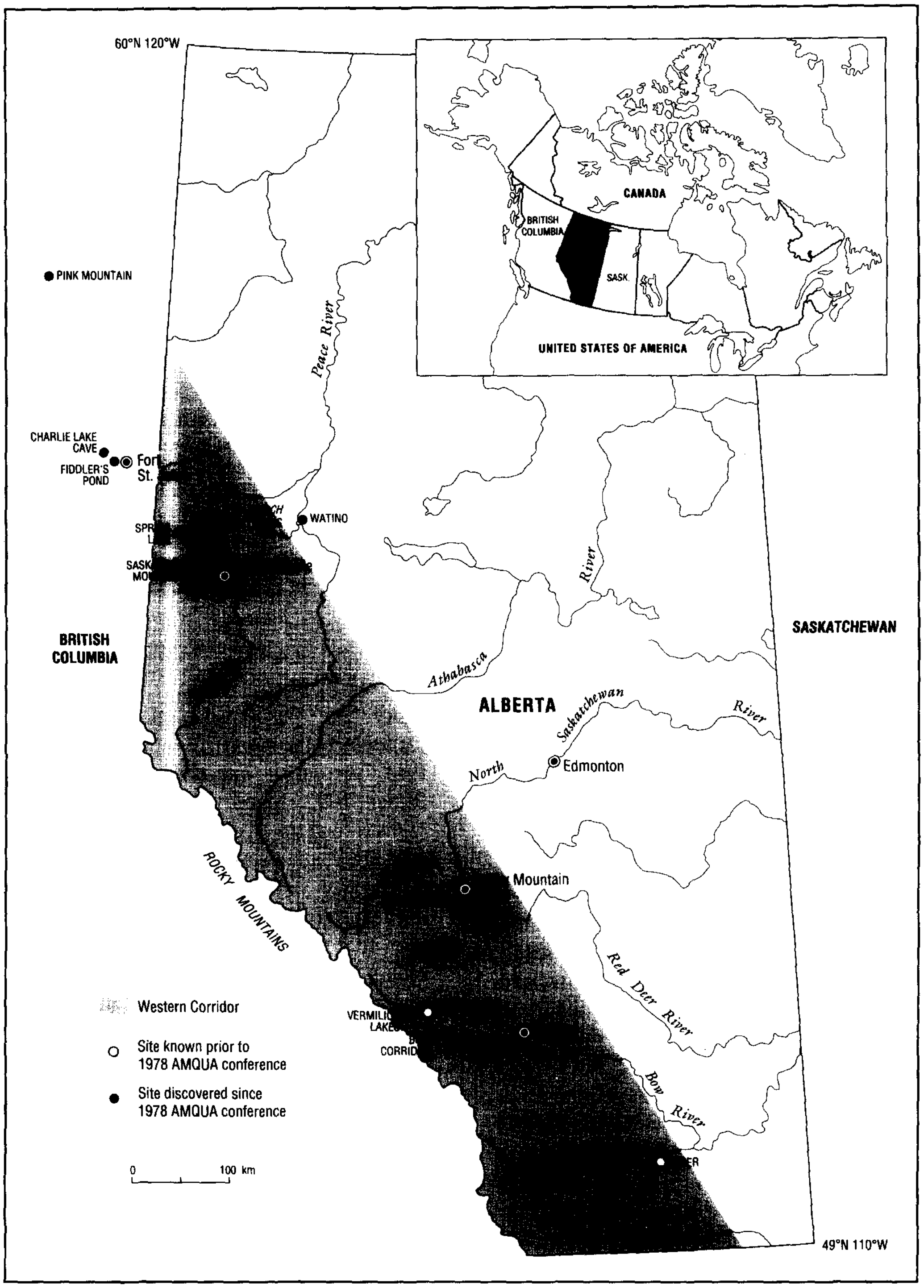

FIG. 1. Location map of Alberta, showing the 'Western Corridor', which encompasses the region often described as the 'Ice-Free Corridor', and terminal Late Wisconsinan/early Holocene archaeological and palaeoenvironmental sites.

Laurentide and Cordilleran ice were coalescent are tangential to an evaluation of the prospects for human presence (Ives *et al.*, 1989). Other landscape factors, such as the occurrence of glacial lakes, lack of vegetation etc., would also be critically important, particularly on newly deglaciated terrain. Landscapes capable of supporting substantial vegetation and large mammals are unlikely to have been extensive in Alberta during Late Wisconsinan glacial maximum. Even if there had been an 'Ice-Free Corridor' through part of this region at the height of the Late Wisconsinan glaciation, the severity of near-ice climates would probably have limited vegetation to sparse tundra and so large mammal populations are unlikely to have been abundant. Theoretical models (e.g. Mandryk, 1992; Zutter, 1989) incorporate palaeoenvironmental data and information on human subsistence strategies to evaluate landscape viability, that is, the capability of the landscape to support long-term human presence. For instance, analysis by Mandryk (1992) of the Mitchell Lake pollen record (Fig. 1), which may extend back to almost 18,000 BP, suggests that, although sparsely-vegetated terrain was present by at least 16,000 BP, viable landscapes were not available in the Rocky

Mountain House area until about 12,000 BP. Thus, lack of food and other resources would likely have precluded human occupation.

Even if suitable terrain and resources were available in the 'Ice-Free Corridor' at Late Wisconsinan maximum, a source population must still be available to move into the area. In this regard, the earliest securely-dated human occupation in eastern Beringia is about 16,000 BP from Bluefish Caves, northern Yukon (Morlan, 1983). From the perspective of the 'First Albertans' project, therefore, the time of most interest is the few millennia before the Holocene, when humans inhabited eastern Beringia and when landscapes that could support vegetation, mammals and therefore people were becoming more widely available in Alberta. As originally argued by Ives *et al.* (1989), therefore, in this view, the 'Ice-Free Corridor' is a feature of deglaciation. Indeed, it could be argued that by the Early Holocene, the 'window of opportunity' for north–south migration along the Eastern Slopes was closing as widespread establishment of coniferous forest made travel more difficult. This may have changed movement patterns more to focus on the major (mainly east–west trending) river valleys.

The search strategy used in this project involved an analysis of the pertinent available Quaternary geology and palaeoenvironmental information to identify landforms, or areas of landscape, that would have been deglaciated relatively early and thus would have offered open terrain for plant colonization. These terrain types included uplands around the ice-margins, parts of the foothills, and the foothills portion of major river valleys. Our attention has focused on upland areas for three reasons. First, proglacial lakes inundated many lowlands during and after ice retreat, thus delaying plant colonization. Second, lowland areas would be prime locales for sediment accumulation in the geomorphically-active, postglacial paraglacial landscape and therefore any contemporary sites may be deeply buried. Third, if some uplands did survive as nunataks, as for example Packer and Vitt (1974) suggested for Mountain Park, then these areas would have already supported a rudimentary flora and vestigial soils and might have acted as nucleii from which vegetation could spread to adjacent areas when conditions became suitable. Certainly, the colonization of such nunatak areas by other vegetation would depend upon a variety of factors, including distance from a suitable seed source, prevailing wind directions, seed dispersal mechanisms etc. High-elevation nunataks are unlikely ever to have supported extensive arboreal vegetation, but their bryophyte and forb vegetation may have acted to 'precondition' surrounding areas whose contemporary environment was more suitable for trees. Our assumption has been that a well-vegetated landscape supporting ungulate herds is a prerequisite for human occupation.

Immediately following deglaciation, landscapes would have been geomorphically more active than now. Steep unvegetated slopes, abundant unconsolidated sediments, and plentiful meltwater would have allowed an interval of intense paraglacial sedimentation (Church and Ryder, 1972). This instability would have lasted until sediment supply diminished and vegetation colonized and stabilized the landscape. Subsequently, a second interval of landscape instability is apparent in many areas during the warm and dry mid-Holocene Hypsithermal interval. For example, at the Fletcher site (DjOw-1) almost 2 m of sand and silty sand overlie deposits dating to about 9300 BP (Vickers and Beaudoin, 1989; Wilson *et al.*, 1991). Therefore Early Holocene (or pre-Holocene) archaeological sites may be deeply buried and may have low 'archaeological visibility' (see Wilson, 1986).

Although copious sedimentation may deeply bury terminal Late Wisconsinan/Early Holocene sites, landforms with some deposition, even if episodic, were ranked highly as search locales because deposition would likely result in stratigraphic separation of occupations. Such landforms have proved productive in previous surveys. For example, at the Vermilion Lakes site (EhPv-8, Fig. 1) discrete occupations, extending back to about 10,400 BP, are separated by predominantly colluvial, debris-flow, or aeolian deposits (Fedje, 1986). In contrast, at Sibbald Creek (EgPr-2, Fig. 1), the deposits are so shallow that temporal resolution of separate occupations is impossible (Gryba, 1983).

A further consideration in designing the search strategy was an assessment of the availability of resources, such as access to water, vantage points, game concentrations etc., that would have been available for people at the time the landscape may have been occupied. In this, site characteristics of known Paleo-Indian occupations, such as Vermilion Lakes, Charlie Lake Cave, and Sibbald Creek, were used for guidance.

Initial attempts to use this search strategy met with some success. In the Upper North Saskatchewan River survey (Ronaghan and Beaudoin, 1988), no Early Holocene archaeological sites were found but landforms and deposits of the appropriate age were identified, demonstrating the fundamental soundness of the search design. Subsequently, in the Bow Valley east of Banff National Park, Newton (1991) identified several sites with pre-Mazama components. In northwest Alberta the survey strategy focussed on high elevation relic shoreline features of Glacial Lake Peace, some of which had previously yielded evidence of Paleo-Indian artifacts (Haynes, 1980). The survey successfully located additional Paleo-Indian sites in the area of the Birch Hills and Grande Prairie but all were from undated, disturbed contexts. Contemporaneity of Paleo-Indian occupations with glacial lakeshore features has been demonstrated elsewhere in Canada (Karrow and Warner, 1990) but Paleo-Indian peoples also used relic glacial lake shoreline zones and contemporaneity needs to be demonstrated in each case and cannot be presumed (Ellis and Deller, 1990).

PALAEOENVIRONMENTAL CONTEXT AND ARCHAEOLOGICAL SITES IN THE GRANDE PRAIRIE AREA

Archaeological survey in the northwestern portion of Alberta has focussed on elevated landforms that would have been the earliest emergent land surfaces following deglaciation and subsequent drainage of Glacial Lake Peace (Beaudoin and Wright, 1993). In northwestern Alberta, research by Liverman (1991) and Bobrowsky (1989) suggests that Late Wisconsinan glacial ice advances from continental (Laurentide) and mountain (Montane and Cordilleran) sources were out-of-phase. The Late Wisconsinan advance appears to have been the most extensive, and only, Laurentide advance in this region (Liverman *et al.*, 1989). It dates prior to about 13,500 BP (Bobrowsky *et al.*, 1993) and was the last glacial event to affect the Grande Prairie area.

During deglaciation, Glacial Lake Peace inundated much of the Peace River district. The maximum elevation of the Lake (Bessborough Stage) was about 840 m a.s.l. (Liverman, 1991). The various phases of Glacial Lake Peace are undated. Relic shorelines are not usually significant terrain features (Liverman, 1991), suggesting that Glacial Lake Peace disappeared too rapidly to have had a major geomorphic impact on the landscape. Liverman (1991) considers that surface radiocarbon dates in the 13,500–10,000 BP range provide a lower temporal limit for the major lake stages, which would have been associated with Laurentide ice retreat. Burns (1986) reported a date of 9075 ± 305 BP (S-2614) on bone collagen from an articulated wapiti (*Cervus elaphus*) skeleton. This was recovered from the 'middle terrace', at an elevation of 420 m a.s.l., about 50 m above the present elevation of the Smoky River near Watino (Fig. 2). We obtained a radiocarbon date of 9730 ± 110 BP (AECV-1620C) on beaver-chewed poplar wood (probably from balsam poplar, *Populus* cf. *balsamifera*) from 'Wood Bog' (Fig. 2), just east of Grande Prairie at an elevation between 640–655 m a.s.l. This provides a minimum date for drainage of these lowlands.

Details of postglacial vegetation have been derived from pollen records at Boone and Spring Lakes in the Saddle Hills (White and Mathewes, 1986; Hickman and White, 1989) and Fiddler's Pond near Fort St John (White and Mathewes, 1982; Fig. 1). White and Mathewes (1986) obtained an AMS date of 11,700 ± 260 BP (SFU-223) on poplar wood near the base of the Boone Lake record. Pollen data from Boone Lake, located about 870 m a.s.l., record the earliest vegetation, a shrub–herb tundra, at about 12,000 BP; White *et al.* (1985) consider that ice was close to the Saddle Hills at this time. Further north, in the Clear Hills, MacDonald (1987) records the earliest postglacial pollen assemblage somewhat later, at ca. 11,000 BP. By 11,700 BP, an open poplar woodland was established around Boone Lake. Increasing amounts of birch and spruce pollen signal development of open coniferous forest by about 11,000 BP (White and Mathewes, 1986). White and Mathewes (1986) argue that the extensive Peace River grasslands probably developed directly from the early postglacial flora.

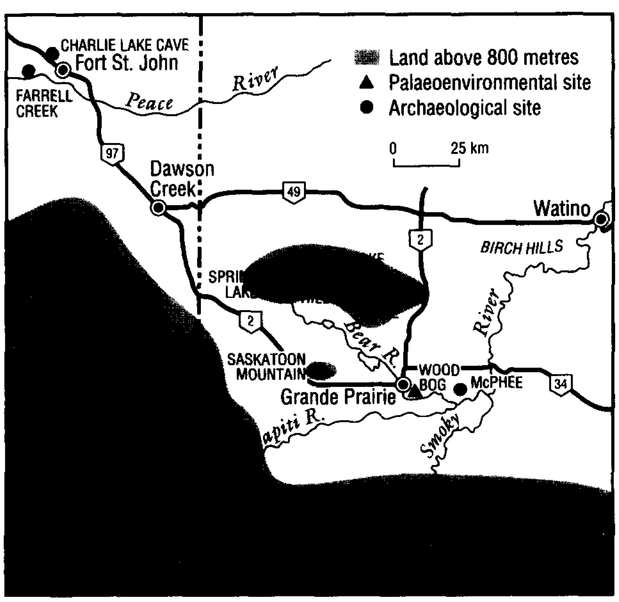

FIG. 2. Archaeological and palaeoenvironmental sites in the Grande Prairie area, northwest Alberta.

In the lowlands, east of Grande Prairie, the plant macrofossil record from 'Wood Bog' (Fig. 3) suggests that well-vegetated landscapes, including trees, were present by at least 9,700 BP. Beneath the 9,700 BP level, the sediments consist of grey clay, probably from Glacial Lake Peace. These sediments yield comparatively few seeds. Abundant seed and plant macrofossil remains, including beaver-chewed wood, occur at and above the 9,700 BP level. Wood is particularly abundant between about 210 and 275 cm depth, and includes poplar, probably both balsam and aspen (*Populus* cf. *balsamifera* and *P. tremuloides*), and willow (*Salix* sp.) (Dr A. S. Gottesfeld, *pers. commun.*, 1992). The seed record reflects mainly local site-specific events. Seeds are predominantly from wetland and aquatic taxa, and include seeds of *Ruppia* below about 220 cm (Fig. 3). This hypersaline-tolerant taxon (Kantrud, 1991) now occurs south of Grande Prairie (Moss, 1983) and has been used as an indicator of postglacial and Early Holocene salinity in central Alberta (Hickman and Schweger, 1993). Other records obtained from sites located above the upper limit of Glacial Lake Peace at Nose and Pierre Lakes (Fig. 2) will provide additional palaeoenvironmental details for the southern Peace River district.

Paleo-Indian projectile points had been recorded in cultivated contexts on the flanks of the Birch Hills region (Haynes, 1980). The Birch Hills have some of the best preserved glacial lake shoreline features in northern Alberta but none of the beach formations are dated. Recent archaeological survey work identified further examples of Paleo-Indian projectile points in the Birch Hills, including small basally-thinned triangular projectile points (Fig. 4). None of these points were recovered from datable contexts, although some did originate from the lowest level of the glacial lake basin, thereby dismissing any contemporaneity between Paleo-Indian occupations and the elevated beach ridges of the glacial lake. In the Birch Hills it appears likely that Paleo-Indian groups were selecting elevated beach ridges for their encampments, possibly because of their well drained soils, unique environmental setting and commanding viewpoints. Therefore, the settlement pattern of Paleo-Indian peoples

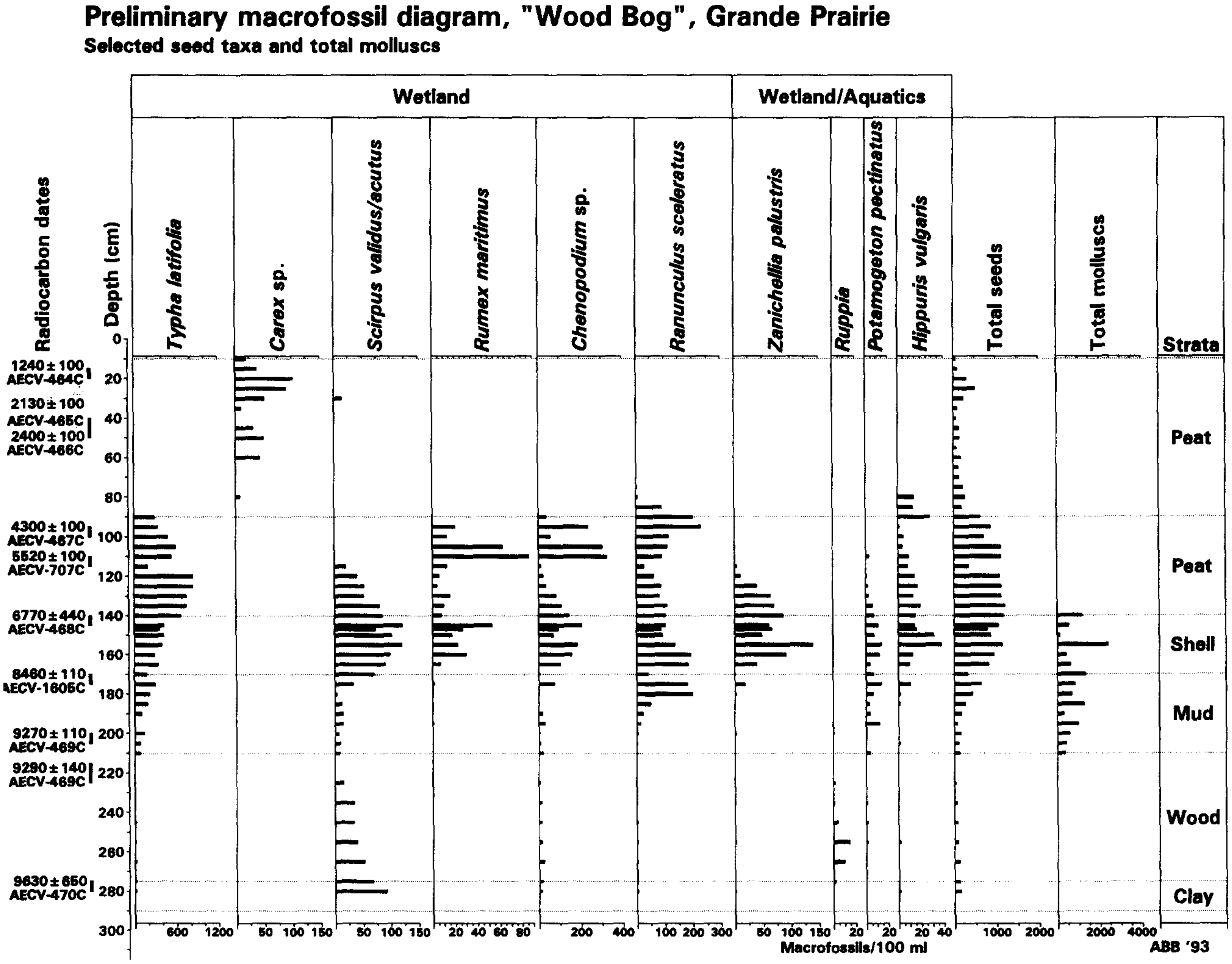

FIG. 3. Preliminary macrofossil diagram for "Wood Bog", Grande Prairie. Only selected wetland and aquatic taxa are shown.

is not simply restricted to favoured hunting locales; other site settings can be anticipated and will need to be factored into survey strategies.

In addition to relic glacial lakeshore features, the survey also included cave sites and upland dune deposits. Although the search for Alberta-based analogues to Charlie Lake Cave (HbRf-39) has proven unproductive so far, there has been some success in the identification of cliff-top dunes in high elevation zones. Cliff-top dunes containing archaeological components have been identified as possible locations for long records of human habitation in the Farrell Creek area of the Peace River valley in British Columbia (Valentine *et al.*, 1980; Fig. 2) but none of these sites appeared to have begun forming in the Early Holocene. In most cases these cliff-top dunes are found at valley rims along extant drainages such as the Peace River. In Alaska, Powers and Hoffecker (1989) also found that areas with aeolian deposition yielded Paleo-Indian archaeological sites.

Cliff-top dunes have also been forming on local cuesta formations within the Grande Prairie lowlands, south of the Saddle Hills (Fig. 2). One such cuesta is called Saskatoon Mountain and the steep southwest-facing slope of this bedrock feature has promoted the incremental growth of a 10,000 m^2 dune deposit. The dune varies in depth from a minimum of 1 m to a maximum of 2.6 m. The aeolian deposits probably began accumulating during and some time after the drainage of Glacial Lake Peace when a source of readily-entrained sediment was available. Several forest fire events are documented within the deposit before it stabilized approximately 5000 years ago.

The Saskatoon Mountain archaeological site (GhQt-4; 55° 13' 50" N, 119° 18' 30" W; approx. 964 m a.s.l.) is defined on the basis of a multicomponent stratified deposit, consisting largely of lithic debitage and a few formed lithic tools. The formed tools include complete unifaces, biface fragments, a probable drill and a fragmentary sandstone abrader. The abrader would have been used to shape and smooth wooden spear shafts, an activity that is consistent with the other kinds of stone tool remains recovered from Saskatoon Mountain. The abrader was found in association with charcoal radiocarbon dated at 7,510 ± 400 BP (AECV-1846C) making this the oldest dated example of this particular tool type in Alberta. Organic preservation at the site is generally poor, but charcoal from 63 cm BD in the section yielded a date of 7,690 ± 170 BP (AECV-1473C). Charcoal obtained from a hearth at the base of the site has yielded a date of 9,380 ± 360 BP (AECV-1474C; Beaudoin and Wright, 1993; Fig. 5). Additional organic remains in the form of carbonized seeds have been recovered from this hearth. Taxa identified comprise *Rubus* sp. (raspberry), *Prunus*

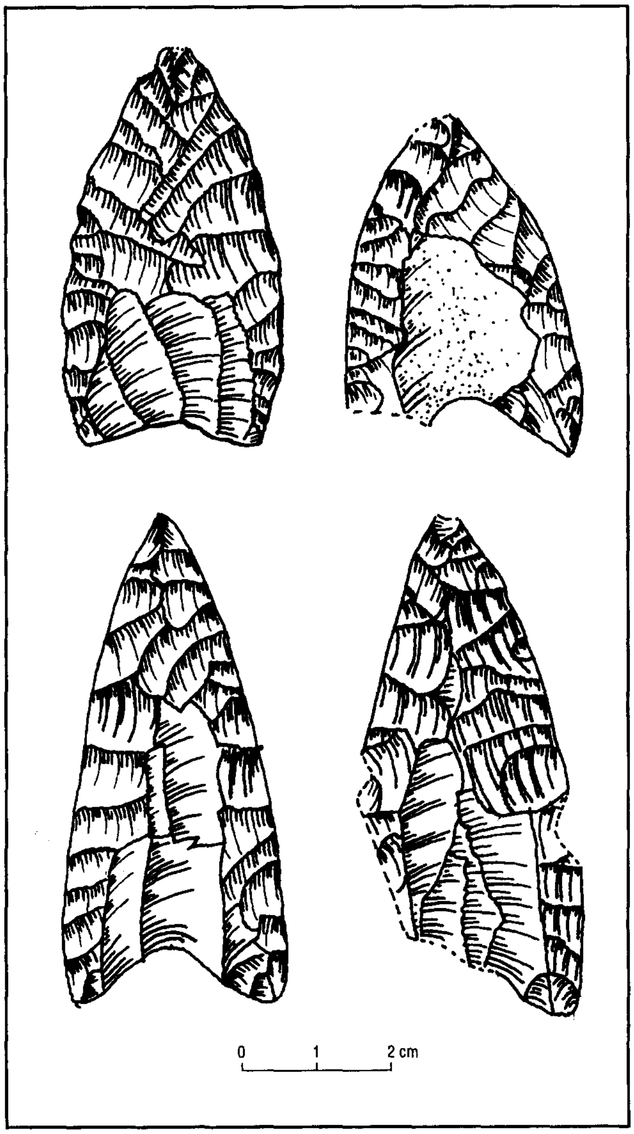

FIG. 4. Examples of basally-thinned triangular projectile points recovered from surface contexts in the Birch Hills. Elsewhere in northern Canada and Alaska this type of fluted point has been referred to as a late northern fluted or a "stubby" fluted point (e.g., Fladmark *et al.*, 1988). This style of fluted point is distinctly different from classic fluted point styles found in the plains of the United States.

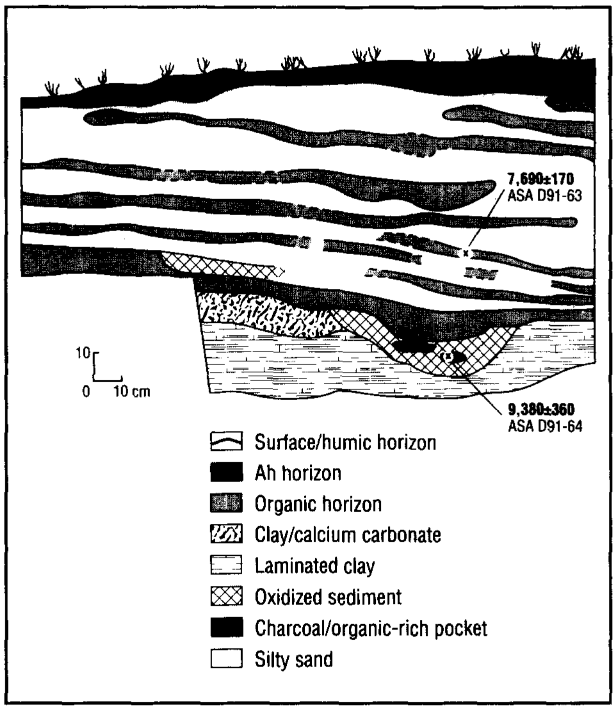

FIG. 5. Profile of stratified sediments in west wall of unit 27, Saskatoon Mountain. Note the upward slope of strata towards the front (foreground) of the dune.

sp. (cherry), *Rosa* sp. (rose), *Fragaria* sp. (strawberry), and *Arctostaphylos uva-ursi* (bearberry). A similar seed assemblage, though with fewer identifiable remains, has been recovered from a second hearth. To date, fine-fraction analyses of column samples elsewhere in the site deposits have not yielded seeds. The identified plant taxa are common in the southern boreal forest region today and all may be found in the Grande Prairie area (Moss, 1983). However, these plants all have ethnobotanic significance and are known to have been used by some native people in the recent past (Johnson, 1982). An AMS date of 9360±60 BP (UCR-3275, CAMS 12365) was obtained from a combined sample of 11 *Rubus* and 12 *Rosa* seeds from the first hearth. This is in close agreement with the previously available charcoal date.

Excavations at this site (Fig. 6) have exposed less than one percent of the entire site area and several features have been recorded including the hearth (Fig. 5) and concentrations of lithic debitage containing thousands of small flakes. Similar flake concentrations have been described by Powers and Hoffecker (1989) from Paleo-Indian sites in Alaska. At Saskatoon Mountain, these latter features appear to represent short-term events involving tool production and discrete discard piles of waste materials. This localized deposition of sharp waste flakes and nearby arrangement of hearth features within the site may indicate the presence of some form of temporary shelter.

The artifact assemblage from the site is consistent with the kinds of activities conducted at a short term encampment, including tool repair, tool production and limited food processing. It would appear that the primary purpose of the site was as a game lookout, for the site commands an impressive panoramic view of the Grande Prairie lowlands. These lowlands would have supported a luxuriant grass cover and presumably grazing ungulates could be observed and their movements monitored from Saskatoon Mountain. Archaeological features and stone tools are found throughout the sandy sediments but, although the site could have been used at any time following the demise of the glacial lake, it currently appears that the major periods of prehistoric occupation were at about 9500 and 8000 BP. Future excavations at the site will attempt to isolate the lowest occupation zones and determine the nature of earlier Holocene (or pre-Holocene) occupations. The Saskatoon Mountain site demonstrates the potential of upland locales to preserve intact stratified archaeological records that begin in the Early Holocene and overlap with stratified records in lowland river valley locations.

FIG. 6. Block excavation area at Saskatoon Mountain, illustrating multiple stratified deposits overlying Cretaceous sandstone bedrock on which the person in the centre of photograph is standing. The Saskatoon Mountain site is the oldest and best stratified human occupation currently recognized in northern Alberta.

PALAEOENVIRONMENTAL CONTEXT AND ARCHAEOLOGICAL SITES IN JAMES PASS

The James Pass Meadow Complex (EkPu-3 to 9, 51° 45' N, 116° 30' W, 1675 m a.s.l.) is situated in the upper Red Deer River valley (Fig. 7). Boydell recognized only one mountain ice advance in the upper Red Deer valley and one Laurentide glacial advance in the Sundre area, about 60 km east of James Pass (Harris and Boydell, 1972). He deduced that mountain ice had retreated before arrival of Laurentide ice so there was no coalescence. Recent AMS dates reported by Reasoner *et al.* (1993) from Crowfoot Lake in the upper Bow Valley, about 70 km west of James Pass, suggest that the last major Late Wisconsinan mountain ice advance, the Crowfoot Advance, predates 10,100 BP. In the Canadian Rockies, Osborn and Luckman (1988) conclude that most glaciers had retreated to within their present limits by about 10,000 BP. Throughout the remainder of the Holocene, ice advances appear to have been of limited extent, usually not breaching the Crowfoot limit until the widespread Little Ice Age Cavell Advance of the last few centuries (Osborn and Luckman, 1988). Therefore, it is likely that the foothills and Front Range portion of the Red Deer Valley, including James Pass, was ice-free for some time before the Holocene.

Palaeoenvironmental data from the North Saskatchewan Valley, the Nordegg–Rocky Mountain House region, about 80 km to the northeast and at a lower elevation than James Pass (Fig. 1), suggest that there was open, though sparsely vegetated terrain by at least about 16,000 BP. Late Wisconsinan palaeoenvironments have been investigated at three sites: Goldeye Lake (Hickman and Schweger, 1993; Schweger, 1989), Mitchell and Strubel Lakes (Mandryk, 1992). Based on conventional radiocarbon dates from core segments, Hickman and Schweger (1993) consider that the Goldeye Lake record (ca. 1350 m a.s.l.) extends to at least 23,600 BP. Mitchell Lake (ca. 1050 m a.s.l.) has yielded an AMS date from molluscs of 17,960 ± 160 BP (TO-574; Mandryk, 1990). At Mitchell Lake, non-arboreal pollen, particularly sage (*Artemisia*) pollen (38%–78%), dominates the basal assemblage (>18,000–16,100 BP) which has low pollen influx values averaging 63 grains/cm^3/year. The succeeding zone, ML-2, is characterized by increasing amounts of birch (*Betula*) pollen to 32% and higher pollen influx values averaging 303 grains/cm^3/year (Mandryk, 1990). These assemblages may represent sparsely-vegetated cold semi-arid steppe conditions changing to a better-vegetated landscape including more shrubs, before development of open spruce woodland, signalled by the increase in *Picea* pollen values, at about 11,400 BP (Mandryk, 1992). By 11,000–10,000 BP, coniferous trees were an important element of the regional vegetation. In this area at least, the occurrence of several palaeoenvironmental sites, all showing a similar pattern of vegetated terrain well before the Holocene, suggests that some areas in the Eastern Slopes may have been only briefly overridden by Late Wisconsinan ice and others, not at all. Although these data are intriguing, the recent work by MacDonald *et al.* (1987) has highlighted problems with radiocarbon-dating lake cores in this region of carbonate-rich bedrock and coal outcrops (see also discussion in Beaudoin (1993) and Wilson (1993)).

The Ya Ha Tinda grasslands (Fig. 8) are a subalpine ecosystem characterized by expansive fescue grasslands and shrub meadows. Although coniferous forest dominates the eastern slopes of the Alberta Rockies, similar grassland communities exist within other major river valley systems in the region (e.g. Kootenay Plains Ecological Reserve in the North Saskatchewan valley, Jasper townsite area in the Athabasca valley), principally because of the control exerted by topography on prevailing weather systems. Deeply cut valleys, heading in passes at the Continental Divide, serve to funnel the vigorous Pacific air masses that frequently invade the region, especially in winter. These high velocity 'chinook' winds increase the generally dry conditions in the valleys, exacerbating the rain-shadow effect of the main Divide ranges, and create conditions suitable for the maintenance of isolated grassland communities, even at relatively high elevations.

These communities are probably less extensive now than during Early and Mid Holocene when conditions were drier and unchecked natural fires would have helped to reduce forest encroachment. Centred along major drainage basins, these ecosystems would have been resource-rich nodes, seasonally attractive to ungulate herds and their prehistoric hunters, because of the presence of fresh water and open grazing. The numerous prehistoric archaeological sites recorded within the Ya Ha Tinda Ranch lands (Elliot, 1971), for instance, testify to the presence of an extensive prehistoric human use pattern associated with this area. Today, these grassland communities are recognized as critical winter habitat for elk (Government of Alberta, 1988). It is likely that they supported significant concentrations of large ungulates in the past.

The James Pass Meadow is an isolated extension of the Ya Ha Tinda grasslands (Fig. 8), located in a large spring-fed basin, situated between two Front Range peaks along the western approaches to a low (1660 m) pass over that range. The meadow is roughly 700 m × 300 m in size and, except along its western margin, is completely enclosed by sharply rising mountain slopes or by dense forest. The morphology of the landforms would have helped encirclement of small grazing ungulate herds.

In 1989, we examined a Calgary family's artifact collection that included material found in James Pass. The most notable specimen was a small, triangular, concave-based projectile point with channel flake scars on both faces (Fig. 9; Ronaghan, 1993). Stylistically, it can be assigned to the Folsom style, which is dated from sites in the United States at 11,000–9000 BP (Haynes et al., 1992). Clearly, this area had very high potential for producing sites dating from the terminal Late Wisconsinan/Early Holocene.

When we visited the area in 1991, we observed prehistoric artifacts and bone fragments intermittently along the full 700 m length of a vehicle track which traverses the meadow (Fig. 7), the only subsurface exposure in the area. A shallow shovel testing program revealed both extensive prehistoric human use of the meadow and significant differential sedimentation rates on the various landforms within and around the basin margins. Around the margins of the meadow, recovery of cultural materials was limited to the upper 30 cm of the modern soil profile, suggesting long-term depositional stability in these areas. Towards its centre, tests indicated that there had been extensive Holocene infilling of the basin. Neither bedrock nor glacial deposits were found in a 2 m-deep test placed in this area. We suspect, though, that significant cultural materials, probably kill site deposits, may be preserved at substantial depths here.

Evidence of a shallow but well separated sequence of archaeological deposits was recovered in tests placed on a small sediment-capped bedrock bench (called the Twin Pines locality, EkPu-8) located along the well-protected northern flanks of the meadow. This topographic feature lies approximately 3 m above the level of the basin, is relatively well drained and receives maximum amount of daily sunlight because of its south-facing exposure. Based on the recovery of stone artifacts and a few bone fragments, which produced two Early Holocene radio-

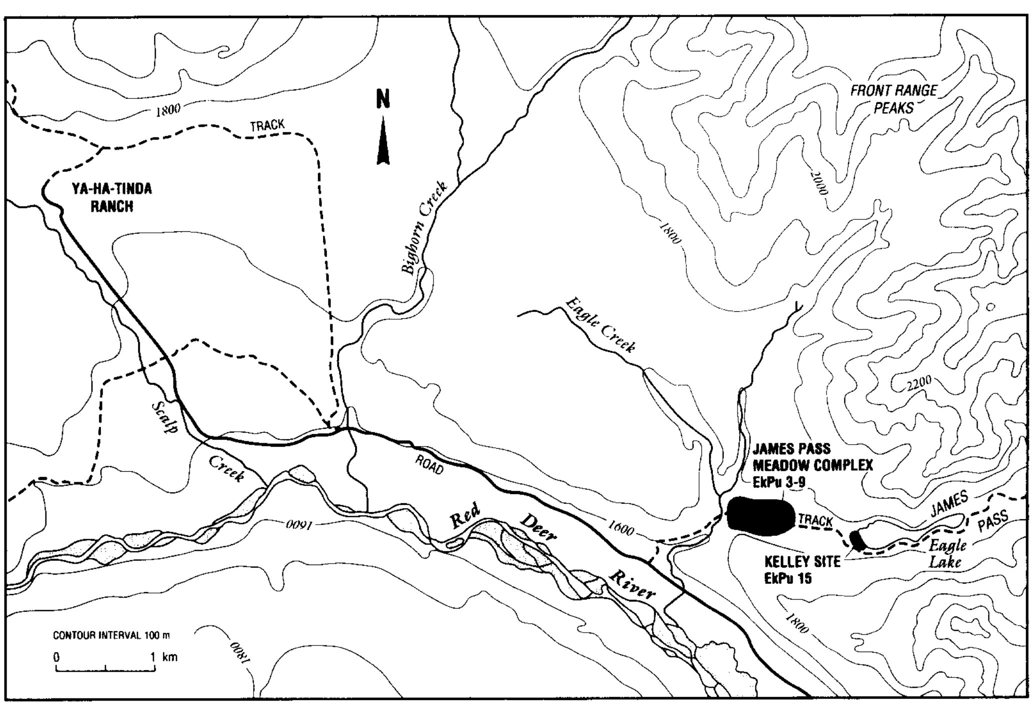

FIG. 7. James Pass study area in the upper Red Deer River valley.

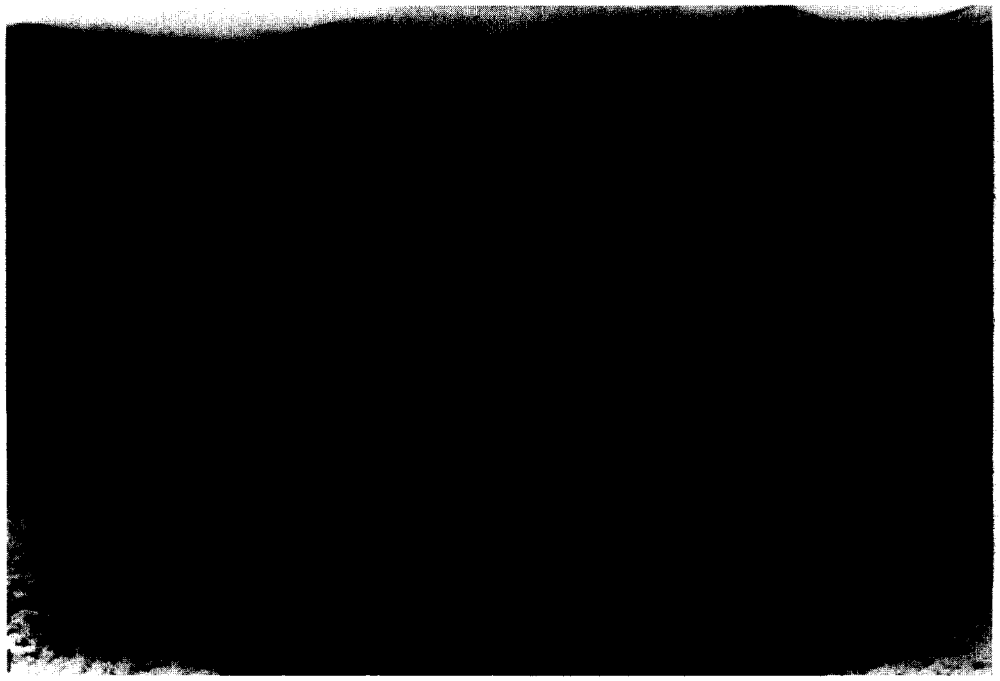

FIG. 8. James Pass study area, photographed from the slopes above Eagle Lake. View is roughly westwards. The James Pass meadow is surrounded by forest in mid-ground. The Ya Ha Tinda grasslands and Red Deer valley are visible in the middle distance.

carbon dates, from the 3 m^2 test sample (Fig. 10), we returned in 1993 to conduct a small scale excavation in this area.

A series of seven Borden designations (EkPu-3 to 9) have been provisionally assigned to spatially-associated productive tests located on several relatively distinct landforms that ring the margins of the meadow. Collectively these occurrences are called the James Pass Meadow Complex. The following discussion incorporates preliminary information available from 17 m^2 of block excavation (Fig. 11) and a dispersed series of smaller tests in the Twin Pines locality of this large site complex.

The sequence of sedimentary units provisionally identified reflects modest but continuous accumulation of fine-grained sediment over weathered limestone bedrock, and appears to encapsulate a large portion of the post-glacial record (Fig. 10). A well-defined layer of ash, morphologically similar to Mazama tephra (Beaudoin, 1984) dated at 6850 BP (Bacon, 1983), interrupts the long-term development of brunisolic soils. The ash layer conveniently divides the cultural materials recovered within the profile into Early and Middle Prehistoric Periods.

Materials recovered in the uppermost portions of the sediment profile were comparatively sparse. Around 17–18 cm below surface, the presence of a thin black layer, sometimes associated with pockets of tephra, provides a convenient natural means of separating occupation intervals. The morphological characteristics of this discontinuous tephra resemble those of Bridge River (Beaudoin, 1984), dating to 2350 BP (Mathewes and Westgate, 1980). Consistent with the stratigraphy, Besant artifacts were recovered above this layer.

At around 30 cm in the profile an approximately 10 cm

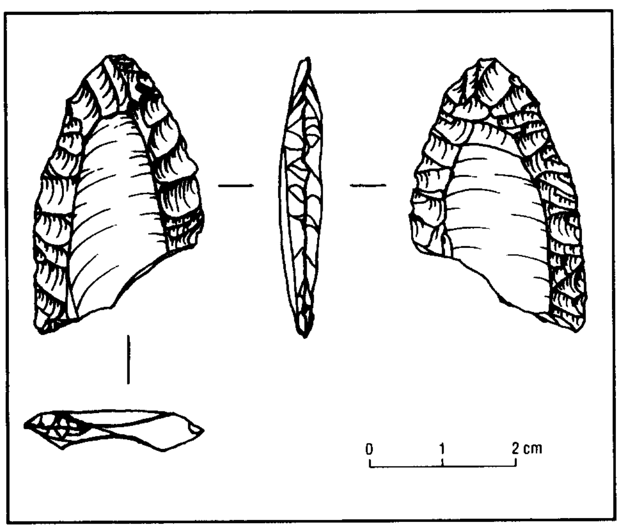

FIG. 9. Fluted point from the vicinity of the Kelley site (EkPu-15), James Pass (Ronaghan, 1993).

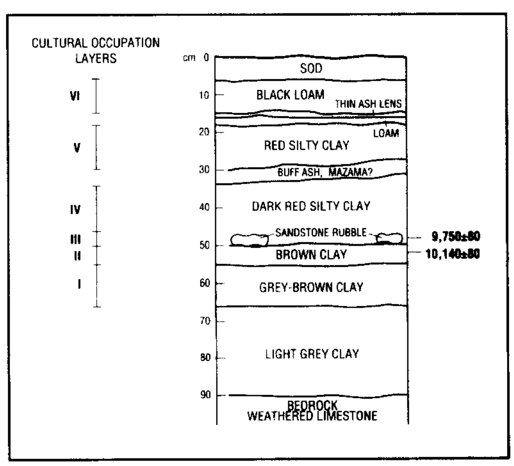

FIG. 10. Schematic profile drawing, Twin Pines site (EkPu-8), James Pass (Ronaghan, 1993).

FIG. 11. Excavation in progress (July 1993) at the Twin Pines locality (EkPu-8), in the stratified area of the James Pass Meadow Complex. Weathered bedrock appears at the base of the excavation; light-coloured tephra is visible in the far wall.

thick layer occurs that incorporates large pockets of volcanic ash within the silty matrix. Just above and extending into the ash layer, a small collection of chronologically-diagnostic projectile points was recovered along with comparatively large amounts of debitage and other tools. These specimens can be preliminarily grouped with a series of styles known to date in the 6000–5300 BP range (Gryba, 1980; Reeves, 1978; Walker, 1992).

At the base of this layer, excavation encountered a single-component living floor consisting, in places, of a thin blackened layer of material believed to be the result of organic remains and foot traffic. Abundant debitage and broken tools are associated with this layer. Also present is a group of points that can be divided into two distinct types. The first exhibits stylistic similarities with materials known to date around 7700 BP at the Mummy Cave site in northern Wyoming (Husted and Edgar, unpublished). The second style is represented by three specimens of a style of point which have no apparent regional referent. More in-depth comparative analysis may eventually clarify the relationships of these specimens.

Below the living floor, lithic artifacts were present throughout a 15 cm thick deposit of dark red silty clay (Fig. 10). All of these materials have been temporarily grouped and designated Cultural Layer IV. Additional analysis will be required to determine internal variations.

At the base of Layer IV, around 47 cm below surface, a concentration of lithic artifacts and a few bone fragments were recovered in direct association with a layer of sandstone rubble and have been designated Cultural Layer III. Collagen from a *Bison* sp. distal metacarpal found at this level in 1991 returned an AMS date of 9750 ± 80 BP (TO-2999; Ronaghan, 1993). In 1993 a single spear point base fragment was recovered along with a substantial cultural assemblage believed to be associated with this date. It is a non-fluted, concave-based lanceolate specimen. Its attributes do not resemble any of the contemporary Agate Basin or Hell Gap materials identified in the Bow Corridor to the south (Fedje, 1986, 1987; Fedje and White, 1988).

In the brown clay that underlies this occupation (Fig. 10) a third Paleo-Indian component has been defined (Cultural Layer II). It consists of a concentration of large flakes, a few cores and an occasional flake tool, but we did not find diagnostic specimens during excavation. Bone recovered from this level has produced an AMS date on collagen of 10,140 ± 80 BP (TO-3000; Ronaghan, 1993). At present, the 10,000 year old date appears to place these materials within the time range of classic Plains Agate Basin/Hell Gap, and in the terminal range for Folsom. The dating of the former in Alberta is unclear except inside the Front Ranges where dated contexts suggest a range of 10,000 to 9600 BP. No intact Folsom components have yet been identified in Alberta.

Although the occasional flake has been recovered from the water-saturated grey-brown and light grey clays at the base of the sediment column, they do not appear to represent a definable occupation. Weathered limestone bedrock was encountered at the base of the excavation around 90 cm below surface.

The earliest human occupations defined at the James Pass Meadow demonstrate that, by at least 10,000 BP, landscapes inside the Front Ranges of the central Alberta Rockies, to at least elevations under 1800 m, had stabilized and had been colonized by productive vegetation communities that supported viable ungulate populations and their human predators. Palaeoenvironmental evidence suggests that around this time Cordilleran ice had receded and was restricted to localized ice-fields mainly along the Continental Divide, 60 km to the west.

Pollen studies suggest that the vegetation communities which first colonized newly deglaciated terrain in these environments were dominated by herbaceous taxa and may have resembled a shrub tundra. Given the dry conditions of the area, it is possible that initial human occupation of the James Pass Meadow Complex may relate to exploitation of the remnants of such communities. The James Pass locale has great potential for linking palaeoenvironmental and archaeological records and may provide significant new information about terminal Late Wisconsinan/Early Holocene landscape development and human history in the Alberta Rockies.

Discovery of the James Pass Meadow Complex has, in our view, further demonstrated the promise of the search strategy employed in the 'First Albertans' project, in which focus has been placed on elevated landforms and associated areas of high resource productivity. We would predict that analogous situations along other drainage systems in the 'Ice-Free Corridor' would have similar potential to produce significant prehistoric sites. The fact that only sites of terminal Late Wisconsinan/Early Holocene, rather than earlier Late Pleistocene, age have been discovered may be more a factor of serendipity than of design. The limited resources we have been able to dedicate to the project, coupled with our belief that sites of the requisite age to have direct bearing on the initial peopling of the province would be exceedingly few, lead us to conclude that there is a good chance that earlier Late Pleistocene age sites may yet be discovered in this process.

The fine-grained sedimentary sequence identified at the Twin Pines locality also confirms the need to consider small scale topographic variation in sediment regimes when undertaking archaeological studies involving subsurface prospecting. Standard archaeological excavation techniques appear sufficient to discover temporally discrete samples from the shallow profile. Towards the centre of the basin, however, where sediment appears to have accumulated in significant quantities, remote sensing techniques or mechanical assistance may be required to discover and sample the archaeological materials we suspect are buried at considerable depth in this area. In other locations lack of sediment deposition or disturbance by arboreal vegetation may effectively preclude recovery of chronologically discrete archaeological assemblages.

DISCUSSION AND CONCLUSIONS

At the time of the 1978 AMQUA conference on the 'Ice-Free Corridor', there was limited evidence for human occupation in Alberta during the terminal Late Wisconsinan/Early Holocene period. This conference offered an exciting forum for the discussion of important discoveries, including the Taber Child bones, thought to be pre-Late Wisconsinan (Stalker, 1983) but later found to be Late Holocene in age (Brown *et al.*, 1983), and several isolated finds of Paleo-Indian artifacts within the province, such as at Minnewanka (Christensen, 1971) and the Birch Hills (Haynes, 1980). The fact remains, however, that in 1978 there was no *in situ* archaeological evidence of human presence within the Alberta portion of the 'Ice-Free Corridor' during the terminal Late Wisconsinan/Early Holocene interval.

The palaeoenvironmental record for the 'Ice-Free Corridor' region in Alberta for the 11,000–9000 BP interval was also largely a blank slate in 1978. Some sites examined by Hansen (1949, 1952) and Heusser (1956) fell within this region, but these pollen records were undated. The Callum Bog record near the upper Oldman River was also undated at the base, although Alley (1972) suggested that it might extend to the Late Wisconsinan. The Crowsnest Lake record (Driver, 1978) was completed that year, but lacks chronologic control for the basal portion although Driver *et al.* (1985) assume that the record begins about 9,000 BP. In fact, there were very few published pollen records available for any other region of the province (Beaudoin, 1993). A few published records were available for Late Pleistocene or Early Holocene faunal remains; these were mainly reports of large mammal finds, including bison, from the Bow Valley and environs (e.g. Churcher, 1968, 1975; Harington and Shackleton, 1978; Wilson, 1974) or southern Alberta (e.g. Shackleton and Hills, 1977; Trylich and Bayrock, 1966).

Given the limitations of the database, many of the 1978 conference papers were dedicated to a discussion of areas and issues somewhat removed from the Alberta portion of the corridor. One author lamented the fact that much of what was known about the corridor was not the result of concerted research efforts and that "better chronologic control and more refined palaeoenvironmental information must replace inspired guesswork" in future studies of the corridor (Workman, 1980: 135).

In the succeeding seventeen years, the picture has in some ways changed dramatically. Numerous palaeoenvironmental records have been produced in Alberta, including many within the 'Ice-Free Corridor' (see listing in Beaudoin, 1993). Besides those already mentioned, published records within the corridor extending to at least the Early Holocene include: Yamnuska Bog and Wedge Lake (MacDonald, 1982), Chalmers Bog (Mott and Jackson, 1982), Toboggan Lake (MacDonald, 1989), Fairfax Lake (Hickman and Schweger, 1991), Muskiki Lake (Kubiw *et al.*, 1989), Excelsior and Watchtower Basins (Luckman and Kearney, 1986), Maligne Lake (Kearney and Luckman, 1987), and Wilcox Pass (Beaudoin and King, 1990). Several relevant records occur in adjacent British Columbia, including Yesterday, Lone Fox, and Snowshoe Lakes (MacDonald, 1987), Tonquin Pass (Kearney and Luckman, 1983), Lake O'Hara and Opabin Lake (Reasoner and Hickman, 1989), and Elk Valley (Fergusson and Hills, 1985). Unpublished records, including Lorraine Lake (Bear, 1989) and Sunwapta Pass (Beaudoin, 1984), are found in theses.

Many of these records extend into the 11,000–9000 BP interval. Although details of inferred vegetation vary between regions, most records concur in showing an initial phase of predominantly non-arboreal vegetation, with some admixture of shrubs, such as birch, and, at lower elevations, poplar, followed by establishment of coniferous forest. The transition between the early vegetation phases generally seems to have occurred quite rapidly and may have been strongly affected by environmental factors such as soil development and plant migration. In addition, Hickman and Schweger (1993) infer Late glacial/Early Holocene aridity in records from central Alberta, extending into the foothills. There is sufficient evidence to suggest that forested landscapes occurred in the Rocky Mountain foothills by at least the Early Holocene.

So far, only the Rocky Mountain House area and Chalmers Bog records are radiocarbon dated well before this. MacDonald *et al.* (1987) have cast doubt on the ca. 18,000 BP basal date at Chalmers Bog. The chronology of the Rocky Mountain House area records also awaits additional confirmation.

Additional palaeontological evidence, notably from Bow Valley (Wilson and Churcher, 1984) and the Peace River District (Churcher and Wilson, 1979), has extended but not substantially altered the picture available in 1978. The data confirm the widespread presence of a varied faunal population, including large ungulates, by the beginning of the Holocene. Burns *et al.* (1993) note the absence of radiocarbon dates on faunal remains between 21,300–11,600 BP in the Edmonton area, suggesting that the landscape was incapable of supporting fauna in this interval.

In the fifteen years since the 1978 AMQUA Conference, several important terminal Late Wisconsinan/Early Holocene archaeological sites, e.g. Vermilion Lakes (Fedje, 1986), Charlie Lake Cave (Fladmark *et al.*, 1988), Pink Mountain (Wilson, 1987) and Bow Corridor Sites (Newton, 1991), have been identified in this region (Fig. 1). With the two new sites described here, these show evidence of human occupation of the Alberta section of the 'Ice-Free Corridor' by at least the terminal Late Wisconsinan/Early Holocene. Although considerable numbers of fluted points have been recorded in Alberta (Gryba, 1985, 1988; Vivian, 1993), few appear to be typical Clovis points and all are from surface or other undated contexts. There is no evidence yet of earlier Late Wisconsinan occupation (i.e. before about 11,000 BP) of the Western Corridor in Alberta. The successful search strategy for the Saskatoon Mountain and James Pass sites, however, emphasizes the merit of a collaborative interdisciplinary approach when conducting field survey in the Corridor.

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