

QUATERNARY DATES and VERTEBRATE FAUNAS in SASKATCHEWAN:

ARCHAEOLOGICAL RADIOCARBON DATES (Section I)

collated by [R. E. Morlan](#)

GEOLOGICAL RADIOCARBON DATES (Section II)

collated by [R. McNeely](#) and [B.T. Schreiner](#)

OPTICAL DATES (Section III)

collated by [S.A. Wolfe](#)

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Quaternary Dates and Vertebrate Faunas in Saskatchewan

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Quaternary Dates and Vertebrate Faunas in Saskatchewan

Abstract

This Date List presents 830 radiocarbon age determinations made by various Radiocarbon Dating Laboratories over the past 40 years, and for the first time optical ages on samples collected in Saskatchewan. The dates are presented in three sections: i) archaeological samples (≈370) with their associated vertebrate faunas, ii) geological samples (≈460), and iii) optical samples (≈40). The archaeological dates include cultural affiliations and associated vertebrate faunas, where identified, and have been presented based on their Borden designation. The geological dates have been organized thematically on the following topics: pre- Holocene dates; deglaciation history; glacial lakes; Holocene dates; and paleontological dates. The optical dates relate to eolian activity in Saskatchewan and all ages have been produced by the Simon Fraser Laboratory (SFU-O). Ten laboratories have been involved in radiocarbon dating archaeological materials (S, Beta, RIDDL, SFU, TO, GaK, GX, AECV, CAMS, and GSC), and ten laboratories have dated geological samples (S, GSC, GX, Beta, AECV, CAMS, TO, I, QU, and WIS).

These data are also available on the Web at the GSC Lab's WebPage at <<<http://sts.gsc.nrcan.gc.ca/radiocarbon>>> in the 'Database / Open File' module, and the archaeological data are available interactively in 'Mapping Ancient History' at <<<http://sts.gsc.nrcan.gc.ca/geoserv.org>>> and on the 'Canadian Archaeological Radiocarbon Database' at <<<http://www.canadianarchaeology.com/radiocarbon/card/card.htm>>>.

Résumé

Cette liste contient 870 datations au carbone radioactif déterminées par différents laboratoires au cours des 40 dernières années, et pour la première fois des âges optiques sur des échantillons provenant de la Saskatchewan. Les dates sont réparties en trois sections: i) échantillons archéologiques (≈370) avec leurs faunes de vertébrés associée, ii) échantillons géologiques (≈460), et iii) échantillons optiques (≈40). Les datations archéologiques incluent les affiliations culturelles et la faune de vertébrés associée, elles sont présentées sur la base de la désignation Borden. Les datations géologiques ont été organisées sur une base thématique selon les sujets suivant: dates pre-Holocène; l'histoire de la déglaciation; lacs glaciaires; dates Holocène; et, dates paléontologie. Les âges optiques sont reliés à l'activité éolienne en Saskatchewan, et la laboratoire Simon Fraser (SFU-O) a fait toutes les datations optiques. Dix laboratoires sont impliqués dans la datation de matériel archéologique (S, Beta, RIDDL, SFU, TO, GaK, GX, AECV, CAMS, and GSC), alors que dix ont déterminé les âge des échantillons géologiques (S, GSC, GX, Beta, AECV, CAMS, TO, I, QU, and WIS).

Ces dates sont également disponibles sur internet sur le site du laboratoire de la CGC: <<<http://sts.gsc.nrcan.gc.ca/radiocarbon>>> dans le module 'Base de données / Dossiers publics', et les données archéologiques sont disponibles sur le site interactif 'L'Histoire ancienne - La Carte' <<<http://sts.gsc.nrcan.gc.ca/geoserv.org>>> et sur le site 'Datations par Radiocarbène en Archéologie Canadienne' <<<http://www.canadianarcheology.com/radiocarbon/fcard/fcard.htm>>>.

**Geological Survey of Canada
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Section I

Archaeological Radiocarbon Dates in Saskatchewan

collated by
R.E. Morlan

INTRODUCTION

The Canadian Archaeological Radiocarbon Database (CARD) contains 370 radiocarbon dates from archaeological and vertebrate paleontological sites in Saskatchewan. Several researchers have previously compiled archaeological radiocarbon dates from the province. Wilmeth's (1971) nationwide listing, updated to the end of 1969, included 18 dates from Saskatchewan, and his list had grown to 60 dates by the time the revised version was published (Wilmeth, 1978). The first major synthesis of Saskatchewan archaeology (Epp and Dyck, 1983) included 120 dates compiled by Dyck (1983) for the southern part of the province. Morlan (1993) assembled 571 radiocarbon dates from Saskatchewan, of which 307 are associated with artifacts or human remains. A compilation of 786 Saskatchewan radiocarbon dates was presented on diskette as a Geological Survey of Canada Open File report (Morlan et al., 1996), and it included 333 archaeological dates and 453 dates pertaining to earth and life sciences other than archaeology. This report is an updated and revised version of the Saskatchewan date list. The dates contained in this section of the report are also available on the Internet at: <http://www.canadianarchaeology.com/radiocarbon/card/card.htm>

The spatial distribution of Saskatchewan radiocarbon dates is by no means uniform, and large parts of the province contain no dated archaeological or paleontological sites (Table I-1; Figures I-1, I-2 & I-3). The main concentrations result from the presence of stratified sites (DM, EN, FN), intensively surveyed reservoir areas (DM, FN), site concentrations at Wanuskewin Heritage Park and in the Dunfermline Sand Hills (FN), and one extensive cemetery (EO).

The temporal distribution of Saskatchewan radiocarbon dates is also very uneven, with nearly all of the dates referring to the last half of the Holocene (Table I-2).

Since the great majority of these dates fall within the last 2500 years, corrections for isotopic fractionation, ranging up to +100 years among Saskatchewan samples, are very important for establishing a reliable chronology. The Saskatchewan dates are summarized by material type in Table I-3, along with the frequencies of measured ¹³C ratios, the estimated ¹³C ratios, and the correction formulae. Nearly three-quarters of the dates are on bone samples, and fewer than 10% of these have measured ¹³C ratios. Most of them can be normalized to δ¹³C = -25‰ only by adopting an estimate of δ¹³C (see Morlan, 1999; Stuiver and Polach, 1977). However, the estimates shown in Table I-3 are known to be conservative. They yield an adequate correction only for pure collagen extracted from the bones of organisms with a terrestrial diet that included no C₄ plants. From the small number of ¹³C ratios that have been measured in this suite of dates, it is clear that C₄ plants contributed substantially to the diets of many Saskatchewan bison. For example, a bison bone from the Oxbow Dam site has a ¹³C ratio of -14.0‰, suggesting that C₄ plants comprised about 50% of its diet, and requiring a correction of 175 years to normalize its radiocarbon date. Since the isotopic composition of a herbivore is passed on to its human consumer (see Chisholm, 1989), all dates on bone collagen require correction for isotopic fractionation. Other constituents of bones, such as apatite, have even higher ¹³C ratios, requiring larger corrections. Therefore, all bone dates normalized here on the basis of estimated ¹³C ratios, marked with an "e" in this list, should be regarded as minimum ages.

In the case of other sample materials, no correction has been made. The age is given only as a normalized age, and an estimated or measured ¹³C ratio is shown. If the sample material is unknown, the date is presented as an uncorrected age.

The Saskatchewan dates span the cultural record of the province and provide ages for vertebrate remains from mid-Wisconsinan to

late Holocene time (Tables I-4 and I-5). To aid the selection of records in the digital version of this database, the cultural sequence has been divided into three periods or stages – Palaeoindian, Archaic, and Woodland – with the Taltheilei tradition distinguished as a separate entity. In addition to the categories shown in Table I-4, one can retrieve 83 dates with the term Archaic and 127 dates with the term Woodland. No claim is made that this is an adequate classification of ancient cultural traditions. The terms are used only to aid retrieval of data.

Just as cultural affiliations can be indicated for dates associated with diagnostic artifacts, vertebrate taxa can be associated with the dates if the bones have been identified and reported. Table I-5 presents the scientific and common names of vertebrates associated with the dates in this list, along with the millennia in which each taxon has been documented. Only the scientific names are listed in the date list.

Twelve laboratories (Table I-6) have contributed dates to this list, mainly by decay counting but a few (CAMS, RIDDL, and TO) by accelerator mass spectrometry (AMS). Some of these laboratories (AECV, GaK, RIDDL, S, SFU) are no longer in operation, and the recent closure of the Saskatchewan laboratory will have a profound effect on the future of chronometric studies in the province.

Dated sites are listed alphabetically by Borden designation within each Borden block. If one knows only the name of a site, its Borden designation can be found in Table I-7. Palaeobiological sites have been assigned Borden designations with a VP suffix in order to integrate their records into a uniform scheme.

IO*	1	IN	0	IM*	0
HO*	0	HN	0	HM*	0
GO*	1	GN	1	GM*	4
FO*	2	FN	150	FM*	4
EO*	28	EN	99	EM*	16
DO*	11	DN*	12	DM*	41

*portion of block is outside Saskatchewan

Table I-1. Saskatchewan archaeological dates by Borden block.

M*	Years BP	Dates
0	<500	35
1	500-1499	95
2	1500-2499	70
3	2500-3499	42
4	3500-4499	54
5	4500-5499	29
6	5500-6499	19
7	6500-7499	7
8	7500-8499	4
9	8500-9499	4
10	9500-10499	1
11	10500-11499	2
>11	11500-12499	2
>11	12500-20499	4
>11	>30000	2

*Millennium codes used in Tables 4 and 5

Table I-2. Saskatchewan archaeological dates by millennium.

Material dated	Number of dates	Anomalous Dates	Measured $\delta^{13}\text{C}$	Estimated $\delta^{13}\text{C}$ (‰)	Correction formula
human bone collagen	32	1	4	-19	+100 ± 20
other bone collagen	231	35	18	-20	+80 ± 20
bone	7	1	2	-20	+80 ± 20
charcoal	66	4	1	-25	none
wood	8	-	-	-25	none
paleosol	15	6	2	-25	none
soil	1	-	-	-25	none
sediment	5	-	-	-25	none
pottery encrustation	1	1	-	-25	none
unknown	4	-	-	?	-
Total	370	48	27		

Table I-3. Saskatchewan archaeological radiocarbon dates by material type.

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Archaeological Association (CAA), and Jean-Luc Pilon, CAA web editor, with translations prepared by Roger Marois. Throughout the work on this body of data, Ian Dyck, Curator of Plains Archaeology, CMC, has been a constant source of encouragement and critical appraisal.

Appeal for Help

If a user of this database discovers errors or would like to suggest amendments to any of the data, the information should be forwarded to Richard E. Morlan, Canadian Museum of Civilization, P.O. Box 3100, Stn. B, Hull, Québec J8X 4H2; 819-776-8197, voice; 819-776-8300, fax; e-mail: richard.morlan@civilization.ca

Significance terms	Dates	Anomalous	Frequency by millennium (excluding anomalous dates)													
			>11	11	10	9	8	7	6	5	4	3	2	1	0	
geoarchaeology	11	2	1				1			1	2	2	2			
palaeobiology	20	5	5					1		1	2		2	4		
Palaeoindian	15	7		1		3	2	2								
Mummy Cave	13	2							11							
Oxbow	34	2							1	13	16	2				
McKean	6	1									5					
Duncan	2	-											2			
Hanna	14	3								1	6	4				
Pelican Lake	9	-									2	5	2			
Sandy Creek	5	-										1	4			
Besant	31	3										3	22	3		
Avonlea	27	5											7	15		
Avonlea, Prairie	1	-												1		
Avonlea, Prairie, Plains	3	-												3		
Prairie	16	-												16		
Prairie, Plains	6	1												5		
Plains	14	1												4	9	
Late Prehistoric	3	-												3		
Laurel	5	1												4		
Pehonan	14	2												3	9	
Clearwater Lake	5	3													2	
Woodland, unspecified	4	-													3	1
Taltheilei	2	-													2	
Protohistoric	1	-														1
Historic	1	-														1
Culture unknown	108	11							3	3	9	14	13	28	21	6
Total	370	49	6	1	0	3	3	6	15	25	47	32	67	87	29	

Table I-4. Saskatchewan archaeological radiocarbon dates by significance.

Scientific Name	Common name	Occurrence by millennium												
		>11	11	10	9	8	7	6	5	4	3	2	1	0
Mammalia	Mammals													
<i>Sorex</i> sp.	Shrew									x			x	
<i>S. cinereus</i>	Masked shrew											x	x	x
<i>S. arcticus</i>	Arctic shrew													x
<i>S. hoyi</i>	Pigmy shrew													x
Chiroptera	Bat													x
<i>Eptesicus fuscus</i>	Big brown bat												x	
<i>Homo sapiens</i>	Human							x	x	x	x	x	x	
<i>Sylvilagus</i> sp.	Rabbit									x	x			
<i>S. nuttallii</i>	Nuttall's cottontail									x			x	x
Leporidae	Rabbit or hare										x	x	x	
<i>Lepus</i> sp.	Hare or jackrabbit							x	x	x	x	x	x	x
<i>L. americanus</i>	Snowshoe hare									x	x	x	x	x
<i>L. townsendii</i>	White-tailed jackrabbit									x		x	x	x
Sciuridae	Squirrels											x		
<i>Tamias minimus</i>	Least chipmunk									x		x		x
<i>Marmota monax</i>	Woodchuck											x		
<i>Spermophilus</i> sp.	Ground squirrel						x	x	x	x	x	x	x	x
<i>S. richardsonii</i>	Richardson's ground squirrel					x		x		x	x	x	x	x
<i>S. tridecemlineatus</i>	Thirteen-lined ground squirrel									x		x	x	x
<i>S. franklinii</i>	Franklin's ground squirrel													x
<i>Tamiasciurus hudsonicus</i>	Red squirrel													x
<i>Glaucomys</i> sp.	Flying squirrel												x	
<i>Thomomys talpoides</i>	Northern pocket gopher					x		x		x	x	x	x	x
<i>Perognathus fasciatus</i>	Olive-backed pocket mouse													x
<i>Castor canadensis</i>	Beaver									x	x	x	x	x
Cricetidae	Mouse family												x	x
<i>Reithrodontomys megalotis</i>	Western harvest mouse								x					
<i>Peromyscus</i> sp.	Mouse								x		x		x	x
<i>P. maniculatus</i>	Deer mouse													x
<i>Onychomys leucogaster</i>	Northern grasshopper mouse											x	x	x
Arvicolinae	Vole subfamily									x				
<i>Clethrionomys gapperi</i>	Gapper's red-backed vole									x	x	x	x	x
<i>Ondatra zibethicus</i>	Muskrat								x			x	x	x
<i>Lagurus curtatus</i>	Sagebrush vole									x				x
<i>Microtus</i> sp.	Vole									x		x	x	
<i>M. ochrogaster</i>	Prairie vole									x			x	x
<i>M. pennsylvanicus</i>	Meadow vole									x	x	x	x	x
<i>Zapus</i> sp.	Jumping mouse											x	x	x
<i>Erethizon dorsatum</i>	Porcupine												x	x
Canidae	Wolf family												x	x
<i>Canis</i> sp.	Coyote, wolf, or dog									x	x	x	x	x
<i>C. latrans</i>	Coyote									x	x	x	x	x
<i>C. lupus</i>	Wolf									x	x	x	x	x
<i>C. familiaris</i>	Dog				x					x	x	x	x	x
<i>Vulpes</i> sp.	Fox									x		x	x	x
<i>V. vulpes</i>	Red fox											x	x	x
<i>V. velox</i>	Swift fox								x	x	x	x	x	x
<i>Ursus</i> sp.	Bear									x	x			x
<i>U. americanus</i>	Black bear												x	
Mustelidae	Weasel family											x	x	
<i>Martes</i> sp.	Marten or fisher										x		x	
<i>M. americana</i>	American marten													x
<i>M. pennanti</i>	Fisher									x			x	
<i>Mustela</i> sp.	Weasel											x	x	x
<i>M. frenata</i>	Long-tailed weasel												x	x
<i>M. vison</i>	Mink									x				x
<i>Taxidea taxus</i>	American badger									x			x	x
<i>Mephitis mephitis</i>	Striped skunk									x	x	x	x	x
<i>Lutra canadensis</i>	River otter											x	x	

Table I-5. Vertebrate taxa associated with archaeological radiocarbon dates in Saskatchewan.

Scientific Name	Common name	Occurrence by millennium												
		>11	11	10	9	8	7	6	5	4	3	2	1	0
<i>Felis</i> sp.	Lynx or bobcat									x				
<i>F. canadensis</i>	Lynx										x	x	x	x
<i>Mammuthus</i> sp.	Mammoth	x												
<i>M. imperator</i>	Imperial mammoth		x											
<i>Equus</i> sp.	Horse	x												
Artiodactyla	Cloven-hoofed animals									x	x		x	
Cervidae	Deer family	x							x				x	
<i>Odocoileus</i> sp.	Deer								x	x	x	x	x	x
<i>Alces alces</i>	Moose									x			x	x
<i>Cervus elaphus</i>	Wapiti									x	x	x	x	x
<i>Antilocapra americana</i>	Pronghorn				x			x	x	x	x	x	x	x
<i>Bison</i> spp.	Bison	x		x	x	x	x	x	x	x	x	x	x	x
Aves	Birds (unid.)								x	x	x	x	x	x
<i>Gavia immer</i>	Common loon													x
<i>Ardea herodias</i>	Great blue heron												x	
Anatidae	Swans, geese, ducks												x	
<i>Cygnus</i> sp.	Swan												x	
<i>C. columbianus</i>	Tundra swan													x
Anserini	Goose tribe									x				x
<i>Branta canadensis</i>	Canada goose										x			x
Anatinae	Duck subfamily								x					
<i>Anas</i> sp.	Duck										x			
<i>A. crecca</i>	Green-winged teal									x				
<i>A. platyrhynchos</i>	Mallard									x				
<i>A. discors</i>	Blue-winged teal												x	x
Accipitridae	Eagles, hawks												x	x
<i>Haliaeetus</i> or <i>Aquila</i>	Eagle								x	x				
<i>H. leucocephalus</i>	Bald eagle													x
<i>Buteo regalis</i>	Ferruginous Hawk													x
Falco sp.	Falcon											x		
Phasianidae	Grouse family									x				x
Tetraoninae	Grouse sub-family												x	x
<i>Bonasa umbellus</i>	Ruffed grouse												x	
<i>Tympanuchus phasianellus</i>	Sharp-tailed grouse									x			x	
<i>Meleagris gallopavo</i>	Turkey												x	
<i>Coturnicops</i> or <i>Porzana</i>	Yellow rail or sora												x	
<i>Grus</i> sp.	Crane													x
Scolopacidae	Sandpiper family												x	
<i>Actitis macularia</i>	Spotted sandpiper													x
<i>Larus californicus</i>	California gull												x	
<i>Ectopistes migratorius</i>	Passenger pigeon							x						
Strigiformes	Owl order													x
<i>Bubo virginianus</i>	Great horned owl													x
Passeriformes	Perching birds										x	x	x	x
<i>Contopus</i> or <i>Sayornis</i>	Pewee or phoebe												x	
<i>Contopus</i> sp.	Pewee													x
<i>Empidonax</i> sp.	Flycatcher												x	
<i>Eremophila alpestris</i>	Horned lark										x		x	x
<i>Riparia riparia</i>	Bank swallow												x	x
<i>Corvus</i> sp.	Crow or raven								x					
<i>C. brachyrhynchos</i>	American crow							x			x		x	x
<i>C. corax</i>	Common raven										x		x	
Troglodytidae	Wren family												x	
<i>Sialia</i> sp.	Bluebird												x	
<i>Catharus fuscescens</i>	Veery										x			
<i>C. minimus</i>	Gray-cheeked thrush												x	
<i>C. ustulatus</i>	Swainson's thrush												x	
<i>Turdus migratorius</i>	American robin												x	x
<i>Anthus</i> sp.	Pipit												x	
<i>Bombycilla cedrorum</i>	Cedar waxwing												x	x
Emberizidae	Warbler family												x	
Parulinae	Warbler sub-family												x	x
<i>Dendroica</i> sp.	Warbler												x	
<i>Calamospiza melanocorys</i>	Lark bunting													x

Table I-5 (continued). Vertebrate taxa associated with archaeological radiocarbon dates in Saskatchewan.

Scientific Name	Common name	Occurrence by millennium												
		>11	11	10	9	8	7	6	5	4	3	2	1	0
<i>Passerculus sandwichensis</i>	Savannah sparrow												x	
<i>Melospiza</i> sp.	Song or Lincoln's sparrow													
<i>Zonotrichia albicollis</i>	White-throated sparrow												x	x
<i>Junco hyemalis</i>	Dark-eyed junco												x	
Icterinae	Blackbird subfamily													
<i>Carduelis</i> sp.	Redpoll												x	
Reptilia	Reptiles													
<i>Chrysemys picta</i>	Painted turtle									x			x	
<i>Thamnophis</i> sp.	Garter snake									x			x	x
Amphibia	Amphibians													
<i>Ambystoma tigrinum</i>	Tiger salamander											x	x	x
Anura	Toads and frogs									x				
<i>Bufo</i> sp.	Toads									x		x	x	
<i>B. hemiophrys</i>	Canadian toad											x	x	x
<i>Pseudacris triseriata</i>	Boreal chorus frog											x	x	x
<i>Rana</i> spp.	True frogs								x			x	x	x
Pisces	Fishes (unid.)								x	x		x	x	x
<i>Acipenser fulvescens</i>	Lake sturgeon											x	x	x
<i>Coregonus artedii</i>	Cisco											x	x	
<i>C. clupeaformis</i>	Lake whitefish										x	x	x	
<i>Hiodon alosoides</i>	Goldeye												x	x
<i>Esox lucius</i>	Northern pike										x	x	x	x
Cypriniformes	Minnnow order											x		
Cyprinidae	Minnnow family											x	x	x
<i>Platygobio gracilis</i>	Flathead chub													x
Catostomidae	Sucker family											x	x	x
<i>Catostomus</i> sp.	Suckers													
<i>C. catostomus</i>	Longnose sucker													x
<i>C. commersoni</i>	White sucker										x	x	x	x
<i>Moxostoma</i> sp.	Redhorse												x	
<i>M. anisurum</i>	Silver redhorse													x
<i>M. macrolepidotum</i>	Shorthead redhorse													x
<i>Ictalurus punctatus</i>	Channel catfish								x					
<i>Lota lota</i>	Burbot											x	x	x
Gasterosteidae	Stickleback family												x	x
Percidae	Perch family												x	x
<i>Perca flavescens</i>	Yellow perch										x	x	x	
<i>Stizostedion canadense</i>	Sauger													x
<i>S. vitreum</i>	Walleye											x	x	x

Table I-5 (continued). Vertebrate taxa associated with archaeological radiocarbon dates in Saskatchewan.

Lab	Laboratory	Country	No. of Dates
A	University of Arizona	U.S.A.	1
AECV	Alberta Environmental Centre at Vegreville	Canada	1
Beta	Beta Analytic Inc.	U.S.A.	10
CAMS	Center for AMS, Livermore	U.S.A.	1
GaK	Gakushuin University	Japan	2
GSC	Geological Survey of Canada	Canada	1
GX	Geochron Laboratories	U.S.A.	4
I	Teledyne Isotopes	U.S.A.	2
RIDDL	SFU @ McMaster University (AMS)	Canada	4
S	Saskatchewan Research Council	Canada	336
SFU	Simon Fraser University	Canada	4
TO	IsoTrace Laboratory, Toronto (AMS)	Canada	4
Total			370

Table I-6. Saskatchewan archaeological radiocarbon dates by laboratory.

Site	Borden#	Site	Borden#	Site	Borden#
Amisk	FbNp-17	Gowen 1	FaNq-25	Napao	DkNv-2
Avonlea	EaNq-1	Gowen 2	FaNq-32	Newo Asiniak	FbNp-16
Battle Creek Coulee	DjOI-no #	Graham	FaNq-30	Niska	DkNu-3
Battle Valley	DjOI-VP	Grandora	FaNr-2	Norby	FaNq-56
Beaver Creek	EINq-3	Gravel Pit	FhNa-61	Omega	DhMn-24
Below Forks	FhNg-25	Gray	EcNx-1a	Opamihaw	FbNp-18
Bennet	DjMw-27	Greenwater Lake	FcMv-1	Oxbow Dam	DhMn-1
Bethune	EeNg-6	Gull Lake	EaOd-1	Pawson	DgMs-28
Bill Richards	FaNp-9	Hamilton	FhNc-5	Peg	DiMv-61
Billet	EkNv-36	Harder	FbNs-1	Perfume Point	GiMv-23
Blumenhof	EaNw-1	Harper Valley	FgNi-24	Red Tail	FbNp-10
Boundary Dam	DgMr-33	Hartley	FaNp-19	Riddell	FaNp-VP
Bracken Cairn	DhOb-3	Heron	EcNx-2	Rocky Island	FaNp-7
Bradwell	EkNm-1	Heron Eden	EeOi-11	Root	FhNa-63
Broken Axle	FhNc-81	Herschel Petroglyph	EjOc-3	Rousell	FbNs-2
Buffalo Pound	EdNi-5	Inkster Island	FhNb-29	Sanderson	DhMs-12
Bushfield East	FhNa-13	Intake	FhNj-15	Saskatoon	FbNp-VP
Bushfield West	FhNa-10	Jots	DiMv-38	Sedo	EfMw-3
Cabri Burial	EdOa-14	Katepwa Beach	EeMv-1	Sheep Creek	EeOc-3
Camp Rayner	EgNr-2	Kisbey	DjMq-3	Site 9	DgMp-65
Carroll	EkNr-2	Kyle mammoth	EfOa-5	Site 10	DgMp-66
Carruthers	FbNs-3	Lake Midden	EfNg-1	Sjovold	EiNs-4
Charlot River	IjOg-2	Lebret	EeMw-26	St. Brieux	FdNf-2
Cline	EINo-3b	Lewis	FhNc-32	Stump Bottom	GiMx-8
Coffin	EINk-1	Lloyd	FhNa-35	Sutherland	FbNp-VP
Conglomerate Valley	DjOg-VP	Long Creek	DgMr-1	Target	DgMs-43
Crane	DiMv-93	Lucky Strike	FdNm-16	Thundercloud	FbNp-25
Crown	FhNa-86	Mad Dog	DgMs-53	Tipi Cluster	DhOc-8
Davenport	DhMs-2	Mann	EfOi-?	Tipi Summit	DiOc-2
Dunn	DjNf-1	Martin Chartier 3	GIoc-20	Tipperary Creek	FbNp-1
Eagle Creek	EkNv-VP	McCallum	GkNp-2	Trade Lake	GiMw-18
East Pasture	EcNx-4	Meewasin Creek	FbNp-9	Tree	DhMt-67
East Village Access	FeNm-86	Melhagen	EgNn-1	Tschetter	FbNr-1
Eastcott Flat	FhNa-69	Miry Creek	EeOc-5	Wallace Adair	EkNv-26
Elma Thompson	EiOj-1	Mitchellton	EaNk-3	Wallington Flat	FhNa-112
Estuary	EfOk-16	Moon Lake	FaNq-5	Walter Felt	EcNm-8
Fitzgerald	EINp-8	Moose Mountain Creek	DhMn-27	Walter Moser	EeOk-16
Frenchman's Flat	EINq-VP	Moose Mountain Medicine Wheel	DkMq-2	Wandering Pelican	FhNc-80
Gap Creek	DIOj-2	Moose Bay Burial Mound	EdMq-1	Willowbunch	DiNj-8
Gap Valley	DIOj-VP	Morris Church	EeNj-2	Wiseton	EhNv-VP
Garratt	EcNj-7	Mortlach	EcNl-1	Woodlawn	DgMr-6
Glen Ewen Burial Mound	DgMI-1	Nagel	EfOj-fs	Yellowsky	FjOd-2
Goosen Pasture	FbNs-15			Zoerb	EINs-4

Table I-7. Saskatchewan archaeological and palaeobiological sites dated by radiocarbon.

ARCHAEOLOGICAL DATES (Figs. I-1, I-2 and I-3)

DgMI-1, Glen Ewen Burial Mound: about 22.5 km south of GlenEwen, Souris drainage, Saskatchewan. It is a conical mound 50 ft (15 m) in diameter, 1.5 ft (46 cm) high, with four linear mounds about 12 ft (3.5 m) wide radiating from it for as much as 600 ft (180 m) and terminating in conical mounds.

T.F. Kehoe collected two radiocarbon samples. S-258 consists of charred wood from planking covering the burial chamber beneath the central tumulus, and it is considered to date the construction of the mound. S-259 consists of charred wood associated with a secondary burial intrusive into the periphery of the central mound. Substantial overlap of these dates suggests that the two events do not differ greatly in age.

According to E.G. Walker (p.c. 1990), this mound differs significantly from those of the Devils Lake - Sourisford burial complex (see Syms 1979), although it is similar in age. Sources: McCallum and Wittenberg, 1968; Morlan, 1993; Syms, 1979; Wilmeth, 1978.

S-259, charred wood, from burial mound, intrusive burial, dates secondary burial in mound periphery, collected 1959, submitted by T.F. Kehoe.

Normalized age: 1110 ± 90
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-258, charred wood, from burial mound, dates mound construction, collected 1959, submitted by T.F. Kehoe.

Normalized age: 1220 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DgMp-65, Site 9: Souris River, Saskatchewan. This is a prehistoric site with multiple features, including hearths. Sources: Canadian Heritage Information Network; C. Germann, p.c. 1998.

Beta-60542, bone collagen, from Level 3, submitted by G. Brewer.

Normalized age: 3760 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 3680 ± 70

Significance: cultural affiliation unknown

DgMp-66, Site 10: Souris River, Saskatchewan. This is a prehistoric site with multiple features, including hearths. Sources: Canadian Heritage Information Network; C. Germann, p.c. 1998.

Beta-60543, bone collagen, from Level 1, submitted by G. Brewer.

Normalized age: 570 ± 55
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 490 ± 50
Significance: cultural affiliation unknown

DgMr-1, Long Creek: south side of Long Creek, 552 m asl, about 13 km south and 1.5 km west of Estevan, Souris drainage, Saskatchewan. Along with Mortlach, the Long Creek site was instrumental in placing Saskatchewan archaeology in a firm stratigraphic framework. Nine well separated occupation levels were recognized by Wettlaufer and Mayer-Oakes (1960). Radiocarbon dates were obtained on charcoal from Levels 4, 5, 7, 8, and 9. Exact provenience has been published for most of the radiocarbon samples (Wettlaufer and Mayer-Oakes 1960: Appendix 2), but the artifacts are reported only by level number. The provenience data of S-49b and S-63b are suspect due to cataloguing errors (Wettlaufer and Mayer-Oakes 1960: 137).

Level 1, referred to the "Hidatsa-Fall River Culture," yielded both Plains and Prairie side-notched, as well as Plains triangular, and a few minor un-named varieties of projectile points. Kehoe (1966: 830) notes that Wettlaufer and Mayer-Oakes (1960) interchanged the definitions of Plains and Prairie side-notched points (cf. MacNeish 1958: 103-104).

Level 2 contained two Avonlea points and one "Plains" [Prairie] side-notched point, the latter thought to have been "trampled down into this level" [Wettlaufer and Mayer-Oakes 1960: 39].

Level 3 yielded Besant points and one triangular point. The ages of these three components are limited by a date on Level 4 (S-49a) which yielded five Pelican Lake points.

Level 4 was separated from Level 5 by nearly one meter of sand and gravel that contained a large bison skull but no associated cultural material (Wettlaufer and Mayer-Oakes 1960: 90). Hence it is not surprising that there is no overlap between S-49a and a date on Level 5 (S-63a) that produced one Hanna point.

Level 6 yielded no projectile points and was not dated. Level 7 yielded three Oxbow points, two triangular points, and a date (S-50) that does not overlap S-63a, on Level 5, but is identical to S-52, on Level 8.

Level 8 contained four Oxbow points, two triangular points, one side-notched point, and one corner-notched point [counted from Wettlaufer and Mayer-Oakes (1960: Plate 18), since no text frequencies are given]. Two dates on Level 8 (S-52, S-53) can be averaged. Level 9 produced a date (S-54) but no projectile points. S-54 is incorrectly assigned to Level 8 in the date list.

After reviewing symposium papers on the subject, Wettlaufer (1981) expressed the view that Levels 6 and 9 should be attributed to Oxbow along with Levels 7 and 8. Culturally sterile gravel 29" (74 cm) below Level 9 contained charcoal dated by S-55. Sources: Kehoe, 1966; MacNeish, 1958; McCallum and Wittenberg, 1962; Morlan, 1993; Wettlaufer and Mayer-Oakes, 1960; Wilmeth, 1978.

S-49a, charcoal, from Level 4, upper portion, top of eroded gravel surface, Grid A, 20N80W, north wall, submitted by B. Wettlaufer.

Normalized age: 2230 ± 100
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Pelican Lake

Associated taxa (Level 4): *Canis familiaris*, *Bison* sp.; *Aves*, *Anatinae*?; *Amphibia*, *Rana* sp.; *Mollusca*, *Lampsilis siliquoidea*; identified by B.A. McCorquodale and A. LaRoque.

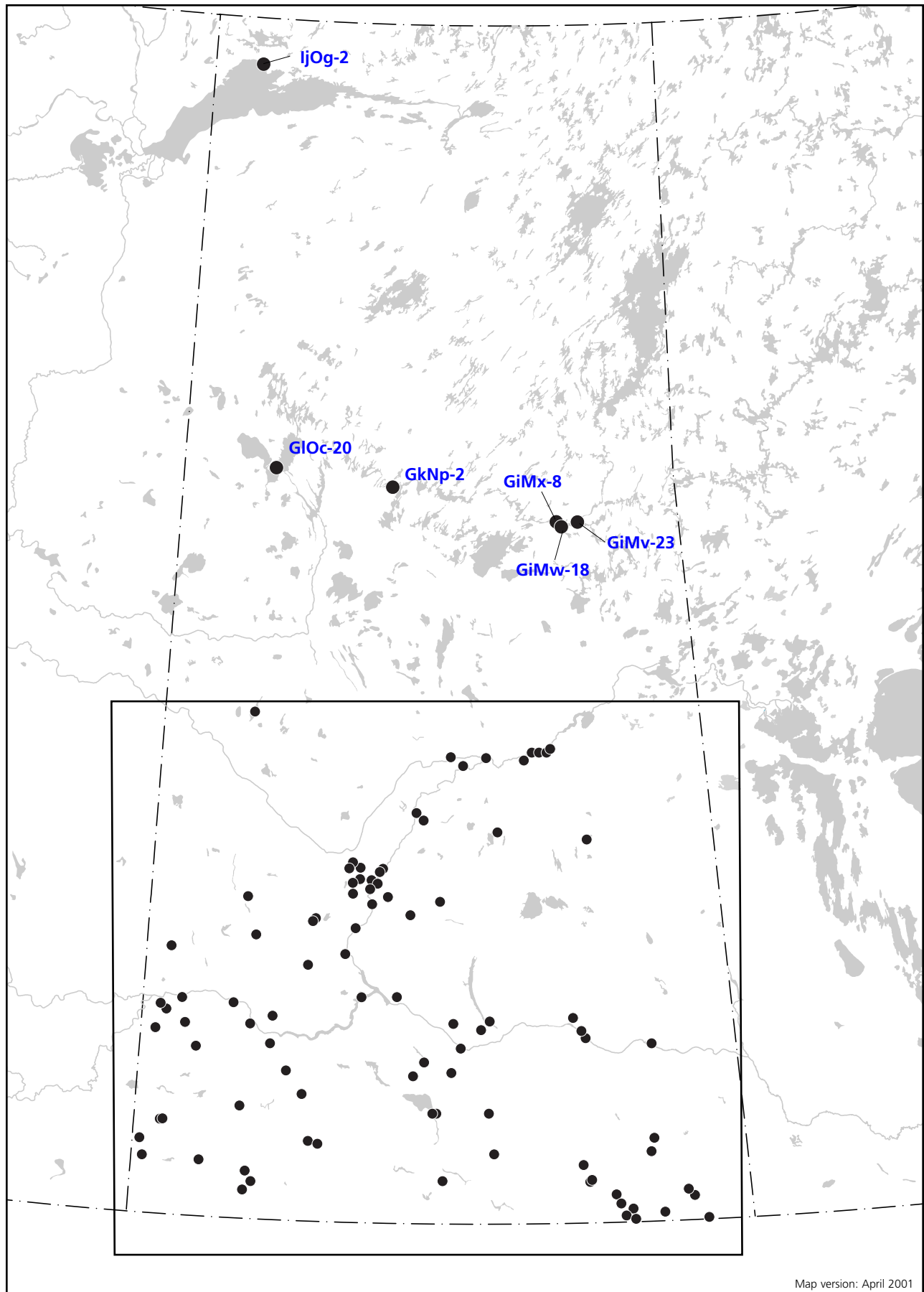


Figure I-1. Distribution of dated archaeological sites in Saskatchewan. For sites shown in box, see Figure I-2 (p. 15).

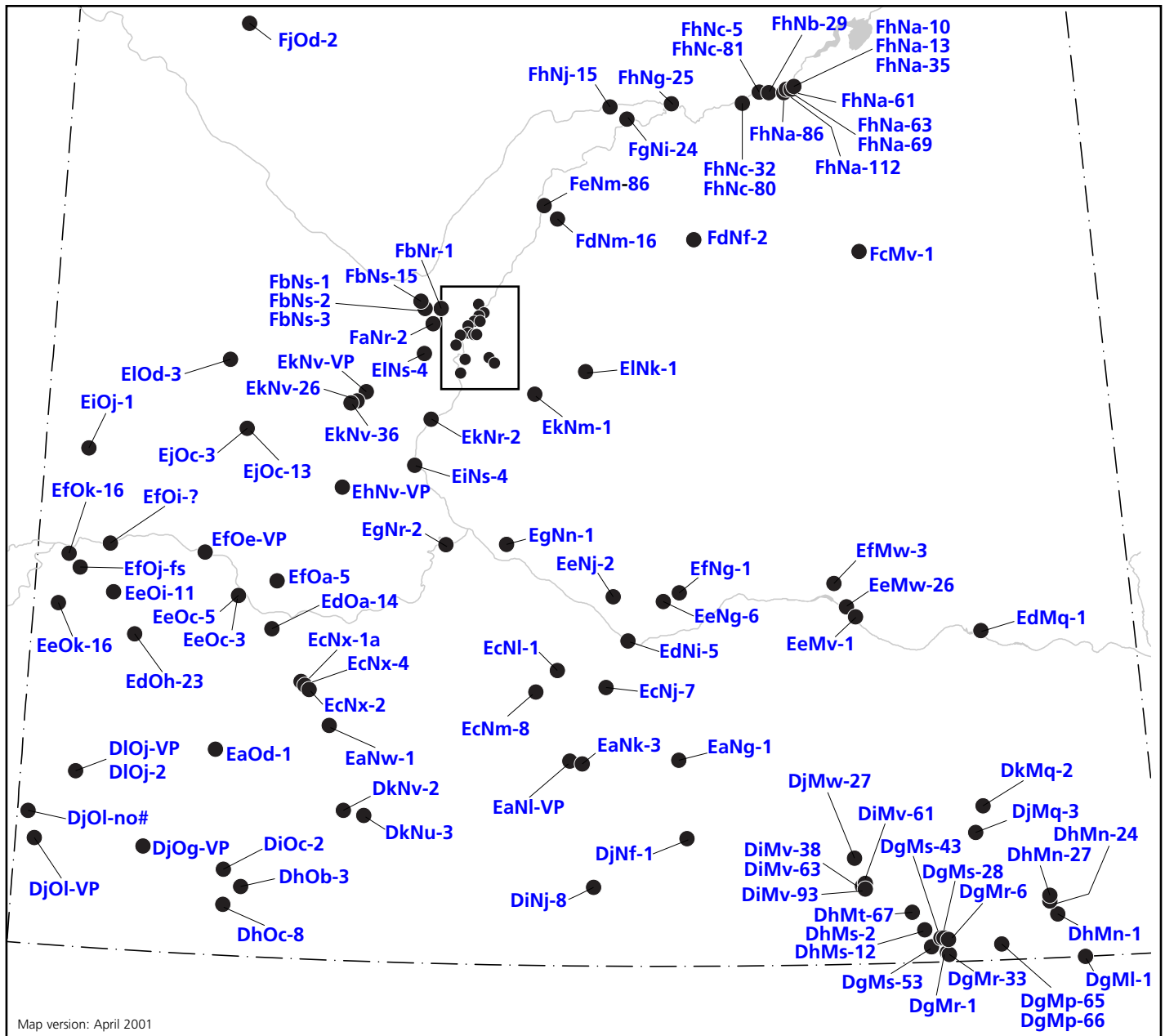


Fig. I-2. Distribution of dated archaeological sites in southern Saskatchewan. See Fig. I-1 for sites from entire province. See Fig. I-3 (p. 34) for information on sites near Saskatoon (small box in middle of the map).

S-49b, charcoal, from Level 4, lower portion, within coarse sand and gravel, Grid B, 20N56 1/2 E, submitted by B. Wettlaufer.

Normalized age: 3710 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: Rejected date; laboratory error suspected.

Significance: Archaic, Pelican Lake, anomalous, old

S-63a, charcoal, from Level 5, uppermost of the clay and silt levels, overlain by sand and gravel, submitted by B. Wettlaufer.

Normalized age: 3370 ± 145
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Hanna

Associated taxa (Level 5): *Homo sapiens*, *Sylvilagus* sp., *Thomomys talpoides*, *Canis familiaris*, *Bison* sp.; Mollusca, *Stagnicola* spp.; identified by B.A. McCorquodale and A. LaRoque.

S-63b, charcoal, from Level 5, lower zone of carbonaceous material below calcareous silty clay, submitted by B. Wettlaufer.

Normalized age: 4520 ± 170
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: Rejected date; laboratory error suspected.

Significance: Archaic, Hanna, anomalous, old

S-50, charcoal, from Level 7, buried soil in banded clay and sand, locally splits into two levels, submitted by B. Wettlaufer.

Normalized age: 4620 ± 150
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Oxbow

Associated taxa (Level 7): *Bison* sp.; identified by B.A. McCorquodale.

S-52, charcoal, from Level 8, upper portion, buried soil on dried surface with mud cracks, submitted by B. Wettlaufer.

Normalized age: 4620 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Oxbow

S-53, charcoal, from Level 8, buried soil on dried surface with mud cracks, submitted by B. Wettlaufer.

Normalized age: 4650 ± 150
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Oxbow

Suggested age (Level 8): 4630 ± 70 BP, average of S-52 and S-53.

Associated taxa (Level 8): *Spermophilus?* sp., *Canis familiaris*, *Bison* sp.; Mollusca, *Lampsilis siliquoidea*, *Lasmigona complanata*, *Anodonta grandis* (cf.), *Sphaerium sulcatum*, *Succinea ovalis*; identified by B.A. McCorquodale and A. LaRoque.

S-54, charcoal, from Level 9, middle portion, yellow-grey clay layer below Level 8, Grid B, 10N56 $\frac{1}{2}$ E & 20N56 $\frac{1}{2}$ E, submitted by B. Wettlaufer.

Normalized age: 5000 ± 125
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Oxbow?

Associated taxa (Level 9): *Bison* sp.; identified by B.A. McCorquodale.

S-55, charcoal, from gravel 74 cm below cultural level 9, submitted by B. Wettlaufer.

Normalized age: > 30 000
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: geoarchaeology

DgMr-6, Woodlawn: on top of a prominent hill north of the Souris River, about 2.4 km south of Estevan, Saskatchewan. Remains of three individuals were associated with a large conch columella pendant (either *Busycon* sp. or *Fulgar perversum*) from the Gulf of Mexico (Walker 1983a). Even though this burial was not in a mound, Syms (1979) included it in the Devils Lake-Sourisford burial complex on the basis of its geographic location, radiocarbon date, and columella pendant. No projectile points were found, but the burial

style and furnishings provide evidence for affiliation with the Late Plains period as confirmed by a date on human rib fragments. Sources: Morlan, 1993; Rutherford et al., 1979; Syms, 1979; Walker, 1983a.

S-1329, human bone collagen, *Homo sapiens* ribs (id. by E.G. Walker), from 12 cm depth in a burial pit, collected 1976, submitted by I. Dyck.

Normalized age: 975 ± 75
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 875 ± 70

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the diet.

Significance: cultural affiliation unknown

Associated taxa: *Homo sapiens*, *Odocoileus* sp.; Mollusca, *Busycon* sp. or *Fulgar perversum*; identified by E.G. Walker.

DgMr-33, Boundary Dam: beach of the Boundary Dam reservoir, 564 m asl, 10 km south of Estevan, Souris drainage, Saskatchewan. The remains, apparently eroded from a burial mound that contained a large number of decorative items, were collected by E.G. Walker who notes that the date on human rib fragments is entirely acceptable for what is expected to be a Devils Lake/Sourisford burial complex interment. No projectile points have been reported, but the burial style and furnishings provide evidence for affiliation with the Late Plains period. Sources: CMC files; Morlan, 1993.

S-2946 (CMC-1383), human bone collagen, *Homo sapiens* ribs (84 g, id. by E.G. Walker), from burial in a hillside eroded by wave action in a reservoir, submitted by E.G. Walker.

Normalized age: 825 ± 90
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 725 ± 90

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the diet.

Significance: cultural affiliation unknown

DgMs-28, Pawson: south bank of Long Creek about 1 km above its confluence with the Souris River, Saskatchewan. This site was originally recorded as a dense scatter of bone on a cultivated field. More recently the site was monitored during the installation of a water pipeline to supply the City of Estevan (Finnigan 1985b). The pipeline trench revealed four archaeological features including a "garbage pit" 90 cm deep originating 60-70 cm below the original ground surface (Finnigan 1985b: 21-23). This pit is believed to belong to the second of three cultural components at the site, and bones from the pit fill supplied a radiocarbon date (S-2692). No diagnostic artifacts were found in association with this date, but the age conforms with slim evidence that the site belongs to the Late Plains period. Sources: Finnigan, 1985b; Morlan, 1993.

S-2692, bone collagen, from "garbage pit," 90 cm deep, top at 60-70 cm depth, submitted by J.T. Finnigan.

Normalized age: 565 ± 110
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 485 ± 110

Significance: cultural affiliation unknown

DgMs-43, Target: north bank of Long Creek about 1 km above the Pawson site and 0.8 km below the Boundary Dam, Souris drainage, Saskatchewan. This site was discovered in the water pipeline trench serving the City of Estevan (Finnigan 1985b). Cultural material was observed in two of seven paleosols visible in the trench walls. Bone from a paleosol 1.55 m below the surface yielded a radiocarbon date (S-2728) but was not associated with diagnostic artifacts. Sources: Finnigan, 1985b; Morlan, 1993.

S-2728, bone collagen, from 1.55 m below surface in paleosol with cultural material, submitted by J.T. Finnigan.

Normalized age: 1360 ± 75
δ¹³C = -20 e
Uncorrected age: 1280 ± 70

Significance: cultural affiliation unknown

DgMs-53, Mad Dog: north bank of the Souris River, 565 m asl, precisely where the Rafferty Dam is now situated, Saskatchewan. The site consisted of 47 stone circles and one cairn in an area of 9.9 ha. The cairn contained a bison skull that was sampled for radiocarbon dating. No diagnostic artifacts were directly associated with the cairn. Sources: Finnigan and McKeand, 1992; Morlan, 1993.

S-2966, bison bone collagen, *Bison* sp. cranium (id. by P. McKeand), from cairn, submitted by J.T. Finnigan.

Normalized age: 1260 ± 80
δ¹³C = -20 e
Uncorrected age: 1180 ± 80

Significance: cultural affiliation unknown

Associated taxa: *Homo sapiens*, Leporidae, *Spermophilus richardsonii*, *Castor canadensis*, *Ondatra zibethicus*, *Microtus* sp., Canidae, *Vulpes velox*, *Taxidea taxus*, *Bison* sp.; Aves, Anatidae, Tetraonidae, Passeriformes; Pisces; Mollusca; identified by P. McKeand.

DhMn-1, Oxbow Dam: lowest terrace of the Souris River valley, 520 m asl, near the Oxbow Dam, Saskatchewan. Charcoal was collected from a large hearth in a paleosol overlain by 9.5 feet (2.9 m) of silt and soil. Some of the five recovered projectile points were in the hearth. Although this is the Oxbow type site, the projectile points have been interpreted as representing late Mummy Cave "at the threshold of the Oxbow complex" (Dyck 1983: 92) or early Oxbow (Walker 1980; Spurling and Ball 1981: Table 3). Nero and McCorquodale (1958: 88) noted the similarity between these points and those from Long Creek, Level 8. S-44 is one of the earliest yet obtained on an Oxbow component.

The site has been restudied by D'Arcy Green who has found as many as six palaeosols in a very complex stratigraphic sequence. The oldest diagnostic artifacts found by Green belong to the Oxbow complex and are dated by S-3648. A much older date, S-3644, was determined for an artifact-bearing level just below the Oxbow level, but no diagnostic artifacts were found in the older deposit. Green believes that S-44 is not reliably associated with the Oxbow complex and may have contained a mixture of charcoal from the Oxbow level and the level beneath it. Sources: Dyck, 1983; Green, 1995, 1998; McCallum and Dyck, 1960; Morlan, 1993; Nero and McCorquodale, 1958; Spurling and Ball, 1981; Walker, 1980; Wilmeth, 1978.

S-44, charcoal, from zone 2-3, possibly a mixture of Green's Levels 6 and 7, collected 1956, submitted by R.W. Nero.

Normalized age: 5200 ± 130
δ¹³C = -25 e

Note: Average of two runs, 5100 ± 210 BP and 5350 ± 250 BP. Significance: Archaic, Oxbow, anomalous, old

Associated taxa (zone 2-3): *Canis lupus?*, *Canis latrans?*, *Vulpes velox*, *Bison* sp.; Amphibia, *Rana* sp.; Mollusca; identified by B.A. McCorquodale.

S-3648, bison bone collagen, *Bison* sp. tibia (378.5 g), from Level 6, unit 99N/29E, northwest quadrant, 128 cm below datum, collected 1996, submitted by D.C. Green.

Normalized age: 3870 ± 80
δ¹³C = -18.05
Uncorrected age: 3760 ± 80

Significance: Archaic, Oxbow

Associated taxa (Level 6): cf. *Sylvilagus* sp., *Spermophilus richardsonii*, Arvicolinae, *Canis familiaris*, *Antilocapra americana*, *Bison* sp.; Reptilia, *Chrysemys picta*, cf. *Thamnophis* sp.; Amphibia, Anura; identified by D.C. Green.

S-3644, bison bone collagen, *Bison* sp. tibia (321.4 g), from Level 7, unit 98N/29E, southeast quadrant, 153 cm below datum, collected 1996, submitted by D.C. Green.

Normalized age: 6985 ± 90
δ¹³C = -14.0
Uncorrected age: 6810 ± 90

Significance: cultural affiliation unknown

Associated taxa (Level 7): *Spermophilus* sp., *Bison* sp.; identified by D.C. Green.

DhMn-24, Omega: tributary ravine to Moose Mountain Creek, Souris drainage, Saskatchewan. Bones from a ravine wash of cobbles mixed in clay 15 cm below the surface were submitted by Millenium Heritage Consultants Ltd. for a radiocarbon date associated with two Plains side-notched points. Sources: J. Finnigan, p.c. 1993; T. Gibson, p.c. 1992; Morlan, 1993.

S-3109, bone collagen, from ravine wash of cobbles mixed in clay, 15 cm depth, submitted by Millenium Heritage Consultants.

Normalized age: 730 ± 80
δ¹³C = -20 e
Uncorrected age: 650 ± 80

Significance: Woodland, Plains

DhMn-27, Moose Mountain Creek: tributary ravine to Moose Mountain Creek, Souris drainage, Saskatchewan. A test excavation yielded bones in sandy silt at 15 cm depth. Although possibly redeposited, some of the bones were submitted by Millenium Heritage Consultants Ltd. for a radiocarbon date; no diagnostic artifacts were associated with this date. Sources: T. Gibson, p.c. 1992; Morlan, 1993.

S-3108, bone collagen, from sandy silt, 15 cm depth, submitted by Millenium Heritage Consultants.

Normalized age: 260 ± 90
δ¹³C = -20 e
Uncorrected age: 180 ± 90

Significance: cultural affiliation unknown

DhMs-2, Davenport: bottom of a coulee that feeds into McDonald Lake, Souris drainage. Saskatchewan. This site consists of five stone circles and contains Plains side-notched points. Six bone fragments from Ring 1 yielded a radiocarbon date. Sources: T. Gibson, p.c. 1992; Morlan, 1993.

S-3217, bone collagen, from stone circle 1, submitted by M. Rollans.

Normalized age: 180 ± 65

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 100 ± 60

Significance: Woodland, Plains

DhMs-12, Sanderson: 543 m asl, south slope and valley bottom of a hogback separating the Souris River from an abandoned coulee, Saskatchewan. This large historic campsite produced Plains side-notched points, Mortlach pottery and a few trade goods from an excavated area of more than 200 m². Bone fragments from a well defined bone bed yielded a radiocarbon date. Sources: Finnigan, et al. 1990; Magee, 1997; Morlan, 1993.

S-2967, bone collagen (4 fragments, 217 g), from Level 1, unit 500N/500E, NW quad, submitted by J.T. Finnigan.

Normalized age: 390 ± 80

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 310 ± 75

Significance: Woodland, Plains

Associated taxa: *Lepus townsendii*, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Spermophilus franklinii*, *Castor canadensis*, *Ondatra zibethicus*, *Microtus pennsylvanicus*, *Canis latrans*, *Canis lupus*, *Vulpes velox*, *Mustela vison*, *Taxidea taxus*, *Mephitis mephitis*, *Antilocapra americana*, *Bison bison*; *Aves*, *Cygnus columbianus*, *Branta canadensis*, *Anas platyrhynchos*, *Anas discors*, Accipitridae, Phasianidae; Pisces (unid.); identified by M.J. Magee

DhMt-67, Tree: bottom of a wooded coulee along an intermittent stream draining into the south bank of the Souris River, Saskatchewan. At least two components are present in this site. Level 2, the main cultural level, produced late prehistoric and early historic remains and a date on bone (S-3218). Level 6, the lower level, yielded scattered remains of a Besant occupation that was not found in all excavation units; a date was obtained on bone fragments (S-3216). Sources: T. Gibson, p.c. 1992; Morlan, 1993.

S-3218, bone collagen (331 g), from Level 2, unit 194N/189E, NW quad, Block B, submitted by M. Rollans.

Normalized age: 250 ± 65

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 170 ± 60

Significance: Woodland, Plains

S-3216, bone collagen (265 g), from Level 6, unit 221N/186E, NW quad, submitted by M. Rollans.

Normalized age: 2790 ± 75

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2710 ± 70

Significance: Woodland, Besant

DiMv-38, Jots: floodplain at the confluence of Jewel Creek and Roughbark Creek, Souris drainage, Saskatchewan. The site consists

of a dense bone bed with hearth features and bone-filled pits. Associated point styles are mainly Prairie side-notched with some Avonlea characteristics noted in the ceramic assemblage. A bone sample from an ash pit just beneath the bone bed yielded a radiocarbon date. Sources: T. Gibson p.c., 1992; Morlan, 1993.

S-3219, bison bone collagen, *Bison* sp. scapula (216 g), from Level 3, unit 106N/143E, SW quad, feature 1, an ash pit, submitted by M. Rollans.

Normalized age: 1130 ± 80

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1050 ± 80

Significance: Woodland, Prairie

DiMv-61, Peg: about 13.5 km west on municipal road 606 from Midale, on the north bank of Souris River, 546 m asl, about 56 km upstream of Estevan, Saskatchewan. This is a multicomponent campsite with several Avonlea components around 2 m depth. One of these, Level 18, yielded a date on bison rib fragments (S-2968).

According to C.T. Shay, in addition to dating the site occupation, GSC-5842 also corresponds to a coarsening of the alluvial sequence, suggesting the occurrence of more frequent and higher magnitude flood events. Sources: Finnigan, et al. 1990; Morlan, 1993; Rollans and McKeand, 1992; Shay, et al. 1990, 1993.

GSC-5842, ash and maple charcoal, *Fraxinus* sp. and cf. *Acer* sp. (DiMv-61:1370, id. by D.M. Deck), from hearth or burn pit in alluvial sediment, Level 11, unit 463S/501E, 50-55 cm depth, collected 1990.07, submitted by C.T. Shay.

Normalized age: 990 ± 80

$\delta^{13}\text{C} = -24.6$

Significance: cultural affiliation unknown

S-2968, bison bone collagen, *Bison* sp. rib (221 g), from Level 18, unit 500S/500E, SE quad, 190-200 cm below datum, submitted by J.T. Finnigan.

Normalized age: 1305 ± 85

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1225 ± 85

Significance: Woodland, Avonlea

DiMv-63: 1.7 km south of road along cutbank of Souris River floodplain, 541 m asl, 8 km west of highway 39 along provincial road 705, between Halbrite and Midale, Saskatchewan. According to C.T. Shay, S-3554 assists in the correlation of the alluvial stratigraphy and the reconstruction of the flood plain history of the Upper Souris River. Sources: Finnigan, 1988.

S-3554, bison bone collagen, *Bison bison* ulna and horn core (DiMv-63:126, 128, id. by P. McKeand), from alluvial sand, Occupation 6, Level 11, 110 cm below surface, submitted by C.T. Shay.

Normalized age: 1465 ± 140

$\delta^{13}\text{C} = -17.8$

Uncorrected age: 1350 ± 140

Significance: cultural affiliation unknown

DiMv-93, Crane: in a cut bank on the north side of the Souris River, 542 m asl, just west of Dr. Mainprize Regional Park, Saskatchewan. This multicomponent campsite spans the last 3000 years of occupation in the Souris valley, beginning with Pelican Lake components and extending to the Railway era. Preliminary findings include six dates on bone samples. Level 5 is the youngest dated

component with late prehistoric material and one radiocarbon date (S-3215). Level 12, with no diagnostic artifacts, has a radiocarbon date (S-3214). Level 16 yielded Besant points and a radiocarbon date (S-3213). A slightly older age, without diagnostic artifacts, was found for Level 19 (S-3211). Level 26 contains a late Pelican Lake or early Besant component and produced a radiocarbon date (S-3212). The next level, Level 27, produced a Pelican Lake point and is much older, according to a date on a bison proximal radius fragment (S-2969). Sources: Finnigan, et al. 1990; Morlan, 1993.

S-3215, bone collagen (14 fragments, 229 g), from Level 5, units 97N/100W & 97N/101W, submitted by J.T. Finnigan.

Normalized age: 260 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 180 ± 70

Significance: Woodland, Plains

S-3214, bone collagen (16 fragments, 211 g), from Level 12, units 96N/102W, 97N/102W and 98N/102W, submitted by J.T. Finnigan.

Normalized age: 780 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 700 ± 60

Significance: cultural affiliation unknown

S-3213, bone collagen (7 fragments, 233 g), from Level 16, unit 97N/99W and 98N/102W, submitted by J.T. Finnigan.

Normalized age: 1680 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1600 ± 70

Significance: Woodland, Besant

S-3211, bone collagen (247 g), from Level 19, unit 95N/100W, submitted by J.T. Finnigan.

Normalized age: 1740 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1660 ± 60

Significance: cultural affiliation unknown

S-3212, bone collagen (4 fragments, 240 g), from Level 26, unit 95N/102W, submitted by J.T. Finnigan.

Normalized age: 2050 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1970 ± 70

Significance: cultural affiliation unknown

S-2969, bison bone collagen, *Bison* sp. radius (208 g), from Level 27, unit 1s/0e, NE quad, submitted by J.T. Finnigan.

Normalized age: 3330 ± 95
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 3250 ± 95

Significance: Archaic, Pelican Lake

DjMq-3, Kisbey: about 6 km west-southwest of Kisbey, 614 m asl, Moose Mountain Creek, Souris drainage, Saskatchewan. Multiple bundle burials were extensively disturbed by cultivation, but partial remains of five or six individuals were recovered in situ. Some of the ribs were submitted for a radiocarbon date. Similarities with the Gray site and the presence of Oxbow points in the surrounding field

prompted Walker (1984a: Table 4) to consider Kisbey as a probable Oxbow burial, but Kisbey produced no diagnostic artifacts in association with the skeletal remains. Sources: Morlan, 1993; Walker, 1982a, 1984a.

S-2251, human bone collagen, *Homo sapiens* ribs (id. by E.G. Walker), from burial, submitted by I. Dyck.

Normalized age: 3245 ± 80
 $\delta^{13}\text{C} = -19 \text{ e}$
 Uncorrected age: 3145 ± 80

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the diet.

Significance: cultural affiliation unknown

Associated taxa: *Homo sapiens*, *Canis* sp.; identified by E.G. Walker.

DjMw-27, Bennet: on the left (locally the southeast) bank of the Souris River, 573 m asl, about 9 km west-northwest of Halbrite, Saskatchewan. Both Late Plains and Avonlea materials had been collected at this site previously, and two radiocarbon samples were submitted following monitoring of a pipeline trench that passed through the site deposits. One date was obtained on bone from a hearth feature, Feature 3, situated 95 cm BS in the north wall of the pipeline trench (S-2726). A date on bone was obtained from another hearth, Feature 21, at a depth of 1.06 m BS (S-2727). The two features were about 80 m apart, and neither was directly associated with diagnostic cultural materials, although Besant points and pottery were recovered from the trench spoil pile. Sources: Finnigan, 1985a; Morlan, 1993.

S-2727, bone collagen, from hearth feature 21, 106 cm depth, submitted by J.T. Finnigan.

Normalized age: 1760 ± 140
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1680 ± 140

Significance: cultural affiliation unknown

S-2726, bone collagen, from feature 3, 95 cm depth, submitted by J.T. Finnigan.

Normalized age: 1925 ± 135
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1845 ± 135

Significance: cultural affiliation unknown

DkMq-2, Moose Mountain Medicine Wheel: 12.9 km north of Kisbey on the highest dome-shaped hill of the area, 785 m asl, Moose Mountain Creek, Souris drainage, Saskatchewan. Five small charcoal samples collected by T.F. Kehoe, from west of center in the central cairn, and from datum to 30 cm above datum, were combined to obtain a radiocarbon date. The stone configuration forms a medicine wheel consisting of central cairn, 9.1 m diam, surrounded by a stone circle, 15.2 to 18.3 m diam, with five lines of stone extending in several directions terminating in stone cairns, 0.9 m diam. Cultural affiliation is unknown.

Charcoal in the black earth indicates that the site burned over before the central cairn and rock feature were built. Prairie side-notched points lay directly above the basal rocks of the central cairn and may date later than the basal configuration. Kehoe considers S-1241 to be a date on the initial construction of the central cairn (Kehoe and Kehoe 1979: 42). However, given the composite origin of the sample, the date is not clearly associated with any particular target. Sources: Kehoe and Kehoe, 1979; Morlan, 1993; Rutherford et al., 1979.

S-1241 (CMC-877-881), charcoal, from five small samples from various contexts within the medicine wheel, collected 1976, submitted by T.F. Kehoe.

Normalized age: 2650 ± 245
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DiNj-8, Willowbunch: from a yard within the town of Willowbunch, 732 m asl, Big Muddy drainage, Saskatchewan. Human remains were under a buried rock cairn at a depth of 99 cm in sandy deposits. The buried cairn was at the base of a steep hill and was covered by colluvium. According to E.G. Walker, the mode of burial and nature of grave inclusions are reminiscent of the Pelican Lake complex, although no diagnostic artifacts were recovered. A large collection of bird bones was recovered with the remains of a subadult individual. A date on human ribs is supportive of a Pelican Lake affiliation. Sources: Morlan, 1993.

S-2945 (CMC-1382), human bone collagen, *Homo sapiens* ribs (91 g, id. by E.G. Walker), from burial beneath a cairn, covered with colluvium, collected 1986, submitted by E.G. Walker.

Normalized age: 3400 ± 90
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3300 ± 90

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet

Significance: Archaic, Pelican Lake?

Associated taxa: *Homo sapiens*; *Aves* (unidentified); identified by E.G. Walker.

DiNf-1, Dunn: near Amulet, Souris headwaters, Saskatchewan. Charred bone was collected by T.F. Kehoe from an undisturbed area below the plow zone, and more than 30 Scottsbluff-Eden points and fragments were collected from the surface of a cultivated field. Remains of the Oxbow complex were also present, but the radiocarbon date, on an insoluble collagen extraction, is not clearly associated with any of the recovered artifacts. Sources: Ebell, 1988; Morlan, 1993; Rutherford et al., 1979.

S-168, bone collagen, from surface finds, collected 1961, submitted by T.F. Kehoe.

Normalized age: 5080 ± 120
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 5000 ± 120

Significance: cultural affiliation unknown

DkNu-3, Niska: about half-way between the towns of Ponteix and Aneroid, Notukeu Creek, Wood River drainage, Saskatchewan. Many Cody complex artifacts have been found on the surface, but only two point stem fragments were found in situ. One of them occurred in unit 132S/293E adjacent to radiocarbon sample S-2235 from unit 132S/292E in the eastern excavation block. Meyer (1985: 28) believes that S-2235 is too recent, possibly due to contamination by recent rootlets; the paleosol was near the surface where a grain crop had been grown in the previous year. The other point stem fragment occurred in the western block in unit 142S/280E, diagonally adjacent to S-2353 from unit 141S/279E. S-2453 consisted of 215 g of bone fragments from the western block that apparently contained very little collagen, resulting in a large standard deviation (Meyer 1986: 172).

Meyer collected more samples from Niska in 1986, and four were submitted for dating (D. Meyer, p.c. 1989). The large standard

deviation on S-2510 (± 650) is a result of having used a small counter that had been out of service for several weeks and lacked adequate background statistics (J. Wittenberg, p.c. to D. Meyer). Of three AMS dates from the Isotracer laboratory, the youngest (TO-362) cannot be considered to date the Cody complex, and the oldest (TO-956) appears to date an earlier Paleoindian hearth about 45 m south of the main site concentration (Meyer and Liboiron 1990). Between these is a date (TO-934) that overlaps the range of S-2235, the latter already mentioned as probably too recent.

Several factors may have contributed to these disparate results. The Niska site may never have been deeply buried, and the bones used for dating may have been subjected to a variety of diagenetic processes in the active layer of the soil. For example, plant rootlets and fungi may have launched repeated or prolonged attack, and bones from such burial environments can be unusually difficult to rid of contaminants. The site has been severely deflated by wind erosion, and the paleosol associated with the occupation debris may be host to a lag deposit that incorporated younger materials during previous deflation episodes. David Meyer (p.c. 1990) has given careful thought to the latter possibility, and he notes that there are no apparent differences in the state of preservation of the bone samples submitted for dating. Judging from other sites, the best estimate of age for the Cody complex occupation at Niska is given either by an average of S-2353 and S-2453 ($7060 \pm 160 \text{ BP}$) or by S-2510 ($8475 \pm 650 \text{ BP}$). Sources: Hanna, et al. 1983; Meyer, 1985, 1986; Meyer and Liboiron, 1990; Morlan, 1993; Pettipas, 1986.

TO-362, bison bone collagen, *Bison* sp. (id. by D. Meyer), from cultural layer, submitted by D. Meyer.

Normalized age: 3100 ± 80
 $\delta^{13}\text{C} = ?$

Significance: Palaeoindian, anomalous, young

S-2235, paleosol, from cultural level, east block, unit 132s/292e, submitted by D. Meyer.

Normalized age: 5910 ± 270
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Palaeoindian, anomalous, young

TO-934, bison bone collagen, *Bison* sp. (id. by D. Meyer), from cultural layer, submitted by D. Meyer.

Normalized age: 6170 ± 70
 $\delta^{13}\text{C} = ?$

Significance: Palaeoindian, anomalous, young

S-2353, paleosol, from cultural layer, west block, unit 141s/279e, submitted by D. Meyer.

Normalized age: 7000 ± 185
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Palaeoindian

S-2453, bison bone collagen, *Bison* sp. (215 g, id. by D. Meyer), from cultural layer, west block, submitted by D. Meyer.

Normalized age: 7245 ± 320
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 7165 ± 320

Significance: Palaeoindian

S-2510, paleosol, from cultural layer, submitted by D. Meyer.

Normalized age: 8475 ± 650
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Palaeoindian

TO-956, charcoal, from hearth in south area of site, submitted by D. Meyer.

Normalized age: 10 880 ± 70
 $\delta^{13}\text{C} = ?$

Significance: Palaeoindian

DkNv-2, Napao: just southwest of Ponteix, Notukeu Creek, Wood River drainage, Saskatchewan. This site, containing a Cody complex component, was discovered and excavated by Henri Liboiron with the assistance of Pat Froese and Gil Watson (D. Meyer, p.c. 1989). Details concerning the associations of these samples are not available, but the site has been deflated by wind erosion. Factors similar to those suspected at Niska (DkNu-3) may account for the spread of three radiocarbon dates. The youngest (S-2569) is too recent for the Cody complex. Either of the two older dates may provide a reasonable age for the Napao site. Sources: Morlan, 1993.

S-2569, bone collagen, from cultural layer, submitted by D. Meyer.

Normalized age: 4760 ± 365
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 4680 ± 365

Significance: Palaeoindian, anomalous, young

S-2891, bone collagen, from cultural layer, submitted by D. Meyer.

Normalized age: 6715 ± 205
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 6635 ± 205

Significance: Palaeoindian, anomalous, young

S-2890, bone collagen, from cultural layer, submitted by D. Meyer.

Normalized age: 8155 ± 230
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 8075 ± 230

Significance: Palaeoindian

DhOb-3, Bracken Cairn: south of the Frenchman River, near Bracken, Saskatchewan. This ochre-covered burial contained the remains of a male, a female and an infant, 0.9-1.2 m below surface, on prominent knoll, covered by a large stone cairn, in which a Pelican Lake point was found. Human bone fragments supplied a date on an insoluble collagen extraction. Sources: King, 1961; Morlan, 1993; Rutherford et al., 1981; Walker, 1982b.

S-912, human bone collagen, *Homo sapiens* (id. by E.G. Walker), from burial cairn, collected 1956, submitted by W. Pendree.

Normalized age: 2570 ± 90
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 2470 ± 90

Note: The normalized age is a minimum, because bison that had consumed C4 plants were probably included in the human diet

Significance: Archaic, Pelican Lake

Associated taxa: *Homo sapiens*, *Spermophilus richardsonii*, *Castor canadensis*, *Microtus pennsylvanicus*, *Vulpes velox*, *Ursus sp.*, *Mephitis mephitis*, *Odocoileus sp.*, *Antilocapra americana*, *Bison sp.*; Aves, *Branta canadensis*, *Corvus brachyrhynchos*; identified by E.G. Walker.

DhOc-8, Tipi Cluster: 700 m south of the Frenchman River, about 1000 m asl, Saskatchewan. A charcoal sample was taken from a post in Feature 4, comprised of two posts in Tipi Ring No. 1. No diagnostic artifacts were found. Sources: Finnigan, 1983; Morlan, 1993.

S-2242, charcoal, from post in tipi ring no. 1, feature 4, submitted by J.T. Finnigan.

Normalized age: 1425 ± 295
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DiOc-2, Tipi Summit: 700 m north of the Frenchman River, 1018 m asl, Saskatchewan. A charcoal sample was recovered from a cobble-lined hearth just outside Tipi Ring No. 3. No diagnostic artifacts were found. Sources: Finnigan, 1983; Morlan, 1993.

S-2241, charcoal, from cobble-lined hearth in tipi ring no. 3, submitted by J.T. Finnigan.

Normalized age: 1590 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DjOg-VP, Conglomerate Valley: on a bench near the confluence with Frenchman River, 950 m asl, Saskatchewan. Sources: Klassen, 1992.

S-2893, bison bone collagen, *Bison sp.*, from silty loam 8 m above the creek bottom, 1 m depth, submitted by R.W. Klassen.

Normalized age: 4050 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3970 ± 80

Significance: palaeobiology

DjOI-no #, Battle Creek Coulee: in Fort Walsh National Historic Park, Cypress Hills, Saskatchewan. Samples were collected by J.S. Murray, Parks Canada, Winnipeg, from stratified hearth features, but no diagnostic artifacts were found. Charcoal from Layer 7 was used for S-1626. Two dates on charcoal from Layer 9 are too different to permit averaging.

Records in the Heritage Branch do not contain references to these dates, and it is not known which of more than 100 sites in this Borden block is dated by these samples (C. Germann, p.c. 1996). Sources: Morlan, 1993; Rutherford et al., 1984.

S-1626, charcoal, from Layer 7, collected 1978, submitted by J.S. Murray.

Normalized age: 3180 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-1625, charcoal, from Layer 9, collected 1978, submitted by J.S. Murray.

Normalized age: 3780 ± 50
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-1624, charcoal, from Layer 9, collected 1978, submitted by J.S. Murray.

Normalized age: 4110 ± 60
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DjOI-VP, Battle Valley: on a terrace in the Battle Creek valley, 1080 m asl, near Fort Walsh, Saskatchewan. Sources: Klassen, 1992.

S-2892, bison bone collagen, *Bison* sp., from silty loam 8 m above the creek bottom, 4 m depth, submitted by R.W. Klassen.

Normalized age: 6650 ± 95
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 6570 ± 95

Significance: palaeobiology

DIOj-2, Gap Creek or Maple Creek: 8 km southwest of Maple Creek, Cypress Hills, Saskatchewan. Charcoal (S-298) was recovered by G.C. Watson from a hearth under 9 feet (2.7 m) of clay and 11 feet (3.4 m) above the bed of Gap Creek. A second sample (S-415) was dated, but no artifacts were associated with the hearth. Sources: Dyck, 1983; McCallum and Wittenberg, 1968; Morlan, 1993; G.C. Watson, p.c. to A. Rutherford, 1970; Wilmeth, 1978.

S-415, charcoal, from hearth exposed in cutbank without associated artifacts, submitted by G.C. Watson.

Normalized age: 1810 ± 60
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-298, charcoal, from hearth exposed in cutbank without associated artifacts, collected 1966, submitted by E.A. Christiansen.

Normalized age: 2000 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

DIOj-VP, Gap Valley: on a bench in the Gap Valley, 785 m asl, near The Weir, Saskatchewan. Sources: Klassen, 1992.

TO-100, bone collagen, from sandy alluvium overlying till, 7 m above the creek bottom, 2 m depth, submitted by A.M. Stalker.

Normalized age: 3600 ± 80
 $\delta^{13}\text{C} = ?$

Significance: palaeobiology

EdMq-1, Moose Bay Burial Mound: near Crooked Lake on the north edge of the Qu'Appelle Valley, 549 m asl, Saskatchewan. Wood from a central roof support of the burial mound structure provided a radiocarbon date (S-453). A Plains side-notched and two Prairie side-notched points were found in the central chamber. Syms (1979) includes a burial intrusive into this mound in the Devils Lake/Sourisford burial complex, but S-453 pre-dates the intrusion. Hanna (1976: 22), Walker (1983b: 113), and Dyck (1983: Table 10.4) list this date as S-543. Sources: Dyck, 1983; Hanna, 1976; Morlan, 1993; Rutherford et al., 1973; Syms, 1979; Walker, 1983b; Wilmeth, 1978.

S-453, wood, from burial mound, central support post, collected 1968, submitted by G.C. Watson.

Normalized age: 910 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Plains, Prairie

Associated taxa: *Homo sapiens*; Reptilia, *Chrysemys picta*; identified by M.G. Hanna.

EeMv-1, Katepwa Beach: at Katepwa Beach in the Qu'Appelle Valley, Saskatchewan. A radiocarbon sample was collected by I. Dyck from a cottage well where an occupation layer 5-15 cm thick, 2.3 m below surface, was associated with chipped stone flakes and a biface. No diagnostic artifacts were recovered. Sources: Morlan, 1993; Rutherford et al., 1979.

S-1067, bison bone collagen, *Bison* sp. (id. by I. Dyck), from cultural layer 5-15 cm thick, 2.3 m depth, exposed in a cottage well, collected 1975, submitted by I. Dyck.

Normalized age: 4860 ± 195
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 4780 ± 195

Significance: cultural affiliation unknown

EeMw-26, Lebret: between Mission Lake and Katepwa Lake in the Qu'Appelle Valley, Saskatchewan. Four excavation areas (A, B, R, and S) revealed stratified deposits containing cultural remains for which 13 radiocarbon dates were obtained. The cultural levels were generally well separated by layers of colluvial and alluvial sediment in Areas A and B, although the upper layers were disturbed by cultivation.

Area A, at the west end of the site, yielded historic (Métis) and late prehistoric artifacts in a plowzone arbitrarily divided into Levels 1 and 2. Level 3 yielded four Avonlea side-notched points, three Avonlea triangular points, and a radiocarbon date on bison bone (S-2691). In Level 4 a single Sandy Creek point was associated with dated bison bone (S-2791). Smith (1986) points out that the Level 4 date is significantly earlier than previously obtained dates from other Sandy Creek components and that it helps to fill a temporal gap between Sandy Creek and its most likely predecessor, the Oxbow complex (cf. Dyck 1983: 108).

Area B, near the east end of the site, was covered by a mixture of historic and late prehistoric artifacts in a plowzone. A component labelled Level 2A contained a tentatively identified Prairie side-notched point base and yielded a date on charcoal (S-2795). Level 3 contained three Avonlea triangular points and produced a date on bison bone (S-2797); a McKean lanceolate point from Level 3 was associated with a rodent burrow and is probably intrusive. Bison bone from Level 4 yielded an anomalous date (S-2801), and no projectile points were recovered in this poorly defined, intermittent paleosol. Level 5 was marked by a well defined paleosol but lacked projectile points and yielded a second anomalous date on bison bone (S-2792). One Sandy Creek point was found in Level 6 and dated on charcoal (S-2796). Three dates on Level 7, with no projectile points, can be averaged.

Smith (1986) rejects the dates from Levels 4 and 5. He notes that cultural level 4 was poorly defined during excavation and yielded very little cultural material. The bone selected for S-2801 was the largest found in this stratigraphic layer, and it was not associated with any diagnostic artifacts. He suggests that the bone, and perhaps the other items, could have been redeposited from other layers, perhaps by rodent disturbance. S-2792 from Level 5 is also out of sequence with respect to S-2797 from Level 3. Smith (1986) prefers the latter date because the sample was larger and had a better documented association with the cultural level. He notes that S-2792 was selected for dating out of necessity rather than choice.

The dates on the Avonlea complex can be interpreted in two ways, depending upon one's interpretation of Area B. Even if S-2801 on dubiously defined Level 4 is ignored, the dates on Level 3 (S-2797) and Level 5 (S-2792) remain out of sequence. Smith (1986) rejects the latter date and suggests that Level 5 may represent a Besant complex occupation on the basis of its stratigraphic position. However, in the absence of diagnostic artifacts, it is equally plausible to interpret Level 5 as a correctly dated Avonlea component, close in age to Avonlea in Area A, and to suggest that the Level 3 has been made spuriously old by rodent disturbance.

Area R, at the east end of the site, was excavated partly with archaeological methods and partly with a backhoe. Smith (1986) generally excluded this area from his analysis, but he reported two radiocarbon dates of which one (S-2800) is attributed to the Avonlea complex. The other (S-2762) has no known cultural affiliation.

Area S, also at the east end of the site, was excavated with archaeological methods but only to a depth specified by the landowner who used the pit as the basement for his cottage. Stratigraphic layers were difficult to recognize during excavation, and 5 cm arbitrary levels were employed with depth measurements recorded for each artifact. Cultural levels were reconstructed using the depth measurements, and these proved to correspond to paleosols that were visible in profile: (1) Métis artifacts in the upper 7 cm (2) one Plains side-notched point, 7-20 cm BS; (3) no diagnostic artifacts, 25-40 cm BS; and (4) net-impressed Avonlea ceramics associated with a date (S-2799) on bison bone. Sources: Dyck, 1983; Morlan, 1993; Smith, 1986; Smith and Walker, 1988.

S-2691, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area A, level 3 (layer 4), unit A-5, paleosol on sand and gravel slopewash, submitted by E.G. Walker.

Normalized age: 1340 ± 115
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1260 ± 115

Significance: Woodland, Avonlea

Associated taxa (Area A, level 3): *Homo sapiens*, *Lepus americanus*, *Castor canadensis*, *Canis lupus*, *Vulpes vulpes*, *Lutra canadensis*, *Bison* sp.; Aves, *Branta canadensis*, *Anas platyrhynchos*, Passeriformes; Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Perca flavescens*, *Coregonus clupeaformis*, *Coregonus artedii*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2791, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area A, level 4 (layer 8), unit A-4, paleosol on grey clay and gravel, submitted by E.G. Walker.

Normalized age: 3060 ± 105
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 2980 ± 105

Significance: Archaic, Sandy Creek

Associated taxa (Area A, level 4): *Lepus americanus*, *Odocoileus* sp., *Bison* sp.; Aves (unid.); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Perca flavescens*, *Coregonus clupeaformis*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2795, charcoal, from Area B, level 2A (layer 3), paleosol in unit 7s/14w, 20-24 cm depth, submitted by E.G. Walker.

Normalized age: 725 ± 95
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Prairie

Associated taxa (Area B, level 2A): *Lepus americanus*, *Canis* sp., *Lutra canadensis*?, *Bison* sp.; Aves (unidentified); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Coregonus clupeaformis*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2797, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area B, level 3 (layer 5) unit 8s/13w, 28-30 cm depth, paleosol on silty sand and gravel slopewash, submitted by E.G. Walker.

Normalized age: 1715 ± 105
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1635 ± 105

Significance: Woodland, Avonlea

Associated taxa (Area B, level 3): *Lepus americanus*, *Lepus townsendii*, *Canis lupus*, *Vulpes vulpes*?, *Odocoileus* sp.?, *Cervus elaphus*?, *Bison* sp.; Aves (unid.); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Perca flavescens*, *Coregonus clupeaformis*, *Coregonus artedii*, *Lota lota*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2801, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area B, level 4 (layer 7), an intermittent paleosol, very little material, submitted by E.G. Walker.

Normalized age: 480 ± 255
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 400 ± 255

Significance: cultural affiliation unknown, anomalous, young

S-2792, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area B, level 5 (layer 9), paleosol, unit 8s/13w, 55-60 cm depth, submitted by E.G. Walker.

Normalized age: 1285 ± 100
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1205 ± 100

Significance: cultural affiliation unknown, anomalous, young

Associated taxa (Area B, level 5): *Bison* sp.; Aves (unid.); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Coregonus clupeaformis*, *Coregonus artedii*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2796, charcoal, from Area B, level 6 (layer 11), unit 8s/14w, 66-72 cm depth, paleosol on grey-brown silty clay and gravel, submitted by E.G. Walker.

Normalized age: 2495 ± 440
 $\delta^{13}\text{C} = -25$ e

Significance: Archaic, Sandy Creek

Associated taxa (Area B, level 6): *Lepus americanus*, *Castor canadensis*, *Canis* sp., Mustelidae, *Bison* sp.; Aves (unidentified); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Coregonus clupeaformis*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2794, charcoal, from Area B, level 7 (layer 13), paleosol on sand and gravel shoreline deposit, submitted by E.G. Walker.

Normalized age: 2590 ± 790
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown

S-2798, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area B, level 7 (layer 13), paleosol on sand and gravel shoreline deposit, submitted by E.G. Walker.

Normalized age: 2665 ± 290
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 2585 ± 290

Significance: cultural affiliation unknown

S-2793, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area B, level 7 (layer 13), paleosol on sand and gravel shoreline deposit, submitted by E.G. Walker.

Normalized age: 3070 ± 115
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 2990 ± 115

Significance: cultural affiliation unknown

Suggested age (Area B, level 7): 3005 ± 110 BP, average of S-2793, S-2794, and S-2798

Associated taxa (Area B, level 7): *Lepus americanus*, *Castor canadensis*, *Canis lupus*, *Bison* sp.; Aves (unid.); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Perca flavescens*, *Coregonus clupeaformis*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

S-2800, material unknown, from cultural level in Area R, partly dug with a backhoe, submitted by E.G. Walker.

Uncorrected age: 1510 ± 105
 $\delta^{13}\text{C} = ?$

Significance: Woodland, Avonlea?

S-2762, material unknown, from cultural level, Area R, hearth in paleosol uncovered by a backhoe, submitted by E.G. Walker.

Uncorrected age: 1795 ± 175
 $\delta^{13}\text{C} = ?$

Significance: cultural affiliation unknown

S-2799, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from Area S, level 4, paleosol, submitted by E.G. Walker.

Normalized age: 1610 ± 105
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 1530 ± 105

Significance: Woodland, Avonlea

Associated taxa (Area S, level 4): *Lepus* sp., *Canis* sp., *Lutra canadensis*?, *Bison* sp.; Aves (unid.); Pisces, *Esox lucius*, *Stizostedion vitreum*, *Catostomus commersoni*, *Coregonus clupeaformis*; Mollusca; identified by E.G. Walker (mammals, birds), F.M. Atton (fishes).

EfMw-3, Sedo: 4 km south, 4 km east of Lipton, Qu'Appelle valley, Saskatchewan. Two Oxbow points and a human skull and mandible were found by G. Blackbeard and G. Bereti in a recently wind-deflated field. The RCMP were notified and deposited the skull in the Saskatchewan Museum of Natural History. The points remained in Blackbeard's possession.

A field inspection by Ian Dyck determined that no burial pit was visible, and no artifacts were directly associated with the skull.

Eroded campsite debris was seen within 10-40 m, including Oxbow and Hanna projectile points, and one Oxbow point was found 1 m northeast of the skull. A brief report on physical anthropology was placed on file by E.G. Walker (unpublished files, Saskatchewan Heritage Branch). Sources: Dyck, 1983; Morlan, 1993.

S-2227, human bone collagen, *Homo sapiens* (id. by E.G. Walker), from sand, recently eroded by wind, 0-30 cm depth, submitted by I. Dyck.

Normalized age: 4725 ± 80
 $\delta^{13}\text{C} = -19$ e

Uncorrected age: 4625 ± 80

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.

Significance: cultural affiliation unknown

EaNf-1, Avonlea: about 5 km east of the town of Avonlea, Moose Jaw valley, Qu'Appelle drainage, Saskatchewan. The original radiocarbon sample (S-45) was taken from a concentration of burned bone fragments associated with Avonlea points that occurred 20-40 cm below the surface, overlain by aeolian fine sand with no levels of occupation occurring above or below the dated material. This sample is described as a charcoal sample by Kehoe and McCorquodale (1961a: 139, 1961b: 186) and elsewhere is said to have come from a "pit with steep sides, filled with ash and charcoal (which was radiocarbon dated)" (Kehoe, et al. 1988: 14).

In 1984, the Kehoes returned to Avonlea with B.A. McCorquodale but could not precisely locate the original excavation units because the site had been plowed during the intervening years. "By 1984, plowing had removed 20 cm of soil leaving only a remnant of the post-Avonlea soil ... in place... The yellow-brown layer ... often appeared immediately at the base of the plow zone" (Kehoe, et al. 1988: 14). Bone fragments were recovered from a hearth in unit 6, 10-15 cm below the plow zone and gave a surprisingly early date (S-2777). Truncation of the site by plowing might have accounted for this result.

Also in 1984, Olga Klimko conducted an excavation designed to mitigate the impact of a new highway alignment approximately 280 m south of the Kehoe and McCorquodale excavation (Klimko 1985a; Klimko and Hanna 1988). Two samples were submitted for radiocarbon dating. S-2628 consisted of "carbon" scraped from the exterior of potsherds, and it "proved to contain a very small amount of carbon" (Klimko and Hanna 1988: 30); therefore the sample material is not properly identified. S-2623 is bone that was associated with Avonlea points.

Assuming that Kehoe and Klimko have sampled the same site, the best estimate for its age is provided by an average of S-45 and S-2623. Some sources give an incorrect Borden designation, EaNf-1, for this site. Sources: Kehoe and McCorquodale, 1961a, 1961b; Kehoe, et al. 1988; Klimko 1985a, 1985c; Klimko and Hanna, 1988; McCallum and Dyck, 1960; Morlan, 1988, 1993; Wilmeth, 1978.

S-2628, charred pottery encrustation, from the exterior surfaces of potsherds, submitted by O. Klimko.

Normalized age: 535 ± 230
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Avonlea, anomalous, young

S-45, charred bison bone, *Bison* sp. (id. by B. McCorquodale), from cultural layer 20-40 cm depth, overlain by aeolian fine sand, collected 1956.10, submitted by R.W. Nero.

Normalized age: 1580 ± 100
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1500 ± 100

Note: Sample pre-treatment by hydrolyzation, a difficult method with little yield. Normalized age is a minimum age.
Significance: Woodland, Avonlea

S-2623, bison bone collagen, *Bison* sp. (id. by E.G. Walker), from cultural layer, submitted by O. Klimko.

Normalized age: 1645 ± 205
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1565 ± 205

Significance: Woodland, Avonlea

Associated taxa: *Castor canadensis*, *Canis* sp., *Bison* sp.; identified by E.G. Walker.

S-2777 (CMC-1357), bone collagen, from hearth, unit 6, 10-15 cm below the plow zone, collected 1984, submitted by T.F. Kehoe.

Normalized age: 3685 ± 135
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 3605 ± 135

Significance: Woodland, Avonlea, anomalous, old

Suggested age: 1595 ± 95 BP, average of S-45 and S-2623

EaNk-3, Mitchellton: southwest of Moose Jaw, Moose Jaw valley, Qu'Appelle drainage, Saskatchewan. This badly disturbed rock cairn contained a human burial but no diagnostic artifacts. A sample of bone yielded the date listed by Dyck (1983: Table 10.4). Sources: Dyck, 1983; Morlan, 1993; E.G. Walker, p.c. 1992.

S-2236, human bone collagen, *Homo sapiens*, from rock cairn burial, submitted by E.G. Walker.

Normalized age: 630 ± 75
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 530 ± 70

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.
Significance: cultural affiliation unknown

EaNi-VP: near Old Wives Lake, south-central Saskatchewan. Comment (G.A. Tackman): Two dates from this site should agree with one another, but they differ considerably. Sources: Tackman, 1997.

Beta-95428, paleosol, from top of incipient soil, a paleosol, unit 4, just above bison(?) bone, submitted by G.A. Tackman.

Normalized age: 1020 ± 50
 $\delta^{13}\text{C} = -22.4$
Uncorrected age: 980 ± 50

Significance: palaeobiology

Beta-95429, paleosol, from top of incipient soil, a paleosol, unit 4, just above bison(?) bone, submitted by G.A. Tackman.

Normalized age: 1830 ± 60
 $\delta^{13}\text{C} = -27.0$
Uncorrected age: 1870 ± 60

Significance: palaeobiology

EaNw-1, Blumenhof: 4.8 km northeast of the village of Blumenhof, Swiftcurrent valley, South Saskatchewan drainage, Saskatchewan. A partial human skeleton was discovered during backhoe operations at 2.4 m depth in Tertiary sands beneath ca. 1.2 m of boulder clay. Bryan and Steele (1976) note that none of the bones was actually seen in original stratigraphic position, and no projectile points were recovered. A bison skull of modern size was found in the backhoe pit at about the same level as the human skeleton. An insoluble collagen extraction from human bones provided a date. Sources: Bryan and Steele, 1976; Morlan, 1993; Rutherford et al., 1979.

S-1220 (CMC-554), human bone collagen, *Homo sapiens* (id. by D.G. Steele), from burial, collected 1961, submitted by A.L. Bryan.

Normalized age: 4335 ± 100
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 4235 ± 100

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.

Significance: cultural affiliation unknown

Associated taxa: *Homo sapiens*, *Bison* sp.

EaNj-7, Garratt: in Moose Jaw, Moose Jaw River, Qu'Appelle drainage, Saskatchewan. The Garratt site yielded three principal occupation levels and a thin scatter of bones and artifacts on a fourth level. The site was excavated in 1966, with radiocarbon samples collected by G.C. Watson, and a detailed analysis was prepared by Morgan (1979).

A plow zone was defined as Level 1, and underlying undisturbed materials as Level 2, but they were treated as a single late prehistoric component that yielded two Plains side-notched, 19 Prairie side-notched, and eight Plains triangular points (Morgan 1979: 263-267). Level 4 produced one Prairie side-notched point (Morgan 1979: 317).

Level 6 contained 19 Avonlea side-notched, 29 Avonlea triangular, one Besant side-notched, and one unclassified point (Morgan 1979: 318-323). "Carbon" from a fire pit extending from Level 6 into Level 7 yielded an anomalous age (S-407).

Level 8 contained three Besant side-notched points (Morgan 1979: 366) and yielded a radiocarbon date (S-409). The date list reports the Garratt series as charcoal samples but omits S-407. In Morgan's (1979: 246) listing, S-408 is misprinted as 2180 ± 60 BP. Sources: Morgan, 1979; Morlan, 1993; Rutherford et al., 1973; Wilmeth, 1978.

S-408, charcoal, from Level 6, paleosol in alluvium, unit 22L1, 0.67 m depth, collected 1966, submitted by G.C. Watson.

Normalized age: 1280 ± 60
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Avonlea

S-406, charcoal, from Level 6, paleosol in alluvium, unit 23C1, 0.79 m depth, collected 1966, submitted by G.C. Watson.

Normalized age: 1450 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Avonlea

Suggested age (Level 6): 1350 ± 45 BP, average of S-406 and S-408

Associated taxa (Level 6): *Lepus townsendii*, *Spermophilus richardsonii*, *Thomomys talpoides*, *Castor canadensis*, *Erethizon dorsatum*, *Canis latrans*, *Canis lupus*, *Vulpes velox*, *Taxidea taxus*, *Mephitis mephitis*, *Odocoileus* sp., *Bison* sp.; Aves (unidentified); Mollusca; identified by G. Morgan.

S-407, charcoal, from Level 6, XU 22L1, fire pit extending into level 7, submitted by G.C. Watson.

Normalized age: 6100 ± 100
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Avonlea, anomalous, old

S-409, charcoal, from Level 8, paleosol in alluvium, 1.07 m depth, collected 1966, submitted by G.C. Watson.

Normalized age: 1990 ± 75
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Besant

Associated taxa (Level 8): *Canis* sp., *Bison* sp.; Mollusca; identified by G. Morgan.

EcNI-1, Mortlach: on the south bank of Sandy Creek in the Besant Valley near Mortlach, Qu'Appelle drainage, Saskatchewan. This site played a seminal role in establishing a stratigraphic framework for Saskatchewan archaeology. Eight occupation levels, some with subdivisions, were described by Wettlaufer (1955), and three radiocarbon samples were processed by the solid carbon method in a screen-wall counter. Both the counting method and the technique used for bone pretreatment are now believed to render ages somewhat too young.

In Project 4, Level 1 contained the "Mortlach" culture; both Plains and Prairie side-notched points are described, but both illustrated specimens appear to represent the Plains side-notched variety (Wettlaufer 1955: Plate 1). In Projects 1, 2 and 3, Levels 1 and 2 contained the "Moose Jaw" culture characterized mainly by Plains triangular and Prairie side-notched points but also including one "eared" (Sandy Creek?), one corner-notched (Pelican Lake?), and one large side-notched point (like a giant Prairie side-notched point). In Level 3 at Project 1 the "Caron" culture was represented by one "eared" and one straight-based side-notched point, the latter ascribed to Besant by Reeves (1983: 237).

Level 4 has five subdivisions. Level 4A yielded mainly Besant points plus one Pelican Lake specimen. Level 4B also yielded mainly Besant points as well as one triangular (Besant preform?) specimen and a radiocarbon date (S-22) on bison bone [Wettlaufer (1955: 71) quotes this date as 1580 ± 325 BP]. Level 4C contained one corner-notched (Pelican Lake?) point, while Level 4D produced a Pelican Lake-like fragment and an "eared" point, the latter referred to Sandy Creek by Dyck (1983: 109). Sandy Creek points in Level 4E were associated with a radiocarbon date on humus with fragments of charcoal (S-28) [quoted as 2400 ± 290 BP by Wettlaufer (1955: 71)].

Level 5A contained Pelican Lake points, and Wettlaufer (1955: 55) suggested that this level may be the source of Pelican Lake points that seem intrusive into Levels 4A and 4C. Levels 5B and 6 yielded one point fragment presumed to represent Pelican Lake on the basis of its diagonal flaking, and a similar fragment was found in Level 7.

Level 8, assigned to the "Thunder Creek" culture, contained stemmed points referred to the Duncan type by Dyck (1983: 89), and it yielded a radiocarbon date on bison bone (S-2). Sources: Dyck, 1983; McCallum, 1955; Morlan, 1993; Reeves, 1983; Wettlaufer, 1955; Wilmeth, 1978.

S-22, charred bison bone, *Bison* sp., from Zone 4B, buried A horizon, dark grey-brown fine sandy loam, 27-33" (70-82 cm), submitted by B. Wettlaufer.

Normalized age: 1660 ± 159
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1580 ± 159

Note: Solid carbon method; pre-treatment by hydrolyzation, a difficult method with poor yield. Normalized age is a minimum age.

Significance: Woodland, Besant

S-28, organic sediment, from Zone 4E, buried A horizon, grey-brown fine sandy loam, 44-48" (112-122 cm), submitted by B. Wettlaufer.

Normalized age: 2400 ± 173
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: Solid carbon method.

Significance: Archaic, Sandy Creek

S-2, charred bison bone, *Bison* sp., from Zone 8, buried C horizon, pale yellow coarse sand, 74-84" (190-215 cm) depth, submitted by B. Wettlaufer.

Normalized age: 3480 ± 200
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 3400 ± 200

Note: Solid carbon method; pre-treatment by hydrolyzation, a difficult method with poor yield. Normalized age is a minimum age.

Significance: Archaic, Duncan

EcNm-8, Walter Felt: on the escarpment of the Missouri Coteau, 13 km south of Mortlach, Besant valley, Qu'Appelle drainage, Saskatchewan. Twenty stratigraphic layers, with sub-units, were distinguishable in 5 feet (1.5 m) of deposits. No detailed report has been published, but two progress reports have appeared (Ranere 1965; Watson 1966). Kehoe (1973: 164; McCallum and Wittenberg, 1968: 376-377) summarizes the predominant point types for six charcoal-dated components.

Level 4 yielded Plains side-notched points and a radiocarbon date (S-280). Level 6 produced Prairie side-notched points and a radiocarbon date (S-203). Prairie side-notched points also occurred in Level 7 with a somewhat older date (S-202).

Level 10 contained Besant (Samantha) points and two dates (S-201, S-260). Level 13 yielded Besant points with a slightly older date (S-200).

Level 15b was originally assigned to the Pelican Lake complex (McCallum and Wittenberg, 1968: 376-377), but Kehoe later changed the assignment to Sandy Creek (Kehoe 1973: 164; also Dyck 1983: 109). It produced one date on charcoal (S-279). Sources: Dyck, 1983; Kehoe, 1973; McCallum and Wittenberg, 1968; Morlan, 1993; Ranere, 1965; Watson, 1966; Wilmeth, 1978.

S-280, charcoal, from Layer 4, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 400 ± 40
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Plains

S-203, charcoal, from Layer 6, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 700 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Prairie

S-202, charcoal, from Layer 7, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 1260 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Prairie

S-201, charcoal, from Layer 10, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 1535 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Besant

S-260, charcoal, from Layer 10, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 1535 ± 90
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Besant

Suggested age (Layer 10): $1535 \pm 60 \text{ BP}$, average of S-201 and S-260

S-200, charcoal, from Layer 13, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 1610 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Besant

S-279, charcoal, from Layer 15b, collected 1962, 1965, submitted by T.F. Kehoe.

Normalized age: 2430 ± 90
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Sandy Creek

EcNx-1a, Gray: about 8 km northwest of Swift Current, 747 m asl, South Saskatchewan valley, Saskatchewan. This site is a remarkable cemetery where excavations have revealed 99 burial units containing the remains of about 304 individuals (Millar 1978). Numerous discussions have dealt with the question of whether the Gray site was used only by people of the Oxbow complex over a long period of time or whether different biological or cultural groups made use of the site during successive periods (see Millar 1978, 1981; Wade 1981; with references). None of the data sets - biological, cultural, or chronometric - is conclusive. Grave goods were relatively uncommon and seldom included projectile points. Only four of 17 radiocarbon dates are definitely associated with Oxbow points. Millar (1978: 389-400) viewed eagle talons as important cultural markers linking several graves, three of which were dated by radiocarbon. Pit outlines were seldom discernable during excavation of the Gray site except where the fill was so enriched with red ochre as to mark the border of a pit. Observations of superposition and intrusion permitted reconstruction of a limited burial unit sequence (Millar 1978: 397). Callaghan (1986) attempted to sequence the Gray site burials by their flourine content with results that he notes

are not entirely conclusive.

Fifteen burial units have been dated by radiocarbon. Nine dates had been published prior to 1993 when Morlan (1993) reported eight additional measurements. Of several extended discussions of the original nine dates (So and Wade 1975; Millar 1978: 386-389; Wade 1981), all noted the great time span and various discontinuities within that span. The additional eight dates reported later caused some changes in that picture. The new dates included four proportional counting dates from Simon Fraser University (SFU-) and four accelerator dates from SFU's former facility, the Radioisotope Direct Detection Laboratory (RIDDL-) at McMaster University's Tandem Laboratory. The dates were obtained in connection with a study of carbon isotope ratios that reflect paleodiets (Lovell, et al. 1986). Special care was taken to isolate the bone collagen through a modification of the Longin (1971) method that eliminated base-soluble humates (Chisholm, et al. 1983: 357). Since base-soluble humates would represent younger contaminants, it is not surprising that five of the new dates fall within the older end of the previously documented time span while three extend the span to earlier centuries.

The oldest date (SFU-297) was obtained from Burial Unit 97 which lacked both artifacts and faunal remains but was heavily ochre-stained. Burial Unit 70, which also lacked both artifacts and faunal remains, yielded the youngest date in the original series (S-1449), but its new date (SFU-296) is the second oldest for the entire site. In view of the special methods employed (Chisholm, et al. 1983; Lovell, et al. 1986), SFU-296 should be adopted as the age of Burial Unit 70 instead of S-1449; this finding reduces the younger end of the original time span by 700 years.

Burial Unit 46 contained an Oxbow point and was heavily stained by ochre. It yielded the oldest date in the original series (S-647), and a new date (SFU-294) is concordant with that finding. An Oxbow point and a shell bead were found among the ochre-stained bones of Burial Unit 23 which yielded the next youngest date in the series (S-619); this date was derived from an insoluble collagen extraction. Burial Unit 68 is next in the series (SFU-295) but yielded neither artifacts nor faunal remains and only light ochre staining. The youngest date directly associated with an Oxbow point is from Burial Unit 62 (RIDDL-513).

Burial Unit 80 yielded a quartzite biface, a shell bead or pendant, and ochre staining on both bones and artifacts (RIDDL-514). Burial Unit 56 contained ochre-stained bones and tools as well as avian tracheal segments that may have been worn as beads (RIDDL-512). Burial Unit 88 contained a heavily ochre-stained adult bundle and the skeleton of a child that was associated with a piece of rolled copper and two bone beads (RIDDL-515). A fragment of copper was also found in Burial Unit 58 (GX-3373).

At this point in the series, there is a gap of about 600 years between the means of adjacent radiocarbon dates, although their calibrated 2-sigma limits overlap by 160 years. Burial Unit 42 is the oldest dated burial containing eagle talons (S-646), and it also produced a piece of native copper. Burial Unit 65 contained eagle talons and an end scraper (S-707). Burial Unit 59 yielded three possible bone tools and a split pebble (S-693). Bone pendants and faunal remains including eagle bones were found in Burial Unit 30 (S-706), and a single bone tool occurred with the ochre-stained bones of Burial Unit 84 (S-1450). The latter is the youngest date from the site (excepting S-1449 which can be rejected in favour of SFU-296).

There are several ways to interpret these dates. The youngest five dates could be considered to represent an episode of site use several centuries younger than its main use with an average age of $3600 \pm 60 \text{ BP}$ for the younger episode. Since McKean points have been found on the surface at the Gray site, such a younger use episode

might reflect McKean activities. However, it is noteworthy that four of the five youngest dates were derived from insoluble collagen extractions that may have given spuriously young ages.

Except for a few of the relatively early dates, association of the Gray site burials with the Oxbow complex rests on the assumption that the site represents a single mortuary complex (Millar 1981) and therefore a single culture (and a single point type). Without more dates and diagnostic artifacts, it is not clear that the Gray site was used only by people of the Oxbow complex, and it is also impossible to demonstrate or to deny use of the site by earlier or later people. For now, this site does not provide strong evidence for the late persistence of the Oxbow complex (see Gibson 1981). That eagle talons are not exclusively (or not at all?) diagnostic of Oxbow burials is shown by their presumed occurrence in a "probable" Pelican Lake grave (Bradwell, EkNm-1, Walker 1984a:147).

The burial units are listed from youngest to oldest. For all except the RIDDLE dates, the normalized age should be considered a minimum, because bison that had consumed C₄ plants were probably included in the human diet. Sources: Callaghan, 1986; Chisholm, et al. 1983; Gibson, 1981; Longin, 1971; Lovell, et al. 1986; Millar, 1978, 1981; Morlan, 1993; Rutherford et al., 1979; So and Wade, 1975; Wade, 1981; Walker, 1984a; Wilmeth, 1978.

S-1450, human bone collagen, *Homo sapiens*, from cemetery, burial unit 84, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3515 ± 105
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3415 ± 105

Significance: Archaic, Oxbow?

S-706, human bone collagen, *Homo sapiens*, from cemetery, burial unit 30, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3585 ± 195
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3485 ± 195

Significance: Archaic, Oxbow?

Associated taxa (burial 30): *Homo sapiens*, *Odocoileus* sp., *Antilocapra americana*, *Bison* sp.; *Aves*, *Anatinae*, *Haliaeetus leucocephalus* or *Aquila chrysaetos*.

S-693, human bone collagen, *Homo sapiens*, from cemetery, burial unit 59, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3650 ± 295
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3550 ± 295

Significance: Archaic, Oxbow?

Associated taxa (burial 59): *Homo sapiens*, *Bison* sp.

S-707, human bone collagen, *Homo sapiens*, from cemetery, burial unit 65, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3850 ± 180
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3750 ± 180

Significance: Archaic, Oxbow?

Associated taxa (burial 65): *Homo sapiens*; *Aves*, *Haliaeetus leucocephalus* or *Aquila chrysaetos*.

S-646, human bone collagen, *Homo sapiens*, from cemetery, burial unit 42a, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3855 ± 100
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 3755 ± 100

Significance: Archaic, Oxbow?

Associated taxa (burial 42a): *Homo sapiens*, *Odocoileus* sp.; *Aves*, *Haliaeetus leucocephalus* or *Aquila chrysaetos*.

RIDDLE-515, human bone collagen, *Homo sapiens*, from cemetery, burial unit 88a, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 4420 ± 190
 $\delta^{13}\text{C} = -17.5$

Significance: Archaic, Oxbow?

GX-3373, human bone collagen, *Homo sapiens* skull fragments, from cemetery, burial unit 58, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 4440 ± 250
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 4340 ± 250

Significance: Archaic, Oxbow?

Associated taxa (burial 58): *Homo sapiens*, *Lepus* sp., *Canis* sp.

RIDDLE-512, human bone collagen, *Homo sapiens*, from cemetery, burial unit 56, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 4510 ± 140
 $\delta^{13}\text{C} = -17.5$

Significance: Archaic, Oxbow?

Associated taxa (burial 56): *Homo sapiens*; *Aves* (unidentified trachea beads).

RIDDLE-514, human bone collagen, *Homo sapiens*, from cemetery, burial unit 80, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 4600 ± 130
 $\delta^{13}\text{C} = -17.5$

Significance: Archaic, Oxbow?

Associated taxa (burial 80): *Homo sapiens*, *Spermophilus* sp.?, *Cervidae*.

RIDDLE-513, human bone collagen, *Homo sapiens*, from cemetery, burial unit 62, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 4600 ± 170
 $\delta^{13}\text{C} = -17.5$

Significance: Archaic, Oxbow

SFU-295, human bone collagen, *Homo sapiens*, from cemetery, burial unit 68, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 4850 ± 160
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 4750 ± 160

Significance: Archaic, Oxbow?

S-619, human bone collagen, *Homo sapiens*, from cemetery, burial unit 23b, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 5055 ± 165
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 4955 ± 165

Significance: Archaic, Oxbow

Associated taxa (burial 23b): *Homo sapiens*, *Canis* sp., *Antilocapra americana*, **Bison** sp.

S-647, human bone collagen, *Homo sapiens*, from cemetery, burial unit 46, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 5200 ± 390
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 5100 ± 390

SFU-294, human bone collagen, *Homo sapiens*, from cemetery, burial unit 46, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 5250 ± 160
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 5150 ± 160

Significance: Archaic, Oxbow

Suggested age (burial 46): 5220 ± 150 BP, average of S-647 and SFU-294

Associated taxa (burial 46): *Homo sapiens*, *Antilocapra americana*.

S-1449, human bone collagen, *Homo sapiens*, from cemetery, burial unit 70, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 3015 ± 85
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 2915 ± 85

Significance: Archaic, Oxbow?, anomalous, young

SFU-296, human bone collagen, *Homo sapiens*, from cemetery, burial unit 70, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 5420 ± 160
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 5320 ± 160

Significance: Archaic, Oxbow?

SFU-297, human bone collagen, *Homo sapiens*, from cemetery, burial unit 97, collected 1970-1971, submitted by N.C. Lovell.

Normalized age: 5720 ± 320
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 5620 ± 320

Significance: Archaic, Oxbow?

EcNx-2, Heron: northwest of Swift Current, 739 m asl, South Saskatchewan valley, Saskatchewan. Artifacts collected from sand surface blowouts by the Southwestern Saskatchewan Archaeological Project include Clovis, Oxbow, McKean, Duncan, Hanna, Pelican

Lake, and side-notched points. Neither of the two radiocarbon samples is reliably associated with cultural material. The dates cannot be confidently attributed to the Sandy Creek complex (see Dyck 1983: 109). Sources: Dyck, 1983; Millar et al., 1972; Morlan, 1993; Rutherford et al., 1975; Wilmeth, 1978.

S-571 (CMC-393), charcoal, from sandy clay zone, unit A67, 63 cm depth, collected 1970, submitted by J.F.V. Millar.

Normalized age: 2280 ± 65
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-572 (CMC-394), charcoal and bone, from sand and clay zone, units B16 and B19, 32 cm depth, collected 1970, submitted by J.F.V. Millar.

Normalized age: 2330 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: It is assumed that charcoal was the main constituent.

Significance: cultural affiliation unknown

EcNx-4, East Pasture: 8 km northwest of Swift Current, 739 m asl, South Saskatchewan valley, Saskatchewan. This is a complex multi-component site with two excavation areas (eastern and western) that are only tentatively correlated with one another. A projectile point base from eastern area Floor I (Wilson 1972: Fig. 26c) resembles a Plains side-notched point, a type consistent with both the pottery and the radiocarbon date from this floor (S-638). S-639 was obtained for Level 2 from unit 70/143 in the western area, but no diagnostic artifacts were found in this level; Dyck (1983: 109) has suggested that this sample might date the Sandy Creek complex. Level 3 is immediately below Level 2, and unit 70/143 provided a second radiocarbon sample (S-637) attributed to the Oxbow complex. The only Oxbow point was recovered from Test Pit 18, several metres south of unit 70/143, requiring correlation between the point and the date over this distance. All three dates were based on insoluble collagen extractions from unidentified bone fragments. Sources: Dyck, 1983; Morlan, 1993; Rutherford et al., 1979; Wilmeth, 1978; Wilson, 1972.

S-638, bone collagen, from Floor I, eastern area, unit 77n/114w, 70-80 cm depth, in grey-yellow brown sand with bone and ochre patches, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 345 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 265 ± 80

Significance: Woodland, Plains

S-639, bone collagen, from Level 2, western area, unit 70n/143w, dark brown sand, 10-20 cm thick, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 2485 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2405 ± 80

Significance: cultural affiliation unknown

S-637, bone collagen, from Level 3, western area, unit 70n/143w, black to brown sand, 40 cm thick, collected 1970-1971, submitted by J.F.V. Millar.

Normalized age: 4315 ± 60
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 4235 ± 55

Significance: Archaic, Oxbow

EdNi-5, Buffalo Pound: south shore of Buffalo Pound Lake, Qu'Appelle valley, Saskatchewan. According to E.G. Walker, human skeletal remains eroded from a hillside were apparently associated with a shell ornament, a projectile point, and quantities of red ochre. Both the ornament and the point were retained by a private collector, and the point type is unknown (E.G. Walker, p.c. 1992). A sample of the ribs provided a date. Sources: Morlan, 1993.

S-2944 (CMC-1381), human bone collagen, *Homo sapiens* ribs (79 g, id. by E.G. Walker), from burial eroded from hillside, collected 1987, submitted by E.G. Walker.

Normalized age: 1020 ± 90
 $\delta^{13}\text{C} = -19 \text{ e}$

Uncorrected age: 920 ± 90

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.

Significance: cultural affiliation unknown

EeNg-6, Bethune: on a knoll northeast of Bethune, Arm River, Qu'Appelle drainage, Saskatchewan. A human burial pit contained portions of seven individuals and associated grave goods. The site was extensively disturbed by cultivation, by a deliberate front-end loader cut, and by looting. A salvage excavation recovered some artifacts, including one Avonlea side-notched point, along with faunal remains from documented associations within the burial pit. Sources: Dawson and Walker, 1988; Morlan, 1993; Rutherford et al., 1981.

S-1575 (CMC-1012), bison bone collagen, *Bison* sp., from burial in shallow pit, disturbed by cultivation, collected 1972, submitted by E.G. Walker.

Normalized age: 1470 ± 45
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1390 ± 40

Significance: Woodland, Avonlea

Associated taxa: *Odocoileus* sp., *Bison* sp.; Reptilia, *Chrysemys picta*; identified by E.G. Walker.

EeNj-2, Morris Church: near Chamberlain, Arm River, Qu'Appelle drainage, Saskatchewan. Charcoal was collected by D.M. Lane and submitted by E.A. Christiansen from two zones, separated by 12 inches (30 cm) of sterile sand, silt, and clay with pebbles. Millar and Gromadko (1981: 4) describe a more complex sequence of deposits, "six separate sets of living floor..., with at least the uppermost one representing three or four distinct sequential camping occupations that occurred fairly close in time." Both of the dated zones yielded pottery, and Millar and Gromadko (1981: Fig. 3) illustrate both Plains and Prairie side-notched points from the site without reporting their exact provenience. Sources: McCallum and Wittenberg, 1962; Millar and Gromadko, 1981; Morlan, 1993; Wilmeth, 1978.

S-121, charcoal, from upper organic zone 30 cm above lower zone, collected 1960.11, submitted by E.A. Christiansen.

Normalized age: 260 ± 50
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland

S-120, charcoal, from lower organic zone 30 cm below upper zone, collected 1960.11, submitted by E.A. Christiansen.

Normalized age: 780 ± 50
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland

EfNg-1, Lake Midden: about 15 km west of the town of Bulyea and 6.5 km east of Last Mountain Lake, Qu'Appelle valley, Saskatchewan. This is a single component site containing Plains side-notched points. Bone fragments from a single layer, 17-30 cm below the surface, encountered in two test pits, were collected by C. Watrall and submitted by D. Walde.

Walde (1994) redefines the Mortlach Phase, including two sub-phases, the Lake Midden sub-phase and the more northerly Lozinsky sub-phase. He interprets these entities as late prehistoric manifestations of the southern and northern branches of the Assiniboine. Sources: Dyck, 1983; Morlan, 1993; Walde, 1994.

S-2246 (CMC-1269), bone collagen, from cultural layer, Test pits 1 and 2, 17-30 cm below the surface, collected 1978, submitted by D. Walde.

Normalized age: 460 ± 100
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 380 ± 100

Significance: Woodland, Plains

Associated taxa: *Sylvilagus nuttallii*, *Lepus townsendii*, *Castor canadensis*, *Canis lupus*, *Vulpes velox*, *Ursus* sp., *Mustela frenata*(?), *Taxidea taxus*, *Mephitis mephitis*, *Antilocapra americana*, *Bison* sp.; identified by D. Walde.

EgNn-1, Melhagen: about 19 km east of the elbow of the South Saskatchewan River and 10 km north of the Qu'Appelle Valley, Saskatchewan. It is a Besant bison kill site. A detailed analysis by Ramsay (1991) considers the significance of six radiocarbon dates. She believes that the youngest date (S-2857) may have been contaminated by algae or fungi. The remaining five dates overlap at their 2-sigma limits, but the two youngest barely overlap the two oldest. The oldest three dates (S-491, S-1640, and S-2855) were obtained from the southern and central areas of the site, and they can be averaged. The other two dates (S-2856 and S-1641) were obtained from the northern and western areas of the site, and they yield a younger average age. Ramsay (1991: 150) notes that the projectile point analysis and the faunal analysis also suggest the presence of more than one occupation. Sources: Morlan, 1993; Phenix, 1969; Ramsay, 1991; Rutherford et al., 1973, 1984; Wilmeth, 1978.

S-2857, bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, north and west areas, unit 90s/120e, NE and NW quads, Level 2, submitted by A. Ramsay.

Normalized age: 890 ± 205
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 810 ± 205

Significance: Woodland, Besant, anomalous, young

S-2856, bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, north and west areas, unit 95s/51e, NW quad, Level 2, submitted by A. Ramsay.

Normalized age: 1655 ± 115
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1575 ± 115

Significance: Woodland, Besant

S-1641 (CMC-1037), bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, north and west areas, unit 65n/100w, Bed 3, collected 1971, submitted by T.S. Phenix.

Normalized age: 1790 ± 55
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1710 ± 50

Significance: Woodland, Besant

Suggested age (northern and western areas): 1765 ± 55 BP, average of S-1641 and S-2856

S-2855, bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, south and central areas, unit 100s/95e, SW quad, Level 2, submitted by A. Ramsay.

Normalized age: 1985 ± 110
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1905 ± 110

Significance: Woodland, Besant

S-1640 (CMC-1036), bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, south and central areas, unit 5s/5e, Bed 4, collected 1971, submitted by T.S. Phenix.

Normalized age: 1990 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1910 ± 70

Significance: Woodland, Besant

S-491, bison bone collagen, *Bison* sp. (id. by A. Ramsay), from cultural layer, south and central areas, unit 60s/100w, Bed 1, collected 1968, submitted by T.S. Phenix.

Normalized age: 2040 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1960 ± 90

Significance: Woodland, Besant

Suggested age (south and central areas): 2005 ± 55 BP, average of S-491, S-1640, S-2855

Associated taxa (entire site): *Canis familiaris*, *Vulpes velox?*, Mustelidae, *Odocoileus* sp., *Bison* sp.; *Aves*, *Falco* sp.; identified by A. Ramsay.

EgNr-2, Camp Rayner: on the Lake Diefenbaker shore near Birsay, South Saskatchewan valley, Saskatchewan. It is a multicomponent habitation and kill site, with a radiocarbon date (S-1318) on bison bone collected by T.S. Phenix from 15 cm below surface associated with Avonlea points. More recent excavations by the Saskatchewan Archaeological Society field school have yielded a second date (S-3115) on charcoal collected 92-94 cm below surface and 5.5-7.5 cm above the base of a lanceolate (late Plano?) spearpoint (T. Jones, p.c. 1992). This date provides no more than a distant limit on the age of the spearpoint. Sources: Morlan, 1993; Rutherford et al., 1984.

S-1318, bison bone collagen, *Bison* sp. (id. by T.S. Phenix), from cultural layer 15 cm depth in multicomponent site, collected 1976, submitted by T.S. Phenix.

Normalized age: 1680 ± 110
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1600 ± 110

Significance: Woodland, Avonlea

S-3115, charcoal, from cultural layer 92-94 cm depth, submitted by T.E.H. Jones.

Normalized age: 2790 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

EhNv-VP, Wiseton: near Wiseton, South Saskatchewan drainage, Saskatchewan. Bone was cored in 1964 from a mammoth femur that had been collected in 1931. In view of the pre-treatment method employed at the time, S-232 should be considered a minimum age. Sources: Rutherford et al., 1973.

S-232, mammoth bone, *Mammuthus imperator* femur, from lacustrine silt, 91.4 cm depth, collected 1931, submitted by W.O. Kupsch.

Normalized age: 10 680 ± 145
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 10 600 ± 140

Note: Pre-treatment of the sample entailed charring of the whole bone. The normalized age is a minimum age.

Significance: palaeobiology

EiNs-4, Sjovold: on the north edge of "Sjovold" Creek, at its junction with the South Saskatchewan River, 500 m asl, 5.5 km southwest of Outlook, Saskatchewan. This is a stratified habitation site with at least 21 buried components reaching to a depth of 4.1 m below datum. Dates and cultural complexes, where known, have been listed by Dyck (1983; Rutherford et al., 1984: 278-279), but a detailed analysis has altered the definitions and cultural assignments of several layers (Dyck and Morlan, 1995). Most of the dates used bone from the six contiguous excavated squares (units 1-6), but several bone samples were taken from deep creek-bank profiles correlated with the excavation. Some of the dates are associated with pottery but not with projectile points. One date is on carbonaceous soil from a suspected hearth lacking diagnostic artifacts, and one is on wood from gravel underlying the cultural components. The large standard deviations for many of the Sjovold dates resulted from uncertainty concerning the system background at the time the samples were counted (J. Wittenberg, p.c. to I. Dyck).

At first glance, these dates seem not to resolve the chronology of the site. Most of the means are in correct order, but the standard deviations overlap quite broadly. However, by considering both the calibrated limits of the dates and their stratigraphic relationships it is possible to construct a fairly refined chronology (Dyck and Morlan, 1995).

Layer I, with late prehistoric ceramics but no projectile points, was dated by S-1757. Layer II also yielded late prehistoric ceramics, but no projectile points, and one date, S-1758. Layer III produced both late prehistoric ceramics and projectile points along with a date on bison? bone fragments, S-1759.

Layers IV and V were originally considered separate occupations, but they have been merged during the final analysis to comprise one occupation with Prairie side-notched points and a date (S-1760). The analysis also shows that materials in Interlayer IV-V/VI, including a date (S-1761), belong to Layer IV-V.

Layer VI is an Avonlea component with both side-notched points and pottery. Although sublayers are mentioned in the date list (Rutherford et al., 1984: 278-279), they have been merged to represent a single occupation dated by S-1762 and S-1763. Interlayer VI/VII produced a bizarre specimen from unit 6. It is a megamammal (giant ground sloth?) rib containing well preserved collagen. A single collagen extraction yielded enough material for two accelerator mass spectrometry dates (CAMS-2274, CAMS-2296) that can be averaged (D.E. Nelson, p.c. 1992).

Layer VII, with Avonlea pottery and Samantha projectile points, is not reliably dated by S-1764, because bone fragments drawn from unit 3 are now thought to belong to Layer VIII whereas a larger quantity of fragments from units 1 and 2 are assigned to Layer VII. Layer VIII presents a similar problem, because analysis has shown that the bone fragments from unit 1 belong to Layer VII, those from unit 2 represent Layer VIII, and the unit 3 bones come from Layer IX. The resulting date (S-1765) is in correct stratigraphic order, but it is not associated with a single occupation layer.

Layer VIII lacks diagnostic artifacts. The other Layer "VIII" date (S-1766) was obtained on carbonaceous soil from the face of Test profile no. 2. The sample was originally thought to consist of hearth fill, but subsequent excavation failed to confirm the presence of a hearth. S-1766 cannot be specifically related to the site chronology. Layer IX yielded neither diagnostic artifacts nor a radiocarbon sample.

Layer X yielded Besant side-notched points as well as a smaller number of Pelican Lake corner-notched points and three radiocarbon dates. S-1767 consisted of bison bone from test profile nos. 2 and 3. Since this was a composite sample requiring correlation with the Layer X occupation, the date was checked by submitting charcoal samples from two Layer X hearths (S-3366 and S-3367). The concordant results can be averaged.

Layer XI is a Besant component with two discordant radiocarbon dates. S-2058 was obtained on bison? bone fragments from units 1, 2, 4, and 5. S-3365 was obtained on charcoal from a hearth in unit 1. These two dates are too dissimilar to permit averaging. S-3365 is significantly older than dates on underlying layers and therefore is chosen for rejection. Perhaps the charcoal was produced by burning wood that was already several centuries old at the time of the Layer XI occupation.

Layer XII produced Sandy Creek points and a radiocarbon date (S-2059) on bison? bone fragments. Layer XIII yielded an unidentified side-notched projectile point and has not been dated. Layer XIV is a Besant component with a radiocarbon date (S-2060) on bison? bone fragments from a hearth.

Layers XV-XVIII yielded no diagnostic artifacts, but there is a radiocarbon date (S-1768) on bison? bone fragments from a test profile correlated with Layer XVI.

Layer XIX is a Pelican Lake component with a date (S-1769) on bison? bone fragments from a test profile. Layer XX also yielded Pelican Lake points and a date (S-2061) on a bison scapula.

Layer XXI is a Hanna component with two discordant dates. S-2062 is on a bison femur from unit 5, whereas S-1770 is on bone fragments from Test profile no. 4. S-1770 was originally reported as 3445 ± 175 BP but was later recalculated as an older age. In view of this reporting history and the need to correlate from a test profile, S-1770 is rejected in favour of S-2062 for Layer XXI. Underlying Layer XXI is a layer of gravel that yielded a date on wood (S-1979) with no cultural association. Sources: Dyck, 1983; Dyck and Morlan, 1995; Morlan, 1993; Rutherford et al., 1984.

S-1757 (CMC-1102), bison bone collagen, *Bison* sp. thoracic vertebra (id. by I. Dyck), and other fragments, from Layer I, units 1-3, base of AC and top of C1 soil horizons, 17 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 660 ± 190
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 580 ± 190

Significance: Woodland, Late Prehistoric

Associated taxa (Layer I): Leporidae, *Canis familiaris*, *Bison* sp.; identified by R.E. Morlan.

S-1758 (CMC-1103), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer II, units 1-3, buried soil horizon, Ahb1, 33-38 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 810 ± 190
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 730 ± 190

Significance: Woodland, Late Prehistoric

Associated taxa (Layer II): *Lepus americanus*, *Spermophilus* sp. (intrusive?), *Felis canadensis*, *Odocoileus* sp., *Bison* sp.; *Aves* (egg); identified by R.E. Morlan.

S-1759 (CMC-1104), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer III, units 1-3, buried soil horizon C3, 50-55 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1030 ± 190
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 950 ± 190

Significance: Woodland, Plains, Prairie

Associated taxa (Layer III): *Sylvilagus nuttallii?*, *Lepus townsendii*, *Spermophilus* sp. (intrusive), *Clethrionomys* cf. *C. gapperi* (intrusive?), *Erethizon dorsatum*, *Canis familiaris?*, *Martes* sp., *Taxidea taxus*, *Lutra canadensis?*, *Odocoileus* sp., *Alces alces*, *Bison* sp.; identified by R.E. Morlan.

S-1760 (CMC-1105), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer IV-V, units 1-3, buried soil horizon, Ahb3, 70-79 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1400 ± 190
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1320 ± 190

Significance: Woodland, Prairie

S-1761 (CMC-1106), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer IV-V, units 1-2, buried soil horizon, Ahb3, 70-79 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1420 ± 190
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1340 ± 190

Significance: Woodland, Prairie

Suggested age (Layer IV-V): 1410 ± 140 BP, average of S-1760 and S-1761

Associated taxa (Layer IV-V): Leporidae, *Sylvilagus nuttallii?* (intrusive?), *Lepus americanus* (intrusive?), *Spermophilus richardsonii* (intrusive?), *Bison* sp.; identified by R.E. Morlan.

S-1762 (CMC-1107), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer VI, units 1-3, buried soil horizon, Ahb4, 88-101 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1460 ± 200
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 1380 ± 200

Significance: Woodland, Avonlea

S-1763 (CMC-1108), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer VI, units 1-3, buried soil horizon, Ahb4, 88-101 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1460 ± 190
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1380 ± 190

Significance: Woodland, Avonlea

Suggested age (Layer VI): 1460 ± 140 BP, average of S-1762 and S-1763

Associated taxa (Layer VI): *Sylvilagus nuttallii?* (intrusive?), *Lepus americanus* (intrusive?), *Lepus townsendii*, *Spermophilus* sp. (intrusive?), *Canis familiaris*, *Martes pennanti*, *Mephitis mephitis?*, *Bison* sp.; Aves, *Larus californicus?*; Amphibia, *Bufo* sp.; Pisces (unid.); Mollusca, Unionidae; identified by R.E. Morlan.

CAMS-2274 (CMC-1102), bone collagen, megamammal rib (unidentified according to R.E. Morlan), from Interlayer VI/VII, unit 6, buff-grey sandy silt horizon, C5, collected 1979, submitted by R.E. Morlan.

Normalized age: 1840 ± 55
 $\delta^{13}\text{C} = -19.6$

Note: The age is an average of two counts (CAMS-2274 and CAMS-2296) that were not reported separately.
Significance: cultural affiliation unknown

S-1764 (CMC-1109), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer VII, units 1-2, Ahb5, 114-121 cm depth, and Layer VIII, unit 3, Ahb6, 124-130 cm depth, collected 1979, submitted by I. Dyck.

Normalized age: 1710 ± 200
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1630 ± 200

Significance: cultural affiliation unknown

Associated taxa (Layer VII/VIII): *Lepus townsendii*, *Spermophilus* sp. (intrusive?), *Microtus pennsylvanicus*, *Canis* sp., *Odocoileus* sp., *Bison* sp.; Pisces, Cyprinidae; identified by R.E. Morlan.

S-1765 (CMC-1110), bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer VII, unit 1, plus layer VIII, unit 2, plus layer IX, unit 3, collected 1979, submitted by I. Dyck.

Normalized age: 1940 ± 200
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1860 ± 200

Significance: cultural affiliation unknown

Associated taxa (Layer VII/VIII/IX): *Antilocapra americana*, *Bison* sp.; Pisces (unid.); Mollusca, Unionidae; identified by R.E. Morlan.

S-1766 (CMC-1111), carbonaceous sediment, from Test profile No. 2, submitted by I. Dyck.

Normalized age: 2710 ± 200
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown, anomalous, old

S-1767, bison bone collagen, *Bison* sp. (id. by I. Dyck), from Layer X, test profiles 2 and 3, buff, yellow-grey sand and silt, 152-165 cm depth, submitted by I. Dyck.

Normalized age: 2170 ± 165
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2090 ± 165

Significance: Woodland, Besant

S-3366 (CMC-1404), charcoal, from Layer X, hearth feature F10-k, buff, yellow-grey sand and silt, 152-165 cm depth, collected 1980, submitted by I. Dyck.

Normalized age: 2190 ± 140
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Besant

S-3367 (CMC-1405), charcoal, from Layer X, hearth feature F10-g, buff, yellow-grey sand and silt, 152-165 cm depth, collected 1980, submitted by I. Dyck.

Normalized age: 2340 ± 120
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Besant

Suggested age (Layer X): 2255 ± 80 BP, average of S-1767, S-3366, and S-3367

Associated taxa (Layer X): *Tamias minimus*, *Thomomys talpoides*, *Clethrionomys gapperi*, *Canis lupus*, *Antilocapra americana*, *Bison* sp.; identified by R.E. Morlan

S-2058, bone collagen, from Layer XI, units 1-2 and 4-5, intermittent faint grey soil in buff sandy silt, 169-178 cm depth, submitted by I. Dyck.

Normalized age: 2585 ± 90
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2505 ± 90

Significance: Woodland, Besant

Associated taxa (Layer XI): Leporidae (intrusive?), *Bison* sp.; Aves, *Corvus corax*; identified by R.E. Morlan.

S-3365 (CMC-1403), charcoal, from Layer XI, hearth feature F11-a, intermittent faint grey soil in buff sandy silt, 169-178 cm depth, collected 1980, submitted by I. Dyck.

Normalized age: 2900 ± 70
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Besant, anomalous, old

S-2059, bone collagen, from Layer XII, units 1 and 4-6, diffuse grey-black zone, buried soil Ahb8, 185-192 cm depth, submitted by I. Dyck.

Normalized age: 2435 ± 105
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2355 ± 105

Significance: Archaic, Sandy Creek

Associated taxa (Layer XII): *Tamias minimus*, *Spermophilus* sp. (intrusive?), *Zapus* sp. (intrusive?), *Odocoileus* sp., *Bison* sp.; identified by R.E. Morlan.

S-2060, bone collagen (290 g), from Layer XIV, hearth feature F14-a, cross-bedded medium grained sand, top of bed A6, 252-263 cm depth, submitted by I. Dyck.

Normalized age: 2580 ± 85
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 2500 ± 85

Significance: Woodland, Besant

Associated taxa (Layer XIV): Leporidae, *Spermophilus* sp. (intrusive?), *Canis* sp., *Felis canadensis*, *Cervus elaphus*, *Bison* sp.; Aves (unidentified); identified by R.E. Morlan.

S-1768, bone collagen, from Layer XVI, test profile no. 4, buff silt and sand, bottom third of bed A6, 296-303 cm depth, submitted by I. Dyck.

Normalized age: 2760 ± 165

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 2680 ± 165

Significance: cultural affiliation unknown

Associated taxa (Layer XVI): *Bison* sp.; Aves, *Haliaeetus leucocephalus* or *Aquila chrysaetos*; identified by R.E. Morlan.

S-1769, bone collagen, from Layer XIX, test profile no. 4, buff sandy silt, sedimentary bed 19, 352-363 cm depth, submitted by I. Dyck.

Normalized age: 3355 ± 160

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 3275 ± 160

Significance: Archaic, Pelican Lake

Associated taxa (Layer XIX): *Lepus americanus*, *Peromyscus* sp., *Canis* sp., *Martes* sp., *Bison* sp.; Aves, *Eremophila alpestris*, *Corvus corax*, *Catharus fuscescens*; identified by R.E. Morlan.

S-2061, bison bone collagen, *Bison* sp. scapula (307 g, id. by I. Dyck), from Layer XX, unit 5, buff-brown silt, sedimentary bed 17, 365-373 cm depth, submitted by I. Dyck.

Normalized age: 3675 ± 150

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 3595 ± 150

Significance: Archaic, Pelican Lake

Associated taxa (Layer XX): *Canis* sp., *Antilocapra americana*, *Bison* sp.; Pisces, *Catostomus* sp., *Perca flavescens*; identified by R.E. Morlan.

S-2062, bison bone collagen, *Bison* sp. femur (295 g, id. by I. Dyck), from Layer XXI, unit 5, buff-brown clay, sedimentary bed 14, 402-413 cm depth, submitted by I. Dyck.

Normalized age: 3610 ± 115

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 3530 ± 115

Significance: Archaic, Hanna

Associated taxa (Layer XXI): *Microtus pennsylvanicus*, *Bison* sp.; identified by R.E. Morlan.

S-1770, bone collagen, from Layer XXI, test profile no. 4, buff-brown clay, sedimentary bed 14, 402-413 cm depth, submitted by I. Dyck.

Normalized age: 4210 ± 205

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 4130 ± 205

Note: This date was originally reported as 3445 ± 175 BP and later revised without explanation.

Significance: Archaic, Hanna, anomalous, old

S-1979, wood, from gravel 307 cm below cultural layer XXI, submitted by I. Dyck.

Normalized age: 4450 ± 240
 $\delta^{13}\text{C} = -25$ e

Significance: geoarchaeology

EkNm-1, Bradwell: 5 km east and 17 km south of Bradwell, 576 m asl, South Saskatchewan drainage, Saskatchewan. This flexed burial of an adult male was exposed during gravel pit quarrying. Walker (1984a: 147-148) lists it as a "probable Pelican Lake" burial and states that "associated artifacts include a necklace of eagle talons, a large biface, a biface fragment, and a bison rib fragment." The original reports (Edmunds, et al. 1938; Kupsch, et al. 1970) mention only the eagle talons and a worked scraper or knife, and they make it clear that all were recovered, along with some of the human bones, from a pile of gravel that had been removed to a road three miles north of the burial site.

A bone was dated 33 years after it was collected, and it required some special pretreatment: "A plaster replica was made of the bone before submission... A grind stone was used to remove the deeply penetrated gummy substance that had been used as a preservative on the bone before the analysis was made" (Kupsch, et al. 1970: 7). Sources: Edmunds, et al. 1938; Kupsch, et al. 1970; Morlan, 1993; Rutherford et al., 1973; Walker, 1984a; Wilmeth, 1978.

S-441, human bone collagen, *Homo sapiens* tibia, from burial, collected 1936, submitted by W.O. Kupsch.

Normalized age: 2900 ± 80

$\delta^{13}\text{C} = -19$ e

Uncorrected age: 2800 ± 75

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the human diet.

Significance: cultural affiliation unknown

Associated taxa: *Homo sapiens*; Aves, *Haliaeetus leucocephalus* or *Aquila chrysaetos*.

EkNr-2, Carroll: 13 km east of Swanson on the west bank of the South Saskatchewan River, Saskatchewan. This bundle burial was exposed and partially disturbed by slumping, and no diagnostic cultural material was found. Sources: Morlan, 1993; Walker, 1984b.

S-2226 (CMC-1266), human bone collagen, *Homo sapiens* ribs (id. by E.G. Walker), from burial in aeolian sand in a pit 60 cm deep, with a large amount of red ochre, collected 1981, submitted by E.G. Walker.

Normalized age: 1670 ± 100

$\delta^{13}\text{C} = -19$ e

Uncorrected age: 1570 ± 100

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the human diet.

Significance: cultural affiliation unknown

EkNv-26, Wallace Adair: about 3.2 km southwest and south of old highway #7 from Harris, Harris Sand Hills, Saskatchewan. This site

was excavated by W. Pendree. No data are available, but a radiocarbon date is listed for the Pelican Lake complex (Dyck 1983: Table 10.2). Sources: Dyck, 1983; Morlan, 1993.

S-1573, material unknown, from unknown provenience, submitted by W. Pendree.

Uncorrected age: 2335 ± 50
 $\delta^{13}\text{C} = ?$

Significance: Archaic, Pelican Lake

EkNv-36, Billet: 1.1 km west of Harris, Harris Sand Hills, Saskatchewan. This is an extensive habitation site with several hearths, representing mainly the Hanna complex, although Oxbow materials are present in some loci. Where both are present (Area C-2), stratigraphic separation is uncertain. Area C-3 yielded Hanna material only. Radiocarbon samples were collected by W. Pendree, but details concerning sample associations have not been published, nor has any comment concerning the discrepancy between S-2053 and S-2054, both associated with a single hearth of supposed Hanna affiliation. Based on information from Pendree, Dyck (1983: Table 10.2) lists both S-2054 and S-2063 as dates on Hanna complex hearths. Sources: Dyck, 1983; Morlan, 1993; Rutherford et al., 1984.

S-2053 (CMC-1223), charcoal, from Area C-3, units 173-L29 and 173-L30, basin-shaped hearth, collected 1978, submitted by W. Pendree.

Normalized age: 1560 ± 160
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Hanna?, anomalous, young

S-2054 (CMC-1224), bone collagen, from Area C-3, units 173-L29, 173-L30, 174-L29, and 174-L30, collected 1978, submitted by W. Pendree.

Normalized age: 3180 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3100 ± 60

Significance: Archaic, Hanna?

S-2063 (CMC-1225), charcoal, from Area C-2, XU 122-L1, immediately adjacent to a hearth feature and directly below a bison mandible, collected 1979, submitted by W. Pendree.

Normalized age: 3470 ± 120
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Archaic, Hanna?

Associated taxa: *Bison* sp.; identified by W. Pendree

EkNv-VP, Eagle Creek: Eagle Creek valley, northwest of Tessier, North Saskatchewan drainage, Saskatchewan. A diversion channel caused bluff slump and redeposition of bison bones. Sources: Rutherford et al., 1979.

S-1073, bison bone collagen, *Bison* sp. bone fragments, from creek bed surface, redeposition exposure, collected 1975, submitted by T. Skwara.

Normalized age: 930 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 850 ± 60

Significance: palaeobiology

S-1074, bison bone collagen, *Bison* sp. bone fragments, from clay matrix, bluff slump, 2 m depth, collected 1975, submitted by T. Skwara.

Normalized age: 2445 ± 75

$\delta^{13}\text{C} = -20 \text{ e}$

2365 ± 70

Uncorrected age:

Significance: palaeobiology

EINK-1, Coffin: South Saskatchewan drainage, Saskatchewan. This is a Besant habitation site with stone circles and cairns. Sources: Canadian Heritage Information Network; C. Germann, p.c. 1998.

S-2481, bone collagen, from unknown provenience, collected 1982, submitted by U. Linnamae.

Normalized age: 1635 ± 85

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1555 ± 85

Significance: Woodland, Besant

EINo-3b, Cline: J.J. Finn Bog, southeast of Strehlow Pond, 517 m asl, 8.5 km north of Dundurn, Moose Woods Sand Hills, Saskatchewan. A test excavation revealed two components: a culturally unidentified occupation centered at a depth of 12 cm, and a Pelican Lake occupation centered at a depth of 50 cm. A composite radiocarbon sample consisted of small bone fragments from six excavation units, 40-60 cm BD, and a Pelican Lake point was found in Unit 3 at this level. Sources: McCann, 1983; Morlan, 1993.

S-2264 (CMC-1270), bison bone collagen, *Bison* sp., from Level 2, 40-60 cm below datum, units 1-6, collected 1981, submitted by D. Meyer.

Normalized age: 3005 ± 110

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2925 ± 110

Significance: Archaic, Pelican Lake

Associated taxa: *Bison* sp.; Mollusca, Unionidae.

EINp-8, Fitzgerald: Moose Woods Sand Hills, 548 m asl, 15 km south of Saskatoon, Saskatchewan. The Fitzgerald site is considered to represent a single use of a bison pound and associated processing area where at least 49 bison were killed and butchered in the fall season. Four bison bones were selected for radiocarbon dating, two each from the kill and the processing area. One sample from each area was sent to Beta Analytic, Inc., and the other two were assayed by the Saskatchewan Research Council Laboratory. The two dates from Beta are nearly two centuries older than the dates from Saskatchewan, and the errors reported by the latter are about twice those of the former. Nonetheless, Hjernstad uses criteria proposed by Long and Rippeteau (1974) to argue that the four dates do not differ significantly from one another, and he presents an average of the four dates (1358 ± 45 BP) as the best estimate for the age of the site. Sources: Hjernstad, 1996; Long and Rippeteau, 1974.

S-3547 (CMC-1454), bison bone collagen, *Bison* sp. metacarpal (265 g, id. by B. Hjernstad), from processing area, unit 105s/129e, SW quad, Level 1, collected 1993, submitted by B. Hjernstad.

Normalized age: 1240 ± 170

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1160 ± 170

Significance: Woodland, Besant

S-3546 (CMC-1453), bison bone collagen, *Bison* sp. 6th cervical vertebra (334 g, id. by B. Hjernstad), from kill area, unit 90s/85e, SE quad, Level 2, collected 1993, submitted by B. Hjernstad.

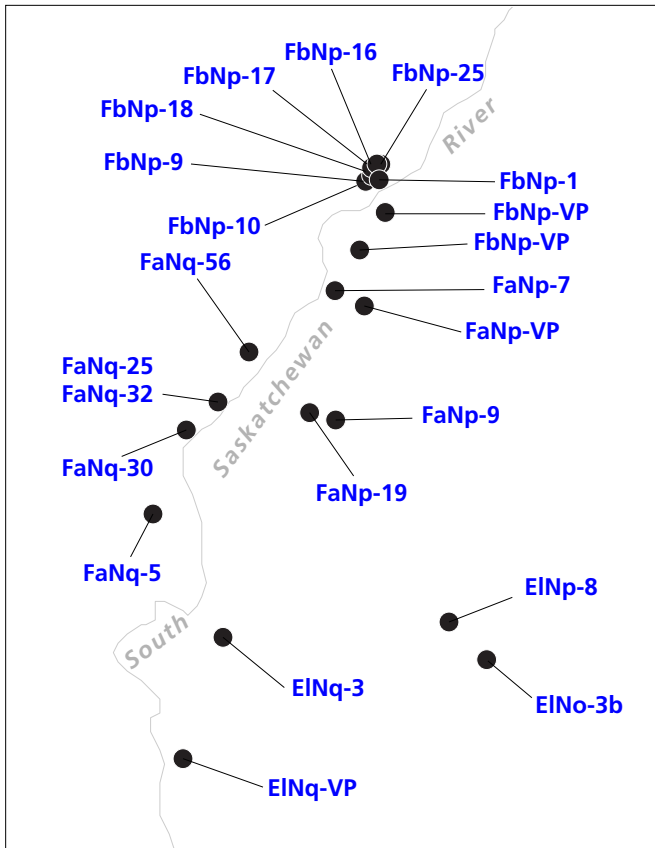


Fig. I-3. Dated sites in the Saskatoon region. For location in southern Saskatchewan, see box shown in Fig. I-2 (p. 14).

Normalized age: 1350 ± 140
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1270 ± 140
 Significance: Woodland, Besant

Beta-69004 (CMC-1425), bison bone collagen, *Bison* sp. humerus (365 g, id. by B. Hjermsstad), from processing area, unit 105s/129e, SE quad, Level 1, collected 1993, submitted by B. Hjermsstad.

Normalized age: 1420 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1340 ± 60

Significance: Woodland, Besant

Beta-69005 (CMC-1426), bison bone collagen, *Bison* sp. 4th cervical vertebra (424 g, id. by B. Hjermsstad), from kill area, unit 86s/79e, SE quad, Level 2, collected 1993, submitted by B. Hjermsstad.

Normalized age: 1570 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1490 ± 90

Significance: Woodland, Besant

EINq-3, Beaver Creek: 200-300 m north of the mouth of Beaver Creek, about 12 mi south of Saskatoon, South Saskatchewan River, Saskatchewan. Walker (1988a: 72; 1992: 170) mentions S-2438 in discussions of Mummy Cave occupations, but no diagnostic artifacts are associated with the date. Unpublished records in the Saskatchewan Heritage Branch record this site as Wettlaufer's S-101.

Notes filed by T.F. Kehoe in 1963 indicate the likelihood that the site would soon be lost to mass wasting of the river bank. Sources: Morlan, 1993; Walker, 1988a, 1992, p.c. 1998.

S-2438, bison bone collagen, *Bison* sp., from test pit 1, 1.2 m depth, submitted by E.G. Walker.

Normalized age: 4940 ± 155
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

EINq-VP, Frenchman's Flat: floodplain of the South Saskatchewan River south of Saskatoon, Saskatchewan. S-266 is one of a series of samples submitted to date parts of a local but morphologically significant floodplain and to give rates of sedimentation of overbank blood deposits. The other dates are on charcoal and wood, and the overall range indicates that the main river channel has been relatively stable for at least 3000 years. S-266 also gives a maximum age for Pike Lake, a large oxbow lake. Sources: McCallum and Wittenberg, 1968.

S-266, bison bone, *Bison* sp., from beneath 8' (2.4 m) of alluvium, collected 1964, submitted by L.E. Hodgins.

Normalized age: 1115 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1035 ± 60

Note: Pre-treatment of the sample entailed charring of whole bone. The normalized age is a minimum age.

Significance: palaeobiology

EINs-4, Zoerb: 40 km southwest of Saskatoon, at the southern edge of the sand dune complex located between Eagle Creek and the South Saskatchewan River, Saskatchewan. Charred bone was collected by W. Pendree from the lower of two occupation layers. The upper layer, ca. 15 cm below surface, contained bone and Avonlea points. The lower layer, separated from the upper by 45-60 cm of yellow sand, contained no diagnostic artifacts. Sources: Morlan, 1993; Rutherford et al., 1975; Wilmeth, 1978.

S-575, bone collagen, from lower of two cultural layers, collected 1970, submitted by W.O. Kupsch.

Normalized age: 2760 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 2680 ± 75

Significance: cultural affiliation unknown

EaOd-1, Gull Lake: 10 km south-southwest of the town of Gull Lake, Swiftcurrent valley, South Saskatchewan drainage, Saskatchewan. Kehoe (1973) described the complex stratigraphy of this site in terms of 52 layers grouped into five zones. Kehoe (1973: 40) considers that the use of this site as a bison drive begins with Layer 32, and any earlier occupations represent campsites.

Zone 5 (Layers 1-14) yielded mainly Plains side-notched and also some Prairie side-notched points. Zone 4 (Layers 15-24) yielded mainly Prairie side-notched points as well as some Avonlea points in Layer 24, and two radiocarbon dates were obtained. Charcoal from Layer 21 was associated with Prairie side-notched points (S-150). Charcoal from Layer 24b was associated with Prairie side-notched and a few Avonlea points (S-149).

Zone 3 (Layers 25-32) yielded Avonlea points and two radiocarbon dates on charred wood from Layer 26 (S-254) and Layer 31a (S-255).

Zone 2 (Layers 33-40) yielded no diagnostic artifacts, but a bell-shaped pestle was found in Layer 34 and a battered quartzite pebble in Layer 40. One radiocarbon date was obtained on Layer 34 (S-256). Dyck (1983: 110) lists this as a date for the Besant complex, a speculation based on the similarity between the bell-shaped pestle and a pestle from Layer VII at the Sjøvold site (I. Dyck, p.c. 1992).

Zone 1 (Layers 41-52) yielded isolated bone fragments and charcoal that could signify human occupation in Layer 47, but no artifacts were found. Sources: Dyck, 1983; Kehoe, 1973; McCallum and Wittenberg, 1962, 1968; Morlan, 1993; Wilmeth, 1978.

S-150, charcoal, from Layer 21, Zone 4, poorly sorted sand, silt, and clay with pebbles, 6" (15 cm) below bison skull 7 in square 26R18, collected 1960, submitted by T.F. Kehoe.

Normalized age: 1165 ± 80
δ¹³C = -25 e

Significance: Woodland, Prairie

Associated taxa: *Bison* sp.; identified by T.F. Kehoe.

S-149, charcoal, from Layer 24b, Zone 4, charcoal lens below Layer 24a, the fifth bone layer, collected 1960, submitted by T.F. Kehoe.

Normalized age: 1220 ± 80
δ¹³C = -25 e

Significance: Woodland, Prairie

Associated taxa: *Bison* sp.; identified by T.F. Kehoe.

S-254, charred wood, from Layer 26, Zone 3, a black charcoal layer 0.2 feet (4 cm) thick, 4' (1.2 m) north and 6" (15 cm) west of Stake 26R18, 7.2 feet (2.2 m) depth, collected 1963, submitted by T.F. Kehoe.

Normalized age: 1290 ± 60
δ¹³C = -25 e

Significance: Woodland, Avonlea

Associated taxa: *Homo sapiens*, *Bison* sp.; identified by T.F. Kehoe.

S-255, charred wood, from Layer 31a, Zone 3, gray soil containing whole to nearly whole bison bones, beneath a large bison skull at 9 feet (2.7 m) depth, collected 1963, submitted by T.F. Kehoe.

Normalized age: 1740 ± 60
δ¹³C = -25 e

Significance: Woodland, Avonlea

Associated taxa: *Bison* sp.; identified by T.F. Kehoe.

S-256, charred wood, from Layer 34, Zone 2, 2nd of five soil layers in well sorted fine sand and silt, associated with a bell-shaped limestone pestle at 11 feet (3.3 m) depth, collected 1963, submitted by T.F. Kehoe.

Normalized age: 1900 ± 65
δ¹³C = -25 e

Significance: cultural affiliation unknown

Associated taxa: *Bison* sp.; identified by T.F. Kehoe.

EdOa-14, Cabri Burial: 21 km west of Cabri, 671 m asl, South Saskatchewan valley, Saskatchewan. Human remains were recovered during road construction and collected by E.G. Walker. Other than red ochre, no artifacts were found with this flexed burial, dated on ribs. Sources: Morlan, 1993.

S-2943 (CMC-1380), human bone collagen, *Homo sapiens* ribs (205 g, id. by E.G. Walker), from burial in sand overlying gravel, collected 1986, submitted by E.G. Walker.

Normalized age: 2435 ± 105
δ¹³C = -19 e
Uncorrected age: 2335 ± 105

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the human diet.

Significance: cultural affiliation unknown

EdOh-23: Frank Yeast lease in the Great Sand Hills, Saskatchewan. Artifacts of Knife River flint, including two complete Besant points, were collected from a deflation area exposing three or four hearths. A radiocarbon sample of bison? bone was collected from the surface in the vicinity of the hearths and therefore is weakly associated with the points. Sources: Johnson, 1983; Morlan, 1993.

S-2348 (CMC-1299), bison bone collagen, *Bison?* sp. (id. by E.A. Johnson), from deflated cultural layer in sand, collected 1981, submitted by E.A. Johnson.

Normalized age: 1755 ± 115
δ¹³C = -20 e
Uncorrected age: 1675 ± 115

Significance: Woodland, Besant

EeOc-3, Sheep Creek: 24 km north of Cabri, South Saskatchewan River, Saskatchewan. Sources: D. Meyer, p.c. 1998.

S-n/a-2, bison bone collagen, *Bison* sp., from unit 2N/1E, submitted by I. Cazakoff.

Normalized age: 965 ± 195
δ¹³C = -20 e
Uncorrected age: 885 ± 195

Significance: cultural affiliation unknown

EeOc-5, Miry Creek: South Saskatchewan River, Saskatchewan. This site contains hearths associated with Oxbow, Pelican Lake and Plains side-notched points. Sources: Canadian Heritage Information Network; C. Germann, p.c. 1998.

S-2568, charcoal, from hearth, submitted by K. Elliott.

Normalized age: 335 ± 70
δ¹³C = -25 e

Significance: cultural affiliation unknown

EeOi-11, Heron Eden: 13 km south and 1.6 km east of Prelate near the northwest edge of the Great Sand Hills, South Saskatchewan valley, Saskatchewan. This site was discovered when Ruth and Fulton Heron found projectile points of the Eden-Scottsbluff complex eroding out on the surface. Excavations by the Southwest Chapter of the Saskatchewan Archaeological Society revealed that a 16x20 m area remains intact and contains a dark brown paleosol below the plow zone. Two complete points were recovered by excavation in the paleosol which also produced bones of a large form of bison. Bison bone fragments from the paleosol were sampled for three radiocarbon dates. Linnamae and Cazakoff (1990) note that S-3118 is older than expected.

Corbeil's (1995) detailed analysis presents two additional dates (S-3308, S-3309) on unburned bison bone. Corbeil considers that an average of these two dates and S-3114 provides the best estimate of the age of the site. Sources: Corbeil, 1995; Linnamae, 1990; Linnamae and Cazakoff, 1990; Morlan, 1993.

S-3208, bison bone collagen, *Bison* sp. (288 g, id. by M. Corbeil), from cultural layer, unit 100n110e, 27 cm depth, submitted by M.R. Corbeil.

Normalized age: 8240 ± 200
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 8160 ± 200

Significance: Palaeoindian, anomalous, young

S-3309, bison bone collagen, *Bison* sp. (id. by M. Corbeil), from cultural layer, unit 102.5n111e, 24-27 cm depth, submitted by M.R. Corbeil.

Normalized age: 9000 ± 130
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 8920 ± 130

Significance: Palaeoindian

S-3114, bison bone collagen, *Bison* sp. (260 g, id. by M. Corbeil), from cultural layer, unit 100n102e, 25-30 cm depth, submitted by M.R. Corbeil.

Normalized age: 9010 ± 120
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 8930 ± 120

Significance: Palaeoindian

S-3308, bison bone collagen, *Bison* sp. (id. by M. Corbeil), from cultural layer, unit 102.5n111e, 28 cm depth, submitted by M.R. Corbeil.

Normalized age: 9290 ± 110
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 9210 ± 110

Significance: Palaeoindian

Associated taxa (entire site): *Spermophilus richardsonii*, *Thomomys talpoides*, *Canis lupus*, *Antilocapra americana*, *Bison* sp.; identified by M. Corbeil.

S-3118, bison bone collagen, *Bison* sp. (380 g, id. by M. Corbeil), from cultural layer, unit 100n112e, 22-30 cm depth, submitted by M.R. Corbeil.

Normalized age: 10290 ± 100
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 10210 ± 100

Significance: Palaeoindian, anomalous, old

EeOk-16, Walter Moser: 8 km east, 1.5 km north of Burstall, 728 m asl, Great Sand Hills, South Saskatchewan valley, Saskatchewan. Charcoal was collected by O.L. Mallory from a fire pit 30 cm below the surface, associated with dwelling floors, cache pits, and other habitation features in the second of a possible four cultural zones. With evidence of occupation from Oxbow and McKean periods to historic time, the association of this sample is not clear. Sources: Morlan, 1993; Rutherford et al., 1979.

S-1307, charcoal, from fire pit 30 cm depth in second occupation layer, collected 1976, submitted by I. Dyck.

Normalized age: 1710 ± 90
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown

EfOa-5, Kyle mammoth: near Kyle, South Saskatchewan drainage, Saskatchewan. Christiansen comments that the scattered skeletal remains and contorted pond deposits in which the mammoth was buried indicate that the remains were disturbed during melting of stagnant ice after the mammoth died. Sources: Haynes et al., 1971; McCallum and Wittenberg, 1968; Wilson and Burns, 1999: 227.

A-619, mammoth bone, *Mammuthus* sp. vertebra, from about 2 m depth, collected 1964, submitted by T.F. Kehoe.

Normalized age: 8685 ± 400
 $\delta^{13}\text{C} = -22.8$
Uncorrected age: 8650 ± 400

Note: The fraction employed was acid-soluble organic matter, suspected to give erroneously young ages.

Significance: palaeobiology, anomalous, young

S-246, mammoth bone, *Mammuthus* sp., from oxidized, clayey sand, contorted pond deposits, 0-1.3 m depth, collected 1964, submitted by E.A. Christiansen.

Normalized age: 12 035 ± 200
 $\delta^{13}\text{C} = -22.8$
Uncorrected age: 12 000 ± 200

Note: Sample pre-treated by charring the whole bone. Age normalized with the ^{13}C ratio reported for this skeleton by the Arizona laboratory.

Significance: palaeobiology

EfOe-VP: north of Lancer, South Saskatchewan River, Saskatchewan. I-1393 was analyzed to determine the recent history of the river, and the date implies that the river has been in a state of dynamic equilibrium for the past 500 years. The presence of numerous bison bones suggests that the locality should be reexamined for possible archaeological evidence. Sources: Trautman and Willis, 1966.

I-1393, carbonized wood, from alluvium halfway up an 8 m cut bank, associated with numerous bison bones, collected 1964, submitted by J.T. Andrews.

Normalized age: 585 ± 205
 $\delta^{13}\text{C} = -25$ e

Significance: palaeobiology

Associated taxa: *Bison* sp.

EfOi-?, Mann: on the north bank of the South Saskatchewan River, Saskatchewan. A cone-shaped hearth, 0.76 m deep, 3 m below surface, contained butchered bison bone and stone flakes but no diagnostic artifacts. Charcoal was collected from the hearth by W. Pendree. Records in the Heritage Branch, Regina, do not contain a reference to this date, and it is not clear whether the site is EfOi-1 (Wettlaufer's site S-46) or EfOi-2, a site northeast of Prelate (C. Germann, p.c. 1996). Sources: Morlan, 1993; Rutherford et al., 1981.

S-577, charcoal, from hearth, 3 m below surface, with butchered bison bone, collected 1970, submitted by W. Pendree.

Normalized age: 4930 ± 100
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown

Associated taxa: *Bison* sp.; identified by W. Pendree.

EFOj-fs, Nagel: 13 km southwest of Leader, Great Sand Hills, South Saskatchewan valley, Saskatchewan. This find spot has not been numbered as a site. Eldon Johnson found a surface scatter of bison bone fragments along with two Folsom fluted points (E.G. Walker, p.c. 1992). A large sample of bone fragments produced a radiocarbon date that is obviously not related to the projectile points. Sources: Morlan, 1993.

S-3028, bison bone collagen, *Bison* sp. (936 g, id. by E.G. Walker), from surface bone scatter, submitted by E.G. Walker.

Normalized age: 1890 ± 190
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1810 ± 190

Significance: cultural affiliation unknown

EFOk-16, Estuary: 13 km west of Leader, 610 m asl, South Saskatchewan valley, Saskatchewan. This is a multi-component site with closely spaced superimposed layers and three radiocarbon dates. The published literature contains contradictions concerning the material dated and the provenience of some of these samples. Following Wilmeth (1978: 101) and Rutherford et al. (1984: 255), the samples are listed as charcoal, but Adams (1977: 38) states that the three samples include "a single carbon date and two collagen dates." Wilmeth (1978: 101) gives the source of GaK-3809 as the "lower layer of midden," but Adams (1977: 38, 42) specifies Feature C-2 on the Level 1 floor plan. S-640 is also from Level 1. Level 2 has a single date with a large standard deviation.

Even if the published contradictions can be corrected, the stratigraphy of the site is open to alternate interpretations. The mixture of Prairie side-notched and Avonlea points in Level 2 is interpreted by Adams (1977: 142-143) to signify a transitional component that he names the Leader subphase. However, it is possible that Estuary Level 2 suffers from compressed stratigraphy in which successive occupations are not adequately separated stratigraphically; there is no layer of sterile sediment separating Level 2 from overlying Level 1 (Adams 1977: 37, Fig. 5). Sources: Adams, 1977; Morlan, 1993; Rutherford et al., 1984; Wilmeth, 1978.

GaK-3809 (CMC-490), charcoal, from Level 1, Area 2, Profile A, Layer E, silt containing cultural remains, collected 1971, submitted by G.F. Adams.

Normalized age: 1020 ± 80
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Prairie

S-640 (CMC-696), charcoal, from Level 1, hearth in silt containing cultural remains, 52 cm depth, collected 1971, submitted by J.F.V. Millar.

Normalized age: 1070 ± 70
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Prairie

Suggested age (Level 1): 1050 ± 55, average of GaK-3809 and S-640

Associated taxa (Level 1): *Canis* sp., *Antilocapra americana*, *Bison* sp.; Mollusca; identified by G.F. Adams.

S-641 (CMC-695), charcoal, from Level 2, hearth in paleosol

developed in silt, 100 cm depth, collected 1971, submitted by J.F.V. Millar.

Normalized age: 1190 ± 170
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Avonlea

Associated taxa (Level 2): *Spermophilus tridecemlineatus*, *Canis* sp., *Vulpes* sp., *Bison* sp.; Aves (unidentified); Mollusca; identified by G.F. Adams.

EiOj-1, Elma Thompson: southwest of Flaxcombe on the western fringe of the Flaxcombe interlobate moraine, South Saskatchewan drainage, Saskatchewan. Wind erosion uncovered this previously buried tipi ring that contained, among other things, two Besant points and a dated bison tibia fragment. Sources: Finnigan and Johnson, 1984; Morlan, 1993.

S-2202 (CMC-1255), bison bone collagen, *Bison* sp. tibia, from unit 9, adjacent to the east side of a tipi ring, 15 cm depth, collected 1981, submitted by J.T. Finnigan.

Normalized age: 1755 ± 145
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1675 ± 145

Significance: Woodland, Besant

EjOc-3, Herschel Petroglyph: Eagle Creek, North Saskatchewan drainage, Saskatchewan. Sources: Houston, 1993; Steinbring and Buchner, 1993.

GX-18515G, bone collagen, from soil matrix partly overlying monolith #1, collected 1992, submitted by A.P. Buchner.

Normalized age: 1350 ± 80
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1270 ± 75

Significance: Woodland

GX-18514G, bone collagen, from soil matrix partly overlying monolith #1, collected 1992, submitted by A.P. Buchner.

Normalized age: 1450 ± 75
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1370 ± 70

Significance: Woodland

EjOc-13: Coal Mine Ravine, southwest of Herschel, Eagle Creek, Saskatchewan. This multi-component site contains seven occupation layers, none of which has produced diagnostic artifacts. However, a radiocarbon date has been obtained from the deepest layer. Sources: Rollans, 1999.

S-3647, bison bone collagen, *Bison* sp. horn core, from Occupation 7, lowest cultural level, 2 m depth, with other bones and lithic debitage surrounding it, submitted by M. Rollans.

Normalized age: 2155 ± 80
 $\delta^{13}\text{C} = -18.96$
Uncorrected age: 2060 ± 80

Significance: cultural affiliation unknown

EiOd-3: bottom of a ravine at the western edge of the Bear Hills, near Plenty, Eagle Creek, Saskatchewan. A bone bed was

encountered in a 1x1 m assessment unit. No artifacts were recovered, but one bison bone has been dated by radiocarbon. Sources: Rollans, 1999.

S-3666, bison bone collagen, *Bison* sp. humerus, from bone bed about 30 cm depth, submitted by M. Rollans.

Normalized age: 2910 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 2830 ± 80

Note: The normalized age is a minimum since this bison probably consumed some C₄ plants during its life.

Significance: cultural affiliation unknown

FcMv-1, Greenwater Lake: near Greenwater Lake Provincial Park, Red Deer drainage, Saskatchewan. This partially disturbed burial, representing a primary interment, was recovered from the back slope of a road cut. An Oxbow point was found in the thoracic region of the skeleton, and human ribs were submitted for a radiocarbon date. Sources: Morlan, 1993; Rutherford et al., 1981; Walker, 1981.

S-1447, human bone collagen, *Homo sapiens* ribs (id. by E.G. Walker), from burial exposed in a road-cut, collected 1973, submitted by I. Dyck.

Normalized age: 4490 ± 105
 $\delta^{13}\text{C} = -19 \text{ e}$
Uncorrected age: 4390 ± 105

Note: The normalized age is a minimum, because bison that had consumed C₄ plants were probably included in the human diet.

Significance: Archaic, Oxbow

FaNp-VP, Riddell: 4.8 km north of Sutherland, South Saskatchewan River, Saskatchewan. Skwara (1988; SkwaraWoolf, 1981) describes the Riddell fauna as a Rancholabrean assemblage that may be as much as 175,000 years old. She rejects S-1305, because it underlies till of the Battleford Formation and leaves too little time for advance and retreat of Late Wisconsinan ice. She notes that GSC-1041, 38,000 ± 560 BP on wood from the top of the Floral Formation near Kenaston, provides a minimum age for the Riddell fauna. I-8581 is also considered to be anomalously young. The bison bones dated by S-1306 are from a younger context stratigraphically above the Floral Formation. Sources: Rutherford et al., 1979; Skwara, 1988; SkwaraWoolf, 1981.

I-8581, horse bone collagen, *Equus scotti* metatarsal (NMC-21326, id. by T. Skwara), from Riddell member, Floral Formation, submitted by C.R. Harington.

Normalized age: 2840 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 2760 ± 90

Significance: palaeobiology, anomalous, young

S-1306, bison bone collagen, *Bison* sp. bone fragments, from Battleford Formation, 30 cm depth, collected 1975, submitted by T. Skwara.

Normalized age: 4640 ± 115
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 4560 ± 115

Significance: palaeobiology

S-1305, horse bone collagen, *Equus* sp. metapodial, from sand 1.5 m below the contact between the Floral and Battleford formations,

exposed in a gravel pit, collected 1975, submitted by T. Skwara.

Normalized age: 15 420 ± 500
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 15 340 ± 500

Significance: palaeobiology, anomalous, young

FaNp-7, Rocky Island: on the east bank of the South Saskatchewan River, in the city of Saskatoon, Saskatchewan. Test excavations yielded two projectile points, a biface and an end scraper near a hearth. A charcoal sample from the hearth provided a radiocarbon date. One of the projectile points resembles the "Un-named Complex" at the Sjøvold site (see Dyck, 1983: Fig. 10.23c) which is now incorporated into a revised concept of Besant (Dyck and Morlan, 1995). Sources: Dyck, 1983; Dyck and Morlan, 1995; Morlan, 1993; Walker, 1983c.

S-2437, charcoal, from hearth in cultural layer, submitted by E.G. Walker.

Normalized age: 2475 ± 120
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Besant

FaNp-9, Bill Richards: immediately south of Saskatoon in a cultivated field, South Saskatchewan River, Saskatchewan. This is a late prehistoric bison pound and processing area thought to be related to the Mortlach Phase. The occupation layer is a thick, black soil layer which is overlain by a 40 cm thick level of yellow sand. A bison metacarpal from the top of the black soil layer provided a date. J.T. Finnigan notes that the date is older than expected, an opinion supported by a thermoluminescence date about 500 years younger than S-2884 (J. Finnigan, p.c. 1993). Sources: Morlan, 1993.

S-2884 (CMC-1369), bison bone collagen, *Bison* sp. metacarpal (267 g), from unit 66s/54w, 46 cm depth, collected 1986, submitted by J.T. Finnigan.

Normalized age: 900 ± 110
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 820 ± 110

Significance: Woodland, Plains, Prairie, anomalous, old

FaNp-19, Hartley: just south of Saskatoon on Preston Avenue, South Saskatchewan River, Saskatchewan. Four field school sessions have yielded evidence of a single occupation containing both Avonlea and late side-notched points. A date has been obtained on bison bone. Clarke (1995) presents a detailed analysis of this site, arguing that it represents a transition from Avonlea to the Old Women's phase of the late prehistoric period. Sources: Clarke, 1995; Clarke and Meyer, 1992; Morlan, 1993.

S-3382, bison bone collagen, *Bison* sp. tibia (id. by G. Clarke), from dark gray to black sandy loam, unit 290n/106e, 5-12 cm depth, submitted by D. Meyer.

Normalized age: 1200 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1120 ± 60

Note: Thermoluminescence date on a hearth in same unit: AD 700 ± 360 (DUR93TL170-1ASpfg).

Significance: Woodland, Avonlea, Prairie

Associated taxa: *Lepus americanus*, *Lepus townsendii*, *Spermophilus richardsonii*, *Thomomys talpoides*, *Castor canadensis*, *Clethrionomys gapperi*, *Microtus ochrogaster*,

Microtus pennsylvanicus, *Canis lupus*, *Canis latrans*, *Vulpes vulpes*, *Vulpes velox*, *Taxidea taxus*, *Bison* sp.; *Aves*, *Anas crecca*, *Anas discors* (cf), *Bubo virginianus*, *Tympanuchus phasianellus*, *Bonasa umbellus*, *Meleagris gallopavo*, *Corvus corax*; *Pisces*, *Esox lucius*; Mollusca; identified by G. Clarke.

FaNq-5, Moon Lake: overlooking a small oxbow lake in a former channel of the South Saskatchewan River, 509 m asl, 4 km west and 6.5 km south of Saskatoon, Saskatchewan. A single component in a paleosol yielded four Oxbow points and two un-notched triangular points in 12 contiguous excavation squares. S-403 is based on an insoluble collagen extraction from a composite sample that included bones from each of the excavation units. The date list misquotes this date as 5000 ± 90 BP (Dyck 1970: 16-17). Sources: Dyck, 1970; McCallum and Wittenberg, 1968; Morlan, 1993; Wilmeth, 1978.

S-403, bone collagen, from cultural layer in paleosol developed in dune sand, a composite sample (ca. 2 kg) from more than one excavation unit, collected 1966, submitted by Z.S. Pohorecky.

Normalized age: 4180 ± 90
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 4100 ± 90

Significance: Archaic, Oxbow

Associated taxa: *Bison* sp.; *Aves*, Anserini; identified by I. Dyck.

FaNq-25, Gowen 1: on a terrace of the South Saskatchewan River, 480 m asl, within the city limits of Saskatoon, Saskatchewan. The main excavation area was comprised of a large number of contiguous squares, and a smaller area to the south was excavated after disturbance by heavy equipment. The 23 recovered projectile points were the subject of a detailed typological analysis that resulted in the definition of the Gowen side-notched type as one of several early side-notched point types. Walker (1992: Table 1; Rutherford et al., 1981: 125) notes that S-1526 is inconsistent with the other dates and rejects it as too recent. The age of the site can be inferred from the average of the other four dates. Sources: Morlan, 1993; Rutherford et al., 1981, 1984; Schroedl and Walker, 1978; Walker, 1980, 1988a, 1992.

S-1526 (CMC-990), bone collagen, from cultural layer in paleosol IIIAhkb, 75-78 cm depth, collected 1977, submitted by E.G. Walker.

Normalized age: 4810 ± 130
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 4730 ± 130

Significance: Archaic, Mummy Cave, anomalous, young

S-1527 (CMC-991), bone collagen, from cultural layer in paleosol IIIAhkb, 75-78 cm depth, collected 1977, submitted by E.G. Walker.

Normalized age: 5750 ± 140
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5670 ± 140

Significance: Archaic, Mummy Cave

S-1448, charcoal, from cultural layer in paleosol IIIAhkb, 75-78 cm depth, collected 1977, submitted by E.G. Walker.

Normalized age: 5760 ± 140
 $\delta^{13}\text{C} = -25$ e

Significance: Archaic, Mummy Cave

S-1488, bone collagen, from cultural layer in paleosol IIIAhkb, 75-78 cm depth, collected 1977, submitted by A.R. Schroedl.

Normalized age: 6150 ± 200

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 6070 ± 200

Significance: Archaic, Mummy Cave

S-1457, bone collagen, from cultural layer in paleosol IIIAhkb, 75-78 cm depth, collected 1977, submitted by E.G. Walker.

Normalized age: 6230 ± 110

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 6150 ± 110

Significance: Archaic, Mummy Cave

Suggested age: 5930 ± 70, average of S-1448, S-1457, S-1488, and S-1527

Associated taxa (entire site): *Spermophilus richardsonii* (intrusive?), *Thomomys talpoides*, *Peromyscus* sp. (intrusive?), *Canis lupus*, *Antilocapra americana*, *Bison* sp.; *Aves*, *Corvus brachyrhynchos*; identified by E.G. Walker.

FaNq-30, Graham: in the South Saskatchewan Valley, 3.5 km south of Saskatoon, Saskatchewan. A Duncan point was found within a hearth that contained a cremated human burial. Comminuted parts of the skeleton were submitted for a radiocarbon date. Sources: Morlan, 1993; Rutherford et al., 1981; Walker, 1984a.

S-1574 (CMC-1011), human bone collagen, *Homo sapiens* (id. by E.G. Walker), from cremation burial in a sand dune, 10 cm depth or less, collected 1977, submitted by E.G. Walker.

Normalized age: 3350 ± 55

$\delta^{13}\text{C} = -19$ e

Uncorrected age: 3250 ± 50

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.

Significance: Archaic, Duncan

Associated taxa: *Homo sapiens*, *Odocoileus* sp., *Bison* sp.; identified by E.G. Walker.

FaNq-32, Gowen 2: on a terrace of the South Saskatchewan River, within the city limits of Saskatoon, about 70 m west of the Gowen 1 site (FaNq-25), Saskatchewan. Most of the 75 projectile points fall within the range of the Salmon River type or the Gowen type, as defined by Walker (1980, 1992), but two Bitterroot and two Oxbow points were also found in situ in the habitation area (Walker 1988a: 70). S-2036B is from the same bone sample as S-2036A, but the former was given 1N HCl pretreatment that appears to have removed some contaminants. Sources: Morlan, 1993; Rutherford et al., 1984; Walker, 1980, 1988a, 1992.

S-2036A, bone collagen, from cultural layer in paleosol VAhkb, 69-78 cm depth, collected 1980, submitted by E.G. Walker.

Normalized age: 5160 ± 150

$\delta^{13}\text{C} = -20$ e

Uncorrected age: 5080 ± 150

Significance: Archaic, Mummy Cave, anomalous, young

S-2037, carbonaceous sediment, from cultural layer in paleosol VAhkb, 69-78 cm depth, collected 1980, submitted by E.G. Walker.

Normalized age: 5670 ± 110

$\delta^{13}\text{C} = -25$ e

Significance: Archaic, Mummy Cave

S-2036B, bone collagen, from cultural layer in paleosol VAhkb, 69-78 cm depth, collected 1980, submitted by E.G. Walker.

Normalized age: 5990 ± 170
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5910 ± 170

Significance: Archaic, Mummy Cave

S-1970 (CMC-1173), bone collagen, from cultural layer in paleosol VAhkb, 69-78 cm depth, collected 1980, submitted by E.G. Walker.

Normalized age: 6000 ± 130
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5920 ± 130

Significance: Archaic, Mummy Cave

S-1971 (CMC-1174), bone collagen, from cultural layer in paleosol VAhkb, 69-78 cm depth, collected 1980, submitted by E.G. Walker.

Normalized age: 6160 ± 160
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 6080 ± 160

Significance: Archaic, Mummy Cave

Suggested age: 5895 ± 70 BP, average of S-1970, S-1971, S-2036B, and S-2037

Associated taxa (entire site): *Tamias minimus*, *Thomomys talpoides*, *Peromyscus* sp., *Ondatra zibethicus*, *Canis latrans*, *Canis lupus*, *Vulpes* sp., *Bison* sp.; identified by E.G. Walker.

FaNq-56, Norby: within a residential area in southwestern Saskatoon, on the Saskatoon terrace, South Saskatchewan River, Saskatchewan. Four excavation areas are separated by narrow impediments such as laneways, and together they span an area about 12 m long. Most of the points are large side-notched forms typical of the early side-notched (Mummy Cave) series, but one is a reworked stemmed point of possible Palaeoindian affinity. The site is a single component bison kill with three radiocarbon dates that can be averaged. Sources: Morlan, 1993; Zurburg, 1991.

S-3206, bone collagen, from cultural layer and bone bed in paleosol in alluvial sand, submitted by E.G. Walker.

Normalized age: 5640 ± 120
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5560 ± 120

Significance: Archaic, Mummy Cave

S-3205, bone collagen, from cultural layer and bone bed in paleosol in alluvial sand, submitted by E.G. Walker.

Normalized age: 5820 ± 110
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5740 ± 110

Significance: Archaic, Mummy Cave

S-3006, bone collagen, from cultural layer and bone bed in paleosol in alluvial sand, submitted by E.G. Walker.

Normalized age: 5965 ± 265
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5885 ± 265

Note: This date was mis-printed as S-3306 in Morlan, 1993.

Significance: Archaic, Mummy Cave

Suggested age: 5760 ± 80 BP, average of S-3205, S-3206, and S-3006

Associated taxa: *Lepus* sp., *Spermophilus* sp., *Canis* sp., *Bison* sp.; *Aves*, *Ectopistes migratorius*; identified by S. Zurburg (mammals) and R.E. Morlan (bird).

FaNr-2, Grandora: in a sand dune about 1.5 km north of Grandora and 19 km west of Saskatoon, Dunfermline Sand Hills, Saskatchewan. Two complete and six broken Besant points were recovered from a single large excavation block. A radiocarbon date was obtained by insoluble collagen extraction from bone recovered from two adjoining excavation units in a buried soil 61 cm below the surface, associated with a hearth and occupation debris (S-542).

During the excavation, the site was visited by E.A. Christiansen who sampled a deeper A-horizon, 1.4 m below the surface, that records a cessation of aeolian activity (S-489). Dyck (1972a: 6) notes that a few broken teeth and bones from this horizon may indicate an earlier cultural occupation. Sources: Christiansen 1970; Dyck, 1972a; Morlan, 1993; Rutherford et al., 1973, 1975; Wilmeth, 1978.

S-542, bone collagen, from cultural layer in buried soil 61 cm below the surface near a hearth, collected 1969, submitted by I. Dyck.

Normalized age: 1640 ± 65
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1560 ± 60

Significance: Woodland, Besant

S-489, paleosol, from cultural layer, 1.4 m depth, collected 1969, submitted by E.A. Christiansen.

Normalized age: 3730 ± 80
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown

FbNp-1, Tipperary Creek: just north of Saskatoon, on a prominent point bar at the mouth of Opimihaw Creek, Wanuskewin Heritage Park, Saskatchewan. At least 20 occupation levels have been recognized on paleosols buried by overbank sedimentation, and 15 of these have been dated by radiocarbon. See cover photo.

Since the appearance of previous publications mentioning some of these dates (Morlan 1988, 1993; Walker 1988b; Walker, et al. 1986, 1987), analysis of continuous stratigraphic profiles through trenches linking the two main site areas has revealed the need to re-number some of the levels in Area A to make them correspond to the numbering of a larger excavation in Area D. The level assignments of four radiocarbon samples have been changed, and three new radiocarbon dates have been obtained.

Level 1 is protohistoric in age (S-2805) and yielded a Plains side-notched point along with artifacts of metal and glass. Level 2 produced Plains side-notched points and a date on bone (S-2806). Levels 3 and 4, with Plains side-notched points, were dated on charcoal (S-2807, S-2808). Level 5, with Plains side-notched points, was dated on bone (S-2809).

Level 6 contained both Plains and Prairie side-notched points, and a date was obtained on bone (S-2810). The same point types occurred in Level 6a (previously numbered Level 7) with a date on charcoal (S-2811). In Level 7 (previously numbered Level 8) there was

pottery but no points, and a date was obtained on bone (S-2812). Similarly, Level 8 (previously numbered Level 9) yielded pottery but no points, along with a date on bone (S-2813). Level 9 has not been dated. Level 10, with a date on bone (S-2814), yielded only a fragment of a point belonging to the side-notched series.

A date on bone from Area A (S-2815), previously assigned to Level 11, is now known to belong to Level 12. Avonlea points were recovered from Level 12, and a date on a bison atlas from Area D (Beta-70705) can be averaged with S-2815. Level 13, with Besant points, has been dated with a bison femur from Area D (S-2885).

Deeper levels of the site lack diagnostic artifacts, but three levels have been dated. Level 14 has a date on bone from Area A (S-2816) that was originally assigned to Level 12. This is an important reassignment, because S-2816 was previously thought to belong to the Avonlea complex and was the oldest Avonlea date on the northern Plains (Morlan 1988, 1993).

In the deeper portions of the site, only some of the numbered levels have yielded evidence of human occupation. Level 19 has been dated with a bison scapula (Beta-70706), and Level 25 with a bison sacrum (Beta-70707). Neither of these levels produced diagnostic artifacts. The last date in the list (S-2368) was on a sample from a backhoe trench, and its position in the sequence is unknown. Sources: Morlan, 1988, 1993, 1997; Walker 1988b; Walker, et al., 1986, 1987.

S-2805, bison bone collagen, *Bison* sp. radius and femur (230 g, id. by E.G. Walker), from Level 1, Area A, units 462s/58e and 461s/57e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: < 100
 $\delta^{13}\text{C} = -20 \text{ e}$

Significance: Protohistoric, Plains

Associated taxa (Level 1): *Sorex cinereus*, *Sorex hoyi*, *Chiroptera*, *Lepus americanus*, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Peromyscus* sp., *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Ondatra zibethicus*, *Lagurus curtatus*, *Microtus ochrogaster*, *Microtus pennsylvanicus*, *Zapus* sp., *Vulpes vulpes*, *Odocoileus* sp., *Cervus elaphus*, *Antilocapra americana*, *Bison* sp.; Aves, *Haliaeetus leucocephalus*; Reptilia, *Thamnophis* sp.; Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, *Acipenser fulvescens*, *Esox lucius*, Cyprinidae, Catostomidae, *Lota lota*, Gasterosteidae, Percidae; identified by R.E. Morlan (mammals, bird, herps), L. Still (fishes).

S-2806, bison bone collagen, *Bison* sp. radius (276 g, id. by E.G. Walker), from Level 2, Area A, unit 461s/54e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 460 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 380 ± 70

Note: The date is anomalous in relation to underlying dates.

Significance: Woodland, Plains, anomalous, old

Associated taxa (Level 2): *Sorex cinereus*, *Lepus townsendii*, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Perognathus fasciatus*, *Onychomys leucogaster*, *Ondatra zibethicus*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis lupus*, *Antilocapra americana*, *Bison* sp.; Aves, *Buteo regalis*, *Contopus* sp., *Riparia riparia*, *Turdus migratorius*, *Lanius ludovicianus*, Parulinae, *Zonotrichia albicollis* (cf.); Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.;

Pisces, Cyprinidae, *Lota lota*, Gasterosteidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2807, charcoal (43.5 g), from Level 3, Area A, unit 462s/54e, Feature A3-2, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 200 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Plains

Associated taxa (Level 3): *Sorex cinereus*, *Lepus americanus*, *Lepus townsendii*, *Spermophilus* sp., *Peromyscus* sp., *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Microtus ochrogaster*, *Microtus pennsylvanicus*, *Zapus* sp., *Erethizon dorsatum*, *Canis lupus*, *Bison* sp.; Aves, cf. *Actitis macularia*, *Eremophila alpestris*, *Corvus brachyrhynchos*, *Turdus migratorius*, *Bombycilla cedrorum*, Parulinae, *Calamospiza melanocorys*, *Melospiza* sp.; Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Reptilia, *Thamnophis* sp.; Pisces, Cyprinidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2808, charcoal (36.7 g), from Level 4, Area A, unit 462s/54e, Feature A4-1, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 290 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Plains

Associated taxa (Level 4): *Sorex cinereus*, *Sorex arcticus*, *Chiroptera*, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Microtus pennsylvanicus*, *Zapus* sp., Canidae, *Bison* sp.; Aves; Amphibia, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Reptilia, *Thamnophis* sp.; Pisces, cf. *Acipenser fulvescens*, Cyprinidae, Gasterosteidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2809, bison bone collagen, *Bison* sp. innominate (334 g, id. by E.G. Walker), from Level 5, Area A, unit 462s/55e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 590 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 510 ± 70

Significance: Woodland, Plains

Associated taxa (Level 5): *Sorex cinereus*, *Lepus americanus*, *Spermophilus richardsonii*, *Castor canadensis*, *Clethrionomys gapperi* (cf.), *Peromyscus* sp., *Onychomys leucogaster*, *Microtus ochrogaster*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Vulpes* sp., Mustelidae, *Bison* sp.; Aves, Scolopacidae, *Eremophila alpestris*, *Riparia riparia*, Troglodytidae, *Catharus minimus* (cf.), *Turdus migratorius*, *Anthus* sp., *Dendroica* sp., *Passerculus sandwichensis*, *Junco hyemalis*, cf. *Carduelis* sp.; Reptilia, *Thamnophis* sp.; Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, *Esox lucius*, Cyprinidae, Catostomidae, Gasterosteidae, Percidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2810, bison bone collagen, *Bison* sp. (197 g, id. by E.G. Walker), from Level 6, Area A, units 461s/56e, 461s/55e, 462s/54e, 461s/53e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 870 ± 135
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 790 ± 135

Significance: Woodland, Plains, Prairie

Associated taxa (Level 6): *Lepus americanus*, *Lepus townsendii*, *Spermophilus* sp., *Castor canadensis*, *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Microtus pennsylvanicus*, *Zapus* sp., *Canis lupus*, *Vulpes* sp., *Antilocapra americana*, *Bison* sp.; Aves, *Coturnicops* or *Porzana*, *Contopus* or *Sayornis*, *Corvus brachyrhynchos*, *Sialia* sp., Emberizidae, Parulinae; Reptilia, *Thamnophis* sp.; Amphibia, *Bufo* sp., *Pseudacris triseriata*, *Rana* spp.; Pisces, *Esox lucius*, Catostomidae, *Lota lota*; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2811, charcoal (19.4 g), from Level 6a, Area A, unit 461s/55e, Feature A6a-1, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 855 ± 70
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: Originally assigned to Level 7 but re-numbered after stratigraphic study.

Significance: Woodland, Plains, Prairie

Associated taxa (Level 6a): *Lepus americanus*, *Thomomys talpoides*, *Castor canadensis*, *Canis* sp., *Mephitis mephitis*, *Bison* sp.; identified by R.E. Morlan.

S-2812, bison bone collagen, *Bison* sp. (242 g, id. by E.G. Walker), from Level 7, Area A, units 462s/54e, 462s/53e, 461s/53e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 960 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 880 ± 70

Note: Originally assigned to Level 8 but renumbered after stratigraphic study.

Significance: Woodland, Plains

Associated taxa (Level 7): *Sorex cinereus*, *Lepus* sp., *Spermophilus richardsonii*, *Thomomys talpoides*, *Castor canadensis*, *Peromyscus* sp., *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Microtus ochrogaster*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Mephitis mephitis*, Cervidae, *Bison* sp.; Aves; Reptilia, *Thamnophis* sp.; Amphibia, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, *Esox lucius*, Cyprinidae, Catostomidae, Percidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2813, bison bone collagen, *Bison* sp. (192 g, id. by E.G. Walker), from Level 8, Area A, units 462s/58e, 461s/54e, 462s/53e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 1025 ± 135
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 945 ± 135

Note: Originally assigned to Level 9 but renumbered after stratigraphic study.

Significance: Woodland, Plains

Associated taxa (Level 8): *Sorex cinereus*, *Lepus americanus*, *Spermophilus* sp., *Clethrionomys gapperi* (cf.), *Microtus pennsylvanicus*, *Canis* sp., *Antilocapra americana*, *Bison* sp.; Aves; Amphibia, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, Cyprinidae, Percidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2814, bison bone collagen, *Bison* sp. (242 g, id. by E.G. Walker), from Level 10, Area A, unit 462s/54e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 1235 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1155 ± 75

Significance: Woodland, Plains, Prairie

Associated taxa (Level 10): *Sorex* sp., *Eptesicus fuscus*, *Lepus americanus*, *Lepus townsendii*, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Thomomys talpoides*, *Clethrionomys gapperi* (cf.), *Ondatra zibethicus*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Bison* sp.; Aves, *Empidonax* sp., *Riparia riparia*, *Corvus brachyrhynchos*, cf. Troglodytidae, *Catharus ustulatus* (cf.), *Turdus migratorius*, *Bombycilla cedrorum*, cf. *Dendroica* sp., *Zonotrichia albicollis* (cf.); Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, Cyprinidae, Catostomidae, Gasterosteidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

Beta-70705 (CMC-1485), bison bone collagen, *Bison* sp. atlas (188 g, id. by R.E. Morlan), from Level 12, Area D, unit 449s/72e, paleosol in alluvium, submitted by R.E. Morlan.

Normalized age: 1260 ± 60
 $\delta^{13}\text{C} = -20.5$
Uncorrected age: 1190 ± 60

Significance: Woodland, Avonlea

S-2815, bison bone collagen, *Bison* sp. (229 g, id. by E.G. Walker), from Level 12, Area A, units 461s/58e and 461s/57e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 1315 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1235 ± 75

Note: Originally assigned to Level 11 but renumbered after stratigraphic study.

Significance: Woodland, Avonlea

Suggested age (Level 12): 1280 ± 50 BP, average of Beta-70705 and S-2815

Associated taxa (Level 12): *Sorex cinereus*, Leporidae, *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Glaucomys* sp., *Thomomys talpoides*, *Peromyscus* sp., *Clethrionomys gapperi* (cf.), *Ondatra zibethicus*, *Microtus ochrogaster*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Mustela* sp., *Felis canadensis*, *Bison* sp.; Aves; Amphibia, *Ambystoma tigrinum*, *Bufo* sp., *Pseudacris triseriata*, *Rana* spp.; Pisces, Catostomidae, Percidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2885 (CMC-1370), bison bone collagen, *Bison* sp. femur (id. by E.G. Walker), from Level 13, Area D, unit 451s/72e, paleosol in alluvium, collected 1986, submitted by R.E. Morlan.

Normalized age: 1615 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1535 ± 75

Note: Questioned date in Morlan (1993), but clearly satisfactory after reassignment of S-2816 to cultural level 14.

Significance: Woodland, Besant

Associated taxa (Level 13): *Sorex cinereus*, Leporidae, *Marmota monax*, *Spermophilus richardsonii*, *Thomomys talpoides*, *Onychomys leucogaster*, *Clethrionomys gapperi* (cf.), *Ondatra zibethicus*, *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Mephitis mephitis*, *Felis canadensis*, *Bison* sp.; Aves; Amphibia, *Ambystoma tigrinum*, *Bufo hemiophrys*, *Pseudacris triseriata*, *Rana* spp.; Pisces, Cyprinidae, Catostomidae; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

S-2816, bison bone collagen, *Bison* sp. metatarsal (171 g, id. by E.G. Walker), from Level 14, Area A, unit 461s/53e, paleosol in alluvium, submitted by E.G. Walker.

Normalized age: 1870 ± 80
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1790 ± 75

Note: Originally assigned to Level 12 but renumbered after stratigraphic study.

Significance: cultural affiliation unknown

Associated taxa (Level 14): *Spermophilus richardsonii*, *Spermophilus tridecemlineatus*, *Castor canadensis*, *Onychomys leucogaster*, *Microtus* sp., *Zapus* sp., *Mephitis mephitis*, *Bison* sp.; Aves; Amphibia, *Ambystoma tigrinum*, *Bufo* sp.; Pisces, Cypriniformes; identified by R.E. Morlan (mammals, herps), D. Balkwill (birds), L. Still (fishes).

Beta-70706 (CMC-1486), bison bone collagen, *Bison* sp. scapula (299 g, id. by R.E. Morlan), from Level 19, Area A, unit 461s/53e, paleosol in alluvium, submitted by R.E. Morlan.

Normalized age: 2250 ± 60
 $\delta^{13}\text{C} = -19.4$
Uncorrected age: 2160 ± 60

Significance: cultural affiliation unknown

Associated taxa (Level 19): Sciuridae, *Bison* sp.; identified by R.E. Morlan

Beta-70707 (CMC-1487), bison bone collagen, *Bison* sp. sacrum (195 g, id. by R.E. Morlan), from Level 25, Area A, unit 461s/53e, paleosol in alluvium, submitted by R.E. Morlan.

Normalized age: 2400 ± 50
 $\delta^{13}\text{C} = -19.4$
Uncorrected age: 2310 ± 50

Significance: cultural affiliation unknown

Associated taxa: *Canis* sp., *Antilocapra americana*, *Bison* sp.; identified by R.E. Morlan.

S-2368, bison bone collagen, *Bison* sp. (158 g, id. by E.G. Walker), from cross-bedded sand and clay in profile of a backhoe trench, the relationship to the cultural sequence unknown, submitted by E.G. Walker.

Normalized age: 2125 ± 140
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2045 ± 140

Significance: cultural affiliation unknown

FbNp-9, Meewasin Creek: just north of Saskatoon, on the left bank of the South Saskatchewan River, within Wanuskewin Heritage Park, Saskatchewan. At least two components, believed to be bison kills, were detected in test pits, but diagnostic artifacts were not recovered. A date on Level 1 is considered anomalous since no trade goods were found, and a Level 2 date may reflect the presence of a

Besant point that was recovered from the site surface. Sources: Morlan, 1993; Walker, 1988b, p.c. 1999.

S-2367, bison bone collagen, *Bison* sp. (285 g), from Level 1, submitted by E.G. Walker.

Normalized age: < 100
 $\delta^{13}\text{C} = -20$ e

Significance: cultural affiliation unknown

S-2366, bison bone collagen, *Bison* sp. (184 g), from Level 2, submitted by E.G. Walker.

Normalized age: 2210 ± 125
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2130 ± 125

Significance: cultural affiliation unknown

FbNp-10, Red Tail: just north of Saskatoon, on the left bank of the South Saskatchewan River, within Wanuskewin Heritage Park, Saskatchewan. A 50 m² excavation block penetrated 15 occupation levels, and seven dates have been obtained on samples of bison bone from Hanna and McKean components analyzed by Ramsay (1993). Avonlea, Besant and Pelican Lake materials occur in higher levels, but specific cultural assignments have not been completed.

Level 11 is a Hanna component with one date (S-3372). Two dates on subdivisions of Level 12 (S-3373, S-3008) can be averaged for the age of a second Hanna component. Level 13 is stratigraphically complex and has been subdivided into four provisional sublevels that contain the McKean cultural record at this site. Sublevel 13b has two dates (S-3374, S-3375) that can be averaged. Sublevel 13d provided a single, much older date (S-3009) that cannot be averaged with the dates from Sublevel 13b. At the bottom of the excavation is Level 15 with no diagnostic artifacts but one radiocarbon date (S-3007). Sources: Morlan, 1993; Ramsay, 1993.

S-3372, bison bone collagen, *Bison* sp. femur (id. by C. Ramsay), from Level 11, unit 124n/108e, SW quad, Ahkb22, very dark fine sandy loam, 110-112 cm depth, submitted by C. Ramsay.

Normalized age: 3580 ± 80
 $\delta^{13}\text{C} = -18.8$
Uncorrected age: 3480 ± 80

Significance: Archaic, Hanna

Associated taxa (Level 11): *Tamias minimus*?, *Spermophilus richardsonii*?, *Spermophilus tridecemlineatus*?, *Canis* sp., *Mephitis mephitis*, *Odocoileus* sp., *Bison* sp.; Amphibia; identified by C. Ramsay.

S-3373, bison bone collagen, *Bison* sp. scapula, vertebra, rib, and long bone fragments, from Level 12a, unit 121n/110e, Ahkb24, very dark grey sandy loam, 114-116 cm depth, submitted by C. Ramsay.

Normalized age: 3570 ± 80
 $\delta^{13}\text{C} = -18.8$
Uncorrected age: 3470 ± 80

Significance: Archaic, Hanna

S-3008, bone collagen, from Level 12b, unit 121n/111e, SW quad, Ahkb24, very dark grey sandy loam, 114-116 cm depth, submitted by C. Ramsay.

Normalized age: 3740 ± 80
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 3660 ± 75

Significance: Archaic, Hanna

Suggested age (Level 12): 3650 ± 60 BP, average of S-3008 and S-3373

Associated taxa (Level 12): *Lepus townsendii*, *Tamias minimus*?, *Spermophilus richardsonii*?, *Reithrodontomys megalotis*, *Peromyscus* sp., *Microtus* sp., *Canis* sp., *Vulpes vulpes*?, *Bison* sp.; Amphibia, Anura; Pisces (unid.); Mollusca; identified by C. Ramsay.

S-3374, bison bone collagen, *Bison* sp., from Level 13b, unit 123n/113e, NE quad, Ahkb26, grey loamy sand, 118-123 cm depth, submitted by C. Ramsay.

Normalized age: 3965 ± 70
 $\delta^{13}\text{C} = -18.3$

Uncorrected age: 3860 ± 70

Significance: Archaic, McKean

S-3375, bison bone collagen, *Bison* sp. radius, from Level 13b, unit 123n/114e, Ahkb26, grey loamy sand, 118-123 cm depth, submitted by C. Ramsay.

Normalized age: 3980 ± 70
 $\delta^{13}\text{C} = -18.9$

Uncorrected age: 3880 ± 70

Significance: Archaic, McKean

Suggested age (Level 13b): 3975 ± 50 BP, average of S-3374 and S-3375

Associated taxa (Level 13b): *Lepus americanus*, *Lepus townsendii*, *Thomomys talpoides*, *Clethrionomys gapperi*, *Canis* sp., *Mustela vison*, *Bison* sp.; Amphibia; identified by C. Ramsay.

S-3009, bison bone collagen, *Bison* sp. humerus, from Level 13d, unit 121n/111e, NW quad, Ahkb28, greyish brown sand, 127-134 cm depth, submitted by C. Ramsay.

Normalized age: 4360 ± 80
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 4280 ± 80

Significance: Archaic, McKean

Associated taxa (Level 13d): *Peromyscus* sp., *Clethrionomys gapperi*, *Microtus ochrogaster*, *Bison* sp.; Aves, *Anas platyrhynchos*, *Corvus* sp.; identified by C. Ramsay.

S-3007, bison bone collagen, *Bison* sp., from Level 15b, unit 122n/110e, grey loamy sand, 215-219 cm depth, submitted by C. Ramsay.

Normalized age: 5090 ± 90
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 5010 ± 90

Significance: cultural affiliation unknown

Associated taxa (Level 15b): *Canis* sp., *Bison* sp.; Pisces, *Ictalurus punctatus*; identified by C. Ramsay (mammals), R.E. Morlan (fish).

FbNp-16, Newo Asiniak: just north of Saskatoon, 475 m asl, in the Opimihaw Creek valley, Wanuskewin Heritage Park, Saskatchewan. Two main areas are distinguished by the excavator: a kill area in a former stream channel at the base of a 25 m embankment, and a processing area on an abandoned point bar.

The kill area deposits were 40 cm thick, but there appeared to be no basis for subdividing the recovered materials into multiple components. Of four projectile points recovered, one is a well made Plains side-notched, and the other three are poorly made points that might be typed as Prairie side-notched. Adult bison mandibles representing individuals in a 5.5-9.5 yr age group suggest a fall season kill, whereas a fetal bison bone indicates a late winter or spring kill. This evidence, along with the great spread between the two radiocarbon dates, suggests that two or more components are contained in a compressed stratigraphic sequence. Therefore neither date is clearly associated with the recovered projectile points. S-2763 is from the uppermost part of the bone bed, whereas S-2528 is from a depth of 25 cm within the bone bed.

Excavations in the processing area at Newo Asiniak revealed a deeper, more complex sequence of 16 stratigraphic layers containing seven cultural levels. This deposit comprises a series of fining-upward alluvial cycles that record the repeated meandering of Opimihaw Creek. Evidence of human occupation is preserved whenever the site is abandoned by the creek long enough to permit the development of a paleosol on the point bar surface. Seven radiocarbon dates were obtained.

Level 1 yielded eight Prairie side-notched points and a date on bone (S-2529). Level 2 produced six Avonlea points and a dated bison humerus (S-2533; misprinted as S-2353 in Kelly, 1986 and Walker, et al. 1987, and as S-2335 in Walker 1988b: Table 2). Level 3 points are predominantly Besant (seven examples), but one Pelican Lake point was also found (S-2530). Level 4 yielded a projectile point that resembles points from the Un-named complex at the Sjovold site, the latter now included in the Besant complex (Dyck and Morlan 1995). The Level 4 date (S-2764) is one of four in a discordant sequence.

Levels 5-7 produced cultural materials, but no diagnostic artifacts were found. Level 5 yielded a date (S-2765) that is younger than the Level 4 date but has a 400 year overlap at 2-sigma. Level 6 produced a date (S-2532) substantially older than Level 7 (S-2766).

Several of these dates are problematical. For example, the date on Level 2 (S-2533) is later than most ages for the Avonlea complex in this area (Morlan 1988), and Kelly (1986) suggests that the component represents a transition between Avonlea and Prairie side-notched assemblages. This interpretation is supported by the associated ceramic types (Kelly 1986), but it is possible that Levels 1 and 2 could not be adequately separated during excavation, because there is no defined body of sediment between them.

At least two dates from Levels 4-7 are inconsistent with the stratigraphic sequence. Kelly (1986) suggests that the dates on Levels 6 and 7 would be appropriate for the Oxbow complex. While this may be true, the most parsimonious explanation for the out-of-sequence dates is redeposition of materials from older contexts, perhaps from up-valley. This interpretation identifies S-2764 on Level 4 and S-2532 on Level 6 as probably containing redeposited bone fragments that have rendered the dates too old. Sources: Amundsen and Kelly, 1987; Dyck and Morlan, 1995; Kelly, 1986; Morlan, 1988, 1993.

S-2763, bone collagen, from uppermost part of 40 cm-thick bone bed in kill area, submitted by E.G. Walker.

Normalized age: 265 ± 190
 $\delta^{13}\text{C} = -20$ e

Uncorrected age: 185 ± 190

Significance: cultural affiliation unknown

S-2528, bone collagen, from from 25 cm level in 40 cm-thick bone bed in kill area, submitted by E.G. Walker.

Normalized age: 1620 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1540 ± 70

Significance: cultural affiliation unknown

Associated taxa (entire kill area): *Lepus* sp., *Spermophilus richardsonii*, *Canis* sp., *Vulpes* sp., *Mustela* sp., *Mephitis mephitis*, *Antilocapra americana*, *Bison* sp.; Pisces (unidentified); identified by D. Kelly.

S-2529, bone collagen, from Level 1, processing area, base of modern soil, dark brown loam, 0-10 cm depth, submitted by E.G. Walker.

Normalized age: 830 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 750 ± 70

Significance: Woodland, Prairie

Associated taxa (Level 1): *Spermophilus* sp., *Microtus pennsylvanicus*, *Zapus* sp., *Canis* sp., *Bison* sp.; identified by D. Kelly (large mammals), R.E. Morlan (small mammals).

S-2533, bone collagen, from Level 2, processing area, dark brown silty loam, 10-18 cm depth, submitted by E.G. Walker.

Normalized age: 995 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 915 ± 70

Significance: Woodland, Avonlea

Associated taxa (Level 2): *Spermophilus richardsonii*, *Microtus pennsylvanicus*, *Canis* sp., *Antilocapra americana*, *Bison* sp.; identified by D. Kelly (large mammals), R.E. Morlan (small mammals).

S-2530, bone collagen, from Level 3, processing area, brown silt, moderate to low organic content, 25-30 cm depth, submitted by E.G. Walker.

Normalized age: 2315 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 2235 ± 70

Significance: Woodland, Besant

Associated taxa (Level 3): *Spermophilus* sp., *Onychomys leucogaster*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Zapus* sp., *Bison* sp.; Aves, Passeriformes; Amphibia, *Pseudacris triseriata*; identified by D. Kelly (large mammals), R.E. Morlan (small vertebrates).

S-2764, bone collagen, from Level 4, processing area, light brown silty loam, 40-45 cm depth, submitted by E.G. Walker.

Normalized age: 3105 ± 250
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 3025 ± 250

Significance: Woodland, Besant, anomalous, old

Associated taxa (Level 4): *Canis* sp., *Bison* sp.; identified by D. Kelly.

S-2765, bone collagen, from Level 5, processing area, silty sand and gravel, 55-60 cm depth, submitted by E.G. Walker.

Normalized age: 2605 ± 210
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2525 ± 210

Significance: cultural affiliation unknown, anomalous, young

Associated taxa (Level 5): *Canis* sp., *Bison* sp.; Aves, Passeriformes; identified by D. Kelly (mammals), R.E. Morlan (birds).

S-2532, bone collagen, from Level 6, processing area, silty sand and gravel, 80-85 cm depth, submitted by E.G. Walker.

Normalized age: 4400 ± 85
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 4320 ± 85

Significance: cultural affiliation unknown, anomalous, old

Associated taxa (Level 6): *Spermophilus* sp., *Bison* sp.; Aves, egg; Amphibia, *Bufo* sp.; identified by D. Kelly (large mammals), R.E. Morlan (small vertebrates).

S-2766, bone collagen, from Level 7, processing area, well sorted sand and gravel, 95-100 cm depth, submitted by E.G. Walker.

Normalized age: 3535 ± 230
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 3455 ± 230

Significance: cultural affiliation unknown, anomalous, young

Associated taxa (Level 7): *Canis* sp., *Bison* sp.; identified by D. Kelly.

FbNp-17, Amisk: just north of Saskatoon, in the Opimihaw Creek valley, Wanuskewin Heritage Park, Saskatchewan. This site is located on a remnant spur extending into the creek valley from the west. Sedimentation was primarily colluvial, augmented by aeolian deposition. According to Amundson (1986; Amundson and Kelly 1987), a sequence of 12 stratigraphic layers contained seven cultural levels.

Level 1 yielded five Plains side-notched points, two Prairie side-notched points, a Plains triangular point, and two Avonlea side-notched points along with three radiocarbon dates. The youngest two are dates on bone (S-2531 and S-2770), and the oldest is on charcoal (S-2537). The variety of point styles and spread of dates indicate that two or more occupations may have been contained in a compressed sequence that could not be separated in excavation. Amundson (1986) suggests that if only two occupations are present they may represent a transition from Avonlea to Prairie side-notched followed by a Plains side-notched component. Without additional data, none of the radiocarbon dates can be definitely associated with a projectile point type.

Levels 2 and 3 lacked diagnostic artifacts, but both were dated on bone. The Level 2 date (S-2769) suggests that a substantial temporal hiatus occurs beneath Level 1. The Level 3 date is somewhat older (S-2767). Level 4 yielded six Oxbow points and a date on bone (S-2536). A single Oxbow point was found in Level 5 along with a date on bone (S-2535).

No diagnostic artifacts were found in Levels 6 and 7, but each was dated on bone. The Level 6 date (S-2534) has a younger mean than the dates on Levels 4 and 5, but all of them overlap at 2- sigma. The Level 7 date is much older (S-2768) and suggests that a second temporal hiatus occurs near the base of the site deposits.

Several years after Amundson's excavations had been back-filled, Abigail Burt opened a test pit farther upslope for the purpose of geomorphological studies. She reached a depth of 2.65 m where a bison radius was recovered, but a date on this bone (Beta-97670) cannot be directly related to the cultural record. Sources: Amundson,

1986; Amundson and Kelly, 1987; Morlan, 1993; E.G. Walker, p.c. 1998.

S-2531, bone collagen, from Level 1, upper portion, modern soil, sandy loam, 10-20 cm thick, submitted by E.G. Walker.

Normalized age: 560 ± 70
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 480 ± 65

Significance: Woodland, Plains, Prairie, Avonlea

S-2770, bone collagen, from Level 1, modern soil, sandy loam, 10-20 cm thick, submitted by E.G. Walker.

Normalized age: 715 ± 85
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 635 ± 85

Significance: Woodland, Plains, Prairie, Avonlea

S-2537, charcoal, from Level 1, lower portion, modern soil, sandy loam, 10-20 cm thick, submitted by E.G. Walker.

Normalized age: 905 ± 155
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Plains, Prairie, Avonlea

Associated taxa (Level 1): *Spermophilus* sp., *Canis* sp., *Antilocapra americana*, *Bison* sp.; Aves (unidentified); Pisces (unidentified); Mollusca; identified by L.J. Amundson.

S-2769, bone collagen, from Level 2, paleosol in sandy loam, 5 cm thick, varies 23-40 cm depth, submitted by E.G. Walker.

Normalized age: 3135 ± 75
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3055 ± 70

Significance: cultural affiliation unknown

Associated taxa (Level 2): *Canis* sp., *Bison* sp.; Mollusca; identified by L.J. Amundson.

S-2767, bone collagen, from Level 3, paleosol in sandy clay loam, 10-15 cm thick, varies 41-72 cm depth, submitted by E.G. Walker.

Normalized age: 3610 ± 110
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3530 ± 110

Significance: cultural affiliation unknown

Associated taxa (Level 3): *Spermophilus* sp., *Canis* sp., *Bison* sp.; Aves (unidentified); Mollusca; identified by L.J. Amundson.

S-2536, bone collagen, from Level 4, paleosol in loamy sand, 10-15 cm thick, varies 55-80 cm depth, submitted by E.G. Walker.

Normalized age: 4095 ± 195
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 4015 ± 195

Significance: Archaic, Oxbow

Associated taxa (Level 4): *Spermophilus* sp., *Castor canadensis*, *Canis* sp., *Bison* sp.; Mollusca; identified by L.J. Amundson.

S-2535, bone collagen, from Level 5, paleosol in loam, 10-15 cm thick, varies 70-95 cm depth, submitted by E.G. Walker.

Normalized age: 4200 ± 190
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 4120 ± 190

Significance: Archaic, Oxbow

Associated taxa (Level 5): *Spermophilus* sp., *Canis* sp., *Bison* sp.; Mollusca; identified by L.J. Amundson.

S-2534, bone collagen, from Level 6, thin paleosol in sandy loam, varies 80-134 cm depth, submitted by E.G. Walker.

Normalized age: 3975 ± 195
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3895 ± 195

Significance: cultural affiliation unknown, anomalous, young

Associated taxa (Level 6): *Bison* sp.; identified by L.J. Amundson.

S-2768, bone collagen, from Level 7, thin intermittent paleosol in sandy clay loam, varies 88-190 cm deep, submitted by E.G. Walker.

Normalized age: 5420 ± 120
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 5340 ± 120

Significance: cultural affiliation unknown

Associated taxa (Level 7): *Canis* sp., *Odocoileus* sp., *Bison* sp.; identified by L.J. Amundson.

Beta-97670 (CMC-1493), bison bone collagen, *Bison* sp. radius (255 g, id. by R.E. Morlan), from test pit, 2.65 m depth, upslope from main occupation area, submitted by E.G. Walker.

Normalized age: 4580 ± 60
 $\delta^{13}\text{C} = -19.7$
Uncorrected age: 4490 ± 60

Significance: geoarchaeology

FbNp-18, Opamihaw: just north of Saskatoon, on a large terrace along the right bank of Opimihaw Creek, Wanuskewin Heritage Park, Saskatchewan. A test excavation revealed at least nine occupation levels, and the lowest one yielded a radiocarbon date of unknown cultural affiliation. Sources: Morlan, 1993; Walker, 1988b.

S-2365, bison bone collagen, *Bison* sp. (246 g), from Level 9, the lowest of nine cultural levels, submitted by E.G. Walker.

Normalized age: 2455 ± 140
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2375 ± 140

Significance: cultural affiliation unknown

FbNp-25, Thundercloud: just north of Saskatoon, in the Opimihaw Creek valley, Wanuskewin Heritage Park, Saskatchewan. This site is located a point bar extending into the creek valley from the east. Sedimentation was primarily alluvial, augmented by a few colluvial episodes. The site was excavated 1993-1998 by the University of Saskatchewan field school, mainly under the direction of Lis Mack and Ernest G. Walker, and an analysis of the fauna and floral assemblages has been presented by Sean Webster (1999).

Ten occupation levels can be distinguished only locally, and there are seven nominal levels with considerable stratigraphic compression in the upper three. The only radiocarbon date is from Level 5 where the McKean complex is represented by Duncan, Hanna, and McKean lanceolate projectile points. Sources: Mack, 1999; Webster, 1999.

S-3645, bison bone collagen, *Bison* sp., from Level 5c, unit 20S/2E, the lowest of three sub-levels of Level 5, 33-47 cm depth, submitted by E.G. Walker.

Normalized age: 4145 ± 90
 $\delta^{13}\text{C} = -18.4$
Uncorrected age: 4040 ± 90

Significance: Archaic, McKean

Associated taxa (Level 5): *Sorex* sp., *Sylvilagus nuttallii* (cf.), *Lepus* sp., *Spermophilus* sp., *Thomomys talpoides*, *Peromyscus* sp., *Clethrionomys gapperi*, *Lagurus curtatus*, *Microtus pennsylvanicus*, *Canis* sp., *Vulpes* sp., *Felis* sp., *Taxidea taxus*, *Mephitis mephitis*, *Antilocapra americana*, *Bison* sp.; Aves, *Anas crecca*, Phasianidae, Icterinae, Parulinae; Amphibia, *Bufo* sp.; Mollusca; identified by S.M. Webster.

FbNp-VP, Saskatoon: sewage plant construction site now within the north limits of the city of Saskatoon, South Saskatchewan River, Saskatchewan. Christiansen's observations of the stratigraphy of this site indicate that the fossiliferous sand belongs to the Floral Formation dated at a nearby test hole to >34,000 BP (S-426; Rutherford et al., 1975). The inconsistent dates on mammoth bones and tusk fragments may reflect contamination by preservatives employed in the field. Sources: Christiansen, 1968; Lammers, 1968; Pohorecky, 1988; Pohorecky and Wilson, 1968; Rutherford et al., 1984.

S-482, mammoth bone collagen, *Mammuthus* sp. tusk, from Units 1 and 4, sand within tills of the Floral Formation, overlain by the late Wisconsinan Battleford Formation, collected 1968, submitted by Z.S. Pohorecky.

Normalized age: 12 080 ± 320
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 12 000 ± 320

Note: The date is anomalous in relation to glacial chronology.

Significance: palaeobiology, anomalous, young

S-498, mammoth bone collagen, *Mammuthus* sp. tusk, from Unit 5, sand within tills of the Floral Formation, overlain by the late Wisconsinan Battleford Formation, collected 1968, submitted by Z.S. Pohorecky.

Normalized age: 14 730 ± 360
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 14 650 ± 360

Significance: palaeobiology, anomalous, young

S-499, mammoth bone collagen, *Mammuthus* sp. skull fragments, from Unit 6, sand within tills of the Floral Formation, overlain by the late Wisconsinan Battleford Formation, collected 1968, submitted by Z.S. Pohorecky.

Normalized age: 20 280 ± 500
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 20 200 ± 500

Significance: palaeobiology

S-483, mammoth bone collagen, *Mammuthus* sp., from Units 1 and 4, sand within tills of the Floral Formation, overlain by the late Wisconsinan Battleford Formation, 2.4 m above S-482, collected 1968, submitted by Z.S. Pohorecky.

Normalized age: > 34 200
 $\delta^{13}\text{C} = -20$ e

Significance: palaeobiology

Associated taxa: *Mammuthus* sp., *Equus niobrarenensis* (cf.), Cervidae, *Bison* sp.; identified by G.E. Lammers.

FbNp-VP, Sutherland: near Saskatoon, South Saskatchewan River, Saskatchewan. Christiansen notes that the date and the field evidence indicate that the gravel was deposited by the glacier which deposited the Battleford Formation. The boulder layer is interpreted as a lag concentrate from erosion of the latter till formation. Sources: Rutherford et al., 1979.

S-685, bone collagen, from 4.6 m gravel bed below 0.6 m of boulders and overlying the Floral Formation, collected 1972, submitted by E.A. Christiansen.

Normalized age: 14 120 ± 465
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 14 040 ± 465

Note: The date is anomalous in relation to glacial chronology.

Significance: palaeobiology, anomalous, young

FbNr-1, Tschetter: Dunfermline Sand Hills, 506 m asl, about 16 km northwest of Saskatoon, Saskatchewan. This site is a single component bison pound that was tested by Dyck (1972b) in 1971 and excavated by a University of Saskatchewan field school from 1971 to 1976 (Prentice 1983; Linnamae 1988). Two radiocarbon dates resulted from this work.

In 1980, Linnamae returned to search for a campsite that might be associated with the pound, excavating eight square meters somewhat south of the bone bed and collecting a third radiocarbon sample. About 270 projectile points represent 55% of the lithic artifacts, and all are of the Prairie side-notched type. S-2225 was misprinted as S-1265 in Linnamae (1988: 115). Sources: Dyck, 1972b; Linnamae, 1988; Morlan, 1993; Prentice, 1983; Rutherford et al., 1975, 1981; Walker, 1979; Wilmeth, 1978.

S-1631 (CMC-1035), bison bone collagen, *Bison* sp., from cultural level 3, 40-50 cm below datum, collected 1976, submitted by U. Linnamae.

Normalized age: 1000 ± 50
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 920 ± 45

Significance: Woodland, Prairie

S-669 (CMC-548), bone collagen, from cultural layer, Test pit 1, Plan 6, 42.7 cm depth, collected 1971, submitted by R. Wilmeth.

Normalized age: 1085 ± 80
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1005 ± 75

Significance: Woodland, Prairie

S-2225 (CMC-1265), bone collagen, from cultural layer, campsite area, unit 105, 10-15 cm depth, collected 1981, submitted by U. Linnamae.

Normalized age: 1100 ± 100
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1020 ± 100

Significance: Woodland, Prairie

Suggested age: 1035 ± 40 BP, average of S-669, S-1631, and S-2225

Associated taxa: *Lepus* sp., *Spermophilus richardsonii*, Cricetidae, *Canis lupus*, *Canis familiaris*, *Taxidea taxus*, *Mephitis mephitis*, *Bison* sp.; Aves (unidentified); identified by E.G. Walker.

Normalized age: 4515 ± 150
 $\delta^{13}\text{C} = -18.3$
Uncorrected age: 4410 ± 150

Significance: Archaic, Oxbow

Associated taxa: *Lepus americanus*, *Canis latrans*, *Canis lupus*, *Canis familiaris*, *Vulpes vulpes*, *Vulpes velox*, *Martes pennanti*, *Taxidea taxus*, *Alces alces*, *Bison* sp.; identified by I. Dyck and R.E. Morlan.

FbNs-1, Harder: Dunfermline Sand Hills, about 23 km west and 10 km north of Saskatoon, Saskatchewan. This is a single component Oxbow site that yielded 25 complete and 48 broken Oxbow points and two radiocarbon dates as a result of Dyck's excavation. The radiocarbon samples were selected from excavation units that contained the greatest concentration of points as well as evidence of a dwelling floor and two hearth disposal areas (Dyck 1977: Figs. 13, 27). The bones were prepared by insoluble collagen extractions and yielded an average age of 3395 ± 80 BP. These dates played a key role in the perception that the Oxbow complex persisted longer on the northern Plains than elsewhere (Gibson 1981).

FbNs-2, Rousell: in the Dunfermline Sand Hills, Saskatchewan. Of five projectile points recovered from four test pits, four points belong to the Avonlea type, and the other has not been assigned a type name. Two Avonlea points were found in Test Pit 4 along with the bones comprising the radiocarbon sample. Sources: Dyck, 1972b; Morlan, 1993; Rutherford et al., 1975; Wilmeth, 1978.

A re-analysis of the Harder site fauna led to three more dates on bison bone. Two of them are significantly older than the age found by Dyck (average 4250 ± 75 BP), but the third can be averaged with Dyck's original dates (3400 ± 70 BP). Dyck (1970, 1977) presents good evidence that the Harder site contains a single Oxbow component for which only one of the averages should represent the correct age. A full discussion of this problem is presented elsewhere (Morlan 1994). S-490 was misprinted as 1560 ± 60 BP in the date list (Rutherford et al., 1973: 204). Sources: Dyck, 1970, 1972b, 1977; Gibson, 1981; Morlan, 1993, 1994; Rutherford et al., 1973, 1975; Wilmeth, 1978.

S-670 (CMC-549), bone collagen, from Test Pit 4, 18-27 cm depth, in a dark brown sandy horizon overlying massive yellow-tan sand, collected 1971, submitted by I. Dyck.

Normalized age: 1265 ± 75
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1185 ± 70

Significance: Woodland, Avonlea

Associated taxa: *Bison* sp.; identified by I. Dyck.

S-490, bone collagen, from cultural layer in paleosol in dune depression, unit 0n/0w, collected 1969, submitted by I. Dyck.

Normalized age: 3440 ± 120
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3360 ± 120

Significance: Archaic, Oxbow

S-668 (CMC-547), bison bone collagen, *Bison* sp., from cultural layer in paleosol in dune depression, unit 5n/0w, collected 1971, submitted by I. Dyck.

Normalized age: 3505 ± 105
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3425 ± 105

Significance: Archaic, Oxbow

S-3453 (CMC-1424), bison bone collagen, *Bison* sp. mandible and humerus (121 g), from cultural layer in paleosol in dune depression, unit 5s/42e, collected 1970, submitted by R.E. Morlan.

Normalized age: 3570 ± 140
 $\delta^{13}\text{C} = -15.5$
Uncorrected age: 3420 ± 140

Significance: Archaic, Oxbow

S-3452 (CMC-1423), bison bone collagen, *Bison* sp. humerus (125 g), from cultural layer in paleosol in dune depression, unit 50s/0w, collected 1970, submitted by R.E. Morlan.

Normalized age: 4335 ± 90
 $\delta^{13}\text{C} = -15.9$
Uncorrected age: 4190 ± 90

Significance: Archaic, Oxbow

S-3444 (CMC-1419), bison bone collagen, *Bison* sp. humerus and tibia (137 g), from cultural layer in paleosol in dune depression, unit 20s/0w, collected 1969, submitted by R.E. Morlan.

S-742, bone collagen, from nine test profiles yielding comminuted bone fragments, collected 1972, submitted by I. Dyck.

Normalized age: 3130 ± 80
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 3050 ± 80

Significance: Archaic, Oxbow

Associated taxa: *Bison* sp.; identified by I. Dyck.

FbNs-15, Goosen Pasture: Dunfermline sand hills, west of Saskatoon, Saskatchewan. The site has not been published, although a manuscript exists (Smith 1984), and a radiocarbon date is said to be associated with a ceramic Avonlea component (Smith and Walker 1988: 85; Morlan 1988: Table 2). The nature of the association and the material dated have not been reported. Sources: Morlan, 1988, 1993; Smith, 1984; Smith and Walker, 1988.

S-2690, material unknown, from unknown provenience, submitted by B.J. Smith.

Uncorrected age: 1095 ± 100
 $\delta^{13}\text{C} = ?$

Significance: Woodland, Avonlea

FdNf-2, St. Brioux: on a sandy kame on a lacustrine plain near St. Brioux, 518 m asl, north of Lenore Lake, Saskatchewan. Articulated human skeletal remains were found in an elongated face-down position, 1.83 m below surface. The individual was an adult male and was associated with red ochre but no diagnostic artifacts. A human femur supplied the radiocarbon date on an insoluble collagen extraction. Sources: Morlan, 1993; Rutherford et al., 1973; Walker, 1984a; Wilmeth, 1978.

S-520, human bone collagen, *Homo sapiens* femur, from burial, 1.83 m depth, collected 1965, submitted by W.O. Kupsch.

Normalized age: 5085 ± 80
 $\delta^{13}\text{C} = -19 \text{ e}$
 Uncorrected age: 4985 ± 75

Note: The normalized age is a minimum, because bison that had consumed C_4 plants were probably included in the human diet.

Significance: cultural affiliation unknown

FdNm-16, Lucky Strike: about 18 km east of Rosthern and 2.3 km east of the South Saskatchewan River, Saskatchewan. The site was destroyed by road construction after investigation by the Saskatchewan Research Council (Wilson 1984). Two areas of artifact concentration were separated by about 65 m of gently sloping terrain. The southern area was exposed by two sets of contiguous squares with a 3 m gap between them, and one Prairie side-notched point was found in the western set. The northern concentration had a main excavation block with smaller tests both east and west of it, and four Prairie side-notched points were recovered from the main block. Bone samples from each concentration were submitted for radiocarbon dating, and the results can be averaged. Sources: Morlan, 1993; Wilson, 1984.

S-2280, bone collagen, from north area, concentration area 1, submitted by J.S. Wilson.

Normalized age: 955 ± 95
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 875 ± 95

Significance: Woodland, Prairie

S-2281, bone collagen, from south area, concentration area 2, submitted by J.S. Wilson.

Normalized age: 1100 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1020 ± 90

Significance: Woodland, Prairie

Suggested age: 1030 ± 70 BP, average of S-2280 and S-2281

Associated taxa: *Lepus* sp., *Canis* sp., *Odocoileus* sp.?, *Bison* sp.; *Aves* (unidentified); identified by J.S. Wilson.

FdNm-86, East Village Access: on the right bank of the South Saskatchewan River, on the east access road into Batoche National Historic Park, Saskatchewan. This site was discovered during construction of an access road into East Village at Batoche National Historic Park. Although corner-notched projectile points reminiscent of Pelican Lake forms were found on the surface, four radiocarbon dates on bone excavated from undisturbed contexts are much older than any known Pelican Lake component. One of the dates (S-2740) is nearly a millennium younger than the other three, and Nieuwhof suggests that a weighted average of the older three dates is the best estimate for the age of this site. He also notes that this age corresponds to the time span of the Mummy Cave series. Sources: Nieuwhof, 1986.

S-2740, bone collagen, from cultural level, unit 21N925E1, 0-10 cm below datum, submitted by P. Nieuwhof.

Normalized age: 5740 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 5660 ± 90

Significance: cultural affiliation unknown, anomalous, young

S-2738, bone collagen, from cultural level, unit 21N924E1, 20-36 cm below datum, submitted by P. Nieuwhof.

Normalized age: 6480 ± 100
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 6400 ± 100

Significance: cultural affiliation unknown

S-2737, bone collagen, from cultural level, unit 21N923K1, 0-20 cm below datum, submitted by P. Nieuwhof.

Normalized age: 6635 ± 185
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 6555 ± 185

Significance: cultural affiliation unknown

S-2739, bone collagen, from cultural level, unit 21N924K1, 0-10 cm below datum, submitted by P. Nieuwhof.

Normalized age: 6825 ± 95
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 6745 ± 95

Significance: cultural affiliation unknown

Suggested age: 6660 ± 70 BP, average of S-2737, S-2738, and S-2739

FgNi-24, Harper Valley: on the southeast side of the South Saskatchewan River, 2.2 km north of the Muskoday Indian Reserve, Saskatchewan. According to D. Meyer, this is a late prehistoric bison kill site now largely disturbed by cultivation. A date on bone was obtained from a depth of 30 cm (S-2033), and charcoal from a depth of 50 cm yielded an older date (S-2031). A third date was obtained on bone from 70 cm depth (S-2032). Meyer notes that S-2031, misprinted as S-1995 in the date list (Rutherford et al., 1984: 287), is older than expected and might pertain to a Besant component at this site. Sources: Morlan, 1993; Rutherford et al., 1984.

S-2033 (CMC-1213), bone collagen, from hearth, unit 90s/95e, 30-35 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 1070 ± 120
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 990 ± 120

Significance: cultural affiliation unknown

Associated taxa: *Bison* sp.; identified by D. Meyer.

S-2031 (CMC-1212), charcoal, from upper level, unit 90n/22e, 50-55 cm BS, collected 1980, submitted by D. Meyer.

Normalized age: 1460 ± 100
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

Associated taxa: *Bison* sp.; identified by D. Meyer.

S-2032 (CMC-1214), bone collagen, from lower level, units 88n/22e, 89n/22e, and 90n/22e, 70-80 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 1990 ± 75

$\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1910 ± 70

Significance: cultural affiliation unknown

Associated taxa: *Bison* sp.; identified by D. Meyer.

FhNa-10, Bushfield West: on the east bank of the Saskatchewan River, 3.8 km south and 2.3 km west of Nipawin, within the reservoir of the Francois-Finlay dam, Saskatchewan. This site was assigned to the Pehonan complex, and more recently to the Keskatchewan complex, on the basis of its pottery. It also yielded Plains side-notched points and a few protohistoric artifacts (Meyer 1981a: 14-17; Meyer and Russell 1987: 17; Hanna 1983; Gibson 1991, 1998). McKeand (1995) presents a detailed analysis of the faunal remains recovered from Bushfield West, and Gibson (1998) provides a thorough study of the socio-economic implications of the rich ceramic assemblage. In addition to four dates on the occupation layer, D. Meyer and B. Schreiner obtained seven dates on paleosols buried beneath the cultural layer. Sources: Gibson, 1991, 1998; Hanna, 1983; McKeand, 1995; Meyer, 1981a, 1984; Meyer and Russell, 1987; Morlan, 1993.

S-2363, charcoal, from cultural layer, unit 201s49e, sw quad, level 3, Area 1, submitted by T.H. Gibson.

Normalized age: 355 ± 155
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Pehonan

AECV-151c, bone collagen (from 500 g), from cultural layer, unit 218s61e, 20 cm depth, submitted by T.H. Gibson.

Normalized age: 360 ± 120
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 280 ± 120

Significance: Woodland, Pehonan

S-2771, paleosol, from cultural layer, unit 114e256s, 25-30 cm depth, submitted by D. Meyer.

Normalized age: 475 ± 60
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Pehonan

S-2203, bone collagen, from cultural layer, unit 44w12s, exposed by front-end loader, submitted by D. Meyer.

Normalized age: 505 ± 70
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 415 ± 65

Significance: Woodland, Pehonan

Suggested age (Pehonan component): 465 ± 40 BP, average of AECV-151c, S-2203, S-2363, and S-2771

Associated taxa (Pehonan component): *Lepus americanus*, *Lepus townsendii*, *Tamias minimus*, *Spermophilus richardsonii*, *Tamiasciurus hudsonicus*, *Thomomys talpoides*, *Castor canadensis*, *Peromyscus maniculatus*, *Ondatra zibethicus*, *Microtus pennsylvanicus*, *Canis* sp., *Vulpes vulpes*, *Ursus* sp., *Martes americana*, *Taxidea taxus*, *Mephitis mephitis*, *Felis canadensis*, *Alces alces*, *Cervus elaphus*, *Bison* sp.; *Aves*, *Gavia immer*, *Cygnus* sp., *Anserini*, *Anas platyrhynchos*, *Accipitridae*, *Tetraoninae*, *Grus* sp., *Strigiformes*, *Passeriformes*; *Pisces*, *Acipenser fulvescens*, *Hiodon alosoides*, *Esox lucius*, *Platygobio*

gracilis, *Catostomus catostomus*, *Catostomus commersoni*, *Moxostoma anisurum*, *Moxostoma macrolepidotum*, *Lota lota*, *Stizostedion canadense*, *Stizostedion vitreum*; identified by P. McKeand.

S-2624, bone collagen, from paleosol, 1.33 m depth, submitted by D. Meyer.

Normalized age: 2170 ± 195
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2090 ± 195

Significance: geoarchaeology

S-2625, paleosol, from organic soil, 1.33 m depth, submitted by J. Campbell.

Normalized age: 2175 ± 205
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: geoarchaeology

S-2288, organic sediment, from organic-rich silt, 1.7 m depth, submitted by B.T. Schreiner.

Normalized age: 2860 ± 190
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: broken bones seen at 1.9 m depth.

Significance: geoarchaeology

S-2615, paleosol, from paleosol, 1.42 m depth (Stratum #11), submitted by D. Meyer.

Normalized age: 3325 ± 105
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: Of six paleosol dates from this site, only this one appears to be anomalous.

Significance: geoarchaeology, anomalous, old

S-2287, organic sediment, from organic-rich silt, 2.45 m depth, submitted by B.T. Schreiner.

Normalized age: 3350 ± 210
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: geoarchaeology

S-2512, paleosol, from paleosol, 2.75 m depth, Stratum #16, submitted by D. Meyer.

Normalized age: 4455 ± 80
 $\delta^{13}\text{C} = -25 \text{ e}$

Note: This is the deepest paleosol at the site; S-2511 dates the carbonate fraction of this sample.

Significance: geoarchaeology

S-2511, paleosol carbonate, from paleosol, 2.75 m depth, Stratum #16, submitted by D. Meyer.

Normalized age: 8120 ± 110
 $\delta^{13}\text{C} = -5 \text{ e}$

Uncorrected age: 7795 ± 105

Note: This is the deepest paleosol at the site; S-2512 dates the organic fraction of this sample.

Significance: geoarchaeology

FhNa-13, Bushfield East: just downstream from the Bushfield West site (FhNa-10), Nipawin project, Saskatchewan River, Saskatchewan. This site is assigned to the Pehonan complex on the basis of its pottery, and it also yielded Plains side-notched and Plains triangular projectile points (Meyer 1981a: 9-14). Unfortunately all of the side-notched points occurred in areas disturbed by bulldozing or cultivation, but two triangular points were closely associated with S-1331.

A Pehonan complex sherd yielded a thermoluminescence date of 380 ± 50 BP (Alpha-3033). S-2322, consisting of a paleosol sample marking the deepest of three levels, is thought to be too recent. Other sites in the area yield Middle Period remains at such depth (70-80 cm), and associated pollen suggests a parkland environment that should be older than 3500 BP (Finnigan, et al. 1983: 121). Sources: Meyer, 1981a, 1984, pers. comm. 1998; Meyer and Russell, 1987; Morlan, 1993; Rutherford et al., 1979.

S-2321, bison and beaver bone, *Bison* sp. and *Castor canadensis* (152 g), from unit 500N/524E, stratum 4, adjacent to a hearth feature, collected 1982, submitted by D. Meyer.

Normalized age: 255 ± 105
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 175 ± 105

Significance: Woodland, Pehonan

S-1331, bone collagen, from cultural layer, collected 1976, submitted by D. Meyer.

Normalized age: 415 ± 65
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 335 ± 60

Significance: Woodland, Pehonan

Associated taxa (Pehonan component): *Castor canadensis*, Cricetidae, *Ondatra zibethicus*, *Canis* sp., *Vulpes* sp., *Alces alces*, *Bison* sp.; Aves (unidentified); Pisces (unidentified); marine shells, *Dentalium* sp., *Trivea* sp.; identified by P. McKeand

S-2561, charcoal, from unit 500N/526E, southeast quad, level 8, 37-40 cm depth, stratum 4 hearth, collected 1984, submitted by D. Meyer.

Normalized age: 800 ± 90
 $\delta^{13}\text{C} = -25$ e

Significance: Woodland, Late Prehistoric

S-2322, paleosol, from paleosol, Level 3, 70-80 cm depth, submitted by D. Meyer.

Normalized age: 1580 ± 115
 $\delta^{13}\text{C} = -25$ e

Significance: geoarchaeology, anomalous, young

FhNa-35, Lloyd: on the north bank of the Saskatchewan River, 325 m asl, within the reservoir of the Francois-Finlay Dam, Saskatchewan. This site is assigned to the Pehonan complex on the basis of its pottery, and it yielded 22 projectile points, most of which are of the Plains side-notched type. Quigg (1983: 201-204) provides detailed observations concerning sample composition and fluctuations in the counting statistics for four dates. The oldest (S-2276) and youngest (S-2396) dates are based on composite samples with bones selected from separate excavation units, and Quigg recommends rejection of these in favour of two dates (S-2274 and S-2275) derived from a single bone each. Sources: Meyer and Russell, 1987; Morlan, 1993; Quigg, 1983.

S-2396, bison bone collagen, *Bison* sp. sacrum, ungulate bones (id. by J.M. Quigg), from cultural layer, units 3s2w, 5s2w, 8s3w, and 25n34e, submitted by D. Meyer.

Normalized age: 275 ± 75
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 195 ± 70

Significance: Woodland, Pehonan

S-2274, bison bone collagen, *Bison* sp. femur (350 g, id. by J.M. Quigg), from cultural layer, unit 7s7w, NE quad, 10-15 cm depth, submitted by D. Meyer.

Normalized age: 465 ± 155
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 385 ± 155

Significance: Woodland, Pehonan

S-2275, bison bone collagen, *Bison* sp. scapula (430 g, id. by J.M. Quigg), from cultural layer, unit 7s5w, SW quad, 23 cm depth, submitted by D. Meyer.

Normalized age: 615 ± 100
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 535 ± 100

Significance: Woodland, Pehonan

S-2276, bison and wapiti bone collagen, *Bison* sp. mandible, *Cervus elaphus* metatarsal and metacarpal (id. by J.M. Quigg), from cultural layer, units 5s1e and 6s0e, level 3, submitted by D. Meyer.

Normalized age: 690 ± 100
 $\delta^{13}\text{C} = -20$ e
 Uncorrected age: 610 ± 100

Significance: Woodland, Pehonan

Suggested age (Pehonan component): 570 ± 90 BP, average of S-2274 and S-2275

Associated taxa (Pehonan component): *Lepus americanus*, *Castor canadensis*, *Erethizon dorsatum*, *Canis* sp., *Vulpes vulpes*, *Ursus americanus*, *Mustela frenata*, *Felis canadensis?*, *Odocoileus* sp., *Alces alces*, *Cervus elaphus*, *Bison* sp.; Aves, *Ardea herodias*, *Cygnus* sp., *Anas* sp., Tetraonidae, Accipitridae; Pisces, *Hiodon alosoides*, *Esox lucius*, *Moxostoma* sp., *Perca flavescens*, *Stizostedion vitreum*; Mollusca; identified by J.M. Quigg.

FhNa-61, Gravel Pit: on the north bank of the Saskatchewan River, 346 m asl, about 2.8 km west and 5.2 km south of the town of Nipawin, within the reservoir of the Francois-Finlay Dam, Saskatchewan. This site is not deeply buried and occupies a land surface that has been "available for occupation for at least 7000 years" (Klimko 1985b: 43). Most of the recovered projectile points belong to the Avonlea type, but McKean and Pelican Lake points were also found in excavation.

Only 680 grams of bone were recovered from the entire site, and nearly half was sacrificed for two radiocarbon dates. S-2354 is a composite sample, because it combined bone from Excavation Block 5, where neither points nor potsherds were found, and Excavation Block 6, where an Avonlea point and a McKean point (but no pottery) were recovered. This sample is not clearly associated with any particular category of cultural material. S-2355, from Block 2, is associated with Avonlea points and a Laurel vessel. Sources: Brandzin-Low, 1997; Klimko, 1985b; Morlan, 1993.

S-2354, bone collagen, from cultural layer, Block 5 (unit 91-92n/133-134e, 124 g) and Block 6 (unit 94-99n/139-146e, 66 g), submitted by D. Meyer.

Normalized age: 425 ± 145
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 345 ± 145

Significance: cultural affiliation unknown

S-2355, bone collagen, from cultural layer, Block 2 (unit 93-100n/111-117e, 114 g), submitted by D. Meyer.

Normalized age: 895 ± 135
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 815 ± 135

Significance: Woodland, Laurel

FhNa-63, Root: on the north bank of the Saskatchewan River, about 6.5 km upstream from the Francois-Finley Dam, Saskatchewan. Two occupation layers were recognized, and the lower one, 70 cm below the surface, produced a radiocarbon date on a bison femur but no diagnostic artifacts. Sources: Finnigan, et al., 1983; Morlan, 1993.

S-2324, bison bone collagen, *Bison* sp. femur, from lower cultural layer, 70 cm depth, submitted by D. Meyer.

Normalized age: 1445 ± 110
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1365 ± 110

Significance: cultural affiliation unknown

FhNa-69, Eastcott Flat: on the south bank of the Saskatchewan River, 334 m asl, about 4.8 km south and 4.8 km west of the town of Nipawin, within the reservoir of the Francois-Finley Dam, Saskatchewan. Following an initial test, during which one radiocarbon sample (S-1330) was collected, this site was excavated more extensively in the hope of documenting a Pelican Lake occupation. Unfortunately, no diagnostic artifacts were found, and additional radiocarbon samples introduced new problems concerning the chronology of the deposit (see Klimko 1985b: 156-157).

Level 1 produced a date on bone (S-2497) that seemed surprisingly young for a layer buried 0.5 m below the surface. A bone sample from Level 2 was submitted as a check on S-1330 but produced a discordant result (S-2496). A sample from a paleosol directly overlying Level 2 failed to solve the problem (S-2560). Sources: Klimko, 1985b; Morlan, 1993; Rutherford et al., 1979.

S-2497, bone collagen, from cultural level 1, gold/brown sandy clay, 50 cm depth, submitted by D. Meyer.

Normalized age: 470 ± 85
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 390 ± 85

Significance: cultural affiliation unknown

Associated taxa (level 1): *Canis* sp., *Bison* sp.; Pisces, *Esox lucius*; identified by E.G. Walker.

S-2560, paleosol, from paleosol above cultural Level 2, submitted by D. Meyer.

Normalized age: 3075 ± 110
 $\delta^{13}\text{C} = -25$ e

Significance: cultural affiliation unknown, anomalous, old

S-2496, bone collagen, from cultural level 2, gold/brown sandy clay, submitted by D. Meyer.

Normalized age: 1325 ± 85
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 1245 ± 85

Significance: cultural affiliation unknown, anomalous, young

S-1330, bone collagen, from cultural level 2, gold/brown sandy clay, collected 1976, submitted by D. Meyer.

Normalized age: 2570 ± 90
 $\delta^{13}\text{C} = -20$ e
Uncorrected age: 2490 ± 90

Significance: cultural affiliation unknown

Associated taxa (level 2): *Lepus americanus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Cervus elaphus*, *Bison* sp.; identified by E.G. Walker.

FhNa-86, Crown: on a narrow terrace just west of the mouth of an unnamed creek, on the south bank of the Saskatchewan River, 10.5 km upstream from the Francois-Finley Dam, Saskatchewan. This is a multi-component site for which 17 radiocarbon dates have been obtained. The first radiocarbon sample (S-1583) was recovered from a test pit that yielded no diagnostic artifacts, but the other samples are attributed to Late Prehistoric, Hanna, and McKean occupations or to unidentified sparse scatters of cultural remains in the middle and at the bottom of the sequence (Quigg 1986: Table 2.1).

Quigg (1986: 20) notes that the "natural stratigraphy is quite complex, with 130 cm of cultural deposits in the east block..., while compressed and merging deposits thin to 65 cm towards the western end of the site." Unfortunately, it is very difficult to determine the precise associations between the radiocarbon dates and the projectile points, because the former are reported with depth measurements in centimetres below surface while depths for the latter are given in terms of numbered levels.

Eight radiocarbon samples were submitted through ASC/CMC, and level numbers are shown on the original forms. From these data and Quigg's detailed report, it is possible to infer the associations between dates and points in some detail. The eastern and western blocks are presented separately. Quigg (1986: 33) found it necessary to reject only two of these dates (S-2557 and S-2524).

In the western excavation block, Level 1 contained four late side-notched points and one Hanna point. Level 2 yielded one late side-notched point, bossed Laurel pottery and two dates (S-2527, S-2555) that can be averaged. Below an apparent temporal hiatus, Level 3 contained no diagnostic artifacts, but an ungulate bone fragment yielded a date (S-2556). Level 4, with one Hanna point and one McKean point, and Level 5, with one Hanna and three McKean points, were not dated. Level 6, with one Hanna and ten McKean points, produced a date on a bison radius (S-2524) that was rejected by Quigg. Level 7 lacked diagnostic artifacts but was dated on 40 ungulate bone fragments (S-2290) and a bison metacarpal (S-2525) with results that can be averaged. Level 8 yielded two McKean points but was not dated.

In the eastern excavation block, Level 1 yielded three late side-notched projectile points, and Level 2 produced one point fragment. Level 3 contained one Hanna and one Oxbow point, and a date on wapiti antler (S-2557) was rejected by Quigg. Level 4 yielded one Hanna and one Mummy Cave point, along with a date on 80 ungulate bone fragments (S-2292). Level 5 produced eight Hanna points, but no dates, and Level 6 yielded four Hanna points, one McKean point and two dates (S-2291, S-2554) on ungulate bone

fragments that can be averaged. Level 7 contained no diagnostic artifacts, but carbonaceous soil gave a date (S-2519). Level 8 yielded one McKean point and a date on bison bone (S-2526). Levels 9-12 lacked diagnostic artifacts. From Level 9, 45 canid bones were submitted for a date (S-2369), and from Level 10, 8 ungulate bone fragments yielded a date (S-2521). Level 11 was not dated, but three humerus fragments from Level 12 produced a date (S-2520). The lowest level lacked diagnostic artifacts but was dated on carbonaceous soil (S-2522).

It seems reasonable to reject the date on antler from Level 3 of the eastern block, but I can see no reason to reject S-2524 on Level 6 from the western block. The latter is consistent with the stratigraphy and seems reasonable in relation to dates on Levels 3 and 7. Sources: Brandzin-Low, 1997; Morlan, 1993; Quigg, 1986; Rutherford et al., 1981.

S-1583 (CMC-1010), bone collagen, from test pits A and B, composite sample, 143 fragments, collected 1976, submitted by D. Meyer.

Normalized age: 1150 ± 45
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 1070 ± 40

Significance: cultural affiliation unknown

FhNa-86, western block

S-2527, bison bone collagen, *Bison* sp. metacarpal (195 g, id. by J.M. Quigg), from component 1, western block, level 2, unit 9n13w, 10-20 cm depth, with bossed pottery, submitted by D. Meyer.

Normalized age: 725 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 645 ± 70

Significance: Woodland, Laurel

S-2555, ungulate bone collagen, *Artiodactyla* (120 g, id. by J.M. Quigg), from component 1, western block, level 2, unit 11n18w, 10-17 cm depth, with bossed pottery, submitted by D. Meyer.

Normalized age: 865 ± 155
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 785 ± 155

Significance: Woodland, Laurel

Suggested age (component 1, western block): 755 ± 70 BP, average of S-2527 and S-2555

Associated taxa (component 1): *Lepus americanus*, *Castor canadensis*, *Alces alces*, *Bison* sp.; Aves, Tetraonidae; Pisces (unid.); identified by J.M. Quigg.

S-2556, ungulate bone collagen, *Artiodactyla* (1 bone, 55 g, id. by J.M. Quigg), from component 2, western block, level 3, unit 11n14w, 23 cm depth, submitted by D. Meyer.

Normalized age: 3685 ± 120
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 3605 ± 120

Significance: cultural affiliation unknown

S-2524 (CMC-1343), bison bone collagen, *Bison* sp. radius (100 g, id. by J.M. Quigg), from component 4, western block, level 6, unit 11n16w, 52 cm depth, collected 1984, submitted by D. Meyer.

Normalized age: 3690 ± 105
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3610 ± 105

Significance: Archaic, McKean, anomalous, young

S-2290, ungulate bone collagen, *Artiodactyla* (40 fragments, 342 g, id. by J.M. Quigg), from component 4, western block, level 7, unit 10n71w, 61 cm depth, feature 7, submitted by D. Meyer.

Normalized age: 4260 ± 115
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 4180 ± 115

Significance: cultural affiliation unknown

S-2525 (CMC-1344), bison bone collagen, *Bison* sp. metacarpal (200 g, id. by J.M. Quigg), from component 4, western block, level 7, unit 13n17w, 65 cm depth, collected 1984, submitted by D. Meyer.

Normalized age: 4375 ± 85
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 4295 ± 85

Significance: cultural affiliation unknown

Suggested age (component 4, western block): 4335 ± 70 BP, average of S-2290 and S-2525

FhNa-86, eastern block

S-2557, wapiti bone collagen, *Cervus elaphus* antler (100 g, id. by J.M. Quigg), from component 2, eastern block, level 3, unit 6n8w, 23 cm depth, submitted by D. Meyer.

Normalized age: 2090 ± 100
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 2010 ± 100

Significance: Archaic, Hanna, anomalous, young

S-2292, ungulate bone collagen, *Artiodactyla* (80 fragments, 340 g, id. by J.M. Quigg), from component 2, eastern block, level 4, unit 5n3w, 35-40 cm depth, submitted by D. Meyer.

Normalized age: 3410 ± 110
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 3330 ± 110

Significance: Archaic, Hanna

S-2291, ungulate bone collagen, *Artiodactyla* (35 fragments, 376 g, id. by J.M. Quigg), from component 2, eastern block, level 6, unit 4n0w, 50-60 cm depth, submitted by D. Meyer.

Normalized age: 3505 ± 105
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 3425 ± 105

Significance: Archaic, Hanna

S-2554 (CMC-1342), ungulate bone collagen, *Artiodactyla* (13 fragments, 586 g, id. by J.M. Quigg), from component 2, eastern block, level 6, unit 4n1w, 50-60 cm depth, collected 1982, submitted by D. Meyer.

Normalized age: 3680 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
 Uncorrected age: 3600 ± 80

Significance: Archaic, Hanna

Suggested age (component 2, eastern block): 3615 ± 65 BP, average of S-2291 and S-2554

Associated taxa (component 2): *Lepus* sp., *Castor canadensis*, *Canis* sp., *Ursus* sp., *Odocoileus* sp., *Alces alces*, *Cervus elaphus*, *Bison* sp.; Aves (unid.); Pisces (unid.); Mollusca; identified by J.M. Quigg.

S-2519 (CMC-1325), soil and charcoal (1600 g), from component 3, eastern block, level 7, unit 3n2w, 62-67 cm depth, collected 1984, submitted by D. Meyer.

Normalized age: 3965 ± 95
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

Associated taxa (component 3): *Lepus* sp., *Canis* sp., *Bison* sp.; Pisces (unidentified); identified by J.M. Quigg.

S-2369, canid bone collagen, *Canis* sp. (45 fragments, 109 g, id. by J.M. Quigg), from component 4, eastern block, level 9, unit 6n3w, 100-105 cm depth, submitted by D. Meyer.

Normalized age: 3905 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3825 ± 90

Significance: cultural affiliation unknown

S-2521 (CMC-1327), ungulate bone collagen, Artiodactyla (8 fragments, 170 g), from component 4, eastern block, level 10, unit 6n2w, 108-110 depth, collected 1984, submitted by D. Meyer.

Normalized age: 3905 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3825 ± 75

Significance: cultural affiliation unknown

S-2526 (CMC-1345), bison bone collagen, *Bison* sp. radius (240 g, id. by J.M. Quigg), from component 4, eastern block, level 8, unit 4n4w, 90-95 cm depth, collected 1984, submitted by D. Meyer.

Normalized age: 4075 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 3995 ± 80

Significance: Archaic, McKean

S-2520 (CMC-1326), ungulate bone collagen, Artiodactyla 3 humerus fragments (180 g), from component 4, eastern block, level 12, unit 4n1w, 122 cm depth, collected 1984, submitted by D. Meyer.

Normalized age: 4410 ± 115
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 4330 ± 115

Significance: cultural affiliation unknown

Associated taxa (component 4): *Lepus* sp., *Castor canadensis*, *Canis* sp., *Mephitis mephitis*, *Alces alces*, *Cervus elaphus*, *Bison* sp.; Aves, *Tympanuchus phasianellus?*; Pisces, *Catostomus* sp.; identified by J.M. Quigg.

S-2522 (CMC-1328), soil and charcoal (3300 g), from component 5, cultural level 13, eastern block, collected 1984, submitted by D. Meyer.

Normalized age: 4775 ± 90
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

Associated taxa (component 5): *Lepus* sp., *Bison* sp.; Pisces (unidentified); identified by J.M. Quigg.

FhNa-112, Wallington Flat: on a well elevated terrace along the north bank of the Saskatchewan River about 10 km upstream from the Francois-Finley Dam, Saskatchewan. This site is assigned to the Avonlea complex on the basis of three Avonlea points as well as net-impressed pottery found in test pits (Finnigan, et al. 1983: 142-143; Meyer, et al. 1988: 37). A previously unpublished radiocarbon date (S-2458) is rejected by the investigators. Sources: Finnigan et al., 1983; Meyer et al., 1988; Morlan, 1993.

S-2458, bone collagen, from cultural layer, submitted by D. Meyer.

Normalized age: 2910 ± 90
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 2830 ± 90

Significance: Woodland, Avonlea, anomalous, old

FhNb-29, Inkster Island: near the mid-point of the north shore of Inkster Island, Saskatchewan River, Saskatchewan. This is a single component site representing the Pehonan complex. Meyer has obtained four radiocarbon dates and two thermoluminescence dates for this site, and he estimates the age of occupation at about 450 BP.

The TL dates are in good agreement with the estimate: AD 1510±95 (Dur88TL111-1AS, on a potsherd) and AD 1405 ± 120 (Dur88TL111-2AS, on baked hearth clay). Two radiocarbon dates on bone have measured ages that appear too young, but their older two-sigma limits overlap the estimated age after they are normalized. The two paleosol dates are anomalously old. Sources: Finnigan et al., 1983; Meyer and Russell, 1987; Meyer, p.c. 1998; Morlan, 1993.

S-2822, bone collagen (from 8 pieces, 218 g), from unit 77S/79E, northeast quadrant, level 3, collected 1985, submitted by D. Meyer.

Normalized age: 290 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 210 ± 70

Significance: Woodland, Pehonan

S-2735, bone collagen (from 233 g), from unit 86S/98E, southeast quadrant, level 3, collected 1985, submitted by D. Meyer.

Normalized age: 295 ± 65
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 215 ± 60

Significance: Woodland, Pehonan

S-2736, paleosol (1460 g), from unit 83S/96E, southwest quadrant, level 1, collected 1985, submitted by D. Meyer.

Normalized age: 1210 ± 60
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Pehonan, anomalous, old

S-2904, paleosol (440 g), from unit 79S/79E, southwest quadrant, immediately above the occupation level, collected 1985, submitted by D. Meyer.

Normalized age: 1230 ± 140
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Pehonan, anomalous, old

FhNc-5, Hamilton: on the north bank of Saskatchewan River, 1 km downstream from River House, Saskatchewan. Of two components in the western side of the site, the upper one, 10-15 cm below the surface, is historic. On the eastern side of the site, the uppermost component was found 10-15 cm below the surface but dipping to as much as 20-25 cm BS. A radiocarbon date on a bison mandible from this level appears to confirm the historic affiliation. Sources: Finnigan et al., 1983; Morlan, 1993.

S-2323, bison bone collagen, *Bison* sp., from uppermost cultural layer, submitted by D. Meyer.

Normalized age: 250 ± 105
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 170 ± 105

Significance: Historic

FhNc-32, Lewis: on the south bank of Saskatchewan River, 45 km downstream from the Forks of the Saskatchewan, opposite Thomson Island, Saskatchewan. A radiocarbon sample was comprised of bone fragments collected 24-55 cm below the surface from four test pits; no diagnostic artifacts were associated with the sample. Sources: Morlan, 1993; Rutherford et al., 1981.

S-1506 (CMC-981), deer and beaver bone collagen, *Odocoileus* sp., *Castor canadensis*, and unidentifiable fragments, from test pits ON/3E, ON/4E, 1S/4E, and 2S/3E, 24-55 cm depth, collected 1977, submitted by D. Meyer.

Normalized age: 1350 ± 75
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 1270 ± 70

Significance: cultural affiliation unknown

FhNc-80, Wandering Pelican: about 20 m from the upstream end on the north side of Thomson Island, Saskatchewan River, Saskatchewan. Of two components recognized in the cut bank and in a test pit, the lower one, about 1 m below the surface, produced a radiocarbon date on bone fragments; no diagnostic artifacts were found. Sources: Finnigan et al., 1983; Morlan, 1993.

S-2252, bone collagen, from cultural layer, 1 m depth, submitted by D. Meyer.

Normalized age: 835 ± 105
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 755 ± 105

Significance: cultural affiliation unknown

FhNc-81, Broken Axle: on the north bank of Saskatchewan River, about 1.6 km east of River House, Saskatchewan. Four poorly defined occupation levels were reconstructed from variations in artifact concentration per 5 cm level. The lowest and best separated component yielded a radiocarbon date on bone fragments; no diagnostic artifacts were associated. Sources: Finnigan et al., 1983; Morlan, 1993.

S-2325, bone collagen, from lowest and best cultural level, submitted by D. Meyer.

Normalized age: 4430 ± 135
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 4350 ± 135

Significance: cultural affiliation unknown

FhNg-25, Below Forks: on a valley bottom flood plain, 2.5 km below the confluence of the North Saskatchewan and South Saskatchewan Rivers, Saskatchewan. Three dates on the lowest level may signify an occupation affiliated with the Mummy Cave series, but no projectile points were found. Sources: Dyck, 1983; Morlan, 1993; Rutherford et al., 1984.

S-1994 (CMC-1205), charcoal, from east side of square 9S/2E, directly overlying the occupation layer, 175 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 5740 ± 100
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: cultural affiliation unknown

S-2034 (CMC-1215), bone collagen, from face of the cutbank, squares 11S/1E, 12S/2E, and 11S/3E, 176-183 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 4140 ± 270
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 4060 ± 270

Significance: cultural affiliation unknown, anomalous, young

S-2245 (CMC-1268), bone collagen, from adjacent units, 9S/2E, 10S/2E, and 11S/2E, 176-183 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 5925 ± 140
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 5845 ± 140

Significance: cultural affiliation unknown

Suggested age: 5775 ± 80, average of S-1994 and S-2245.

FhNj-15, Intake: on the north bank of the North Saskatchewan River about 9 km east of Prince Albert, Saskatchewan. Of two components, the upper one, 0-30 cm below surface, contains small side-notched points and pottery. Although originally considered to represent Besant (Meyer 1981b), the upper component is now regarded as a variant of the Laurel complex (D. Meyer, p.c. 1993). The lower component, 70-85 cm below surface, yielded a single point considered similar to some of the Gowen site points (Meyer 1981b: 115).

Two radiocarbon dates have been obtained on composite bone samples from the upper component. S-2180 consisted of burned bone that was weathered, and the sample may have contained rootlets. S-2185 was comprised of unburned bone that was weathered and fragile. Given the weathered condition, shallow burial environment, and composite nature of these samples, neither of them is clearly a reliable date. Sources: Meyer, 1981b; Morlan, 1993.

S-2180 (CMC-1243), bone collagen, from upper of two cultural layers, units 6S/4E, 7S/3E, 5S/5E, 7S/6E and 7S/4E, base of humus to 35 cm depth, collected 1980, submitted by D. Meyer.

Normalized age: 890 ± 145
 $\delta^{13}\text{C} = -20 \text{ e}$

Uncorrected age: 810 ± 145

Significance: Woodland, Laurel, anomalous, young

S-2185 (CMC-1250), bone collagen, from upper of two cultural layers, units 5S/17E, 5S/15E, 6S/15E and 7S/16E, collected 1981, submitted by D. Meyer.

Normalized age: 1285 ± 80
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 1205 ± 80

Significance: Woodland, Laurel

FjOd-2, Yellowsky: on the east shore of Turtle Lake, 660 m asl, at the base of a prominent peninsula known as Indian Point, Saskatchewan. This is a single component site attributed to the Avonlea complex on the basis of recovered pottery and a single fragmentary projectile point (Wilson-Meyer and Carlson 1985). Two radiocarbon samples yielded somewhat different ages. S-2299 was carbonaceous soil from a prominent hearth associated with the Avonlea point fragment. S-2300 was comprised of nearly all of the recovered faunal remains and is therefore a composite sample. The excavators reject S-2300, although the calibrated 2-sigma ranges of the two dates overlap at cal 644-510 BP. Sources: Morlan, 1993; Wilson-Meyer and Carlson, 1985, 1986.

S-2300 (CMC-1280), bone collagen, from cultural layer, including nearly all recovered bone, collected 1982, submitted by A.D. Wilson-Meyer.

Normalized age: 420 ± 140
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 340 ± 140

Significance: Woodland, Avonlea, anomalous, young

S-2299 (CMC-1281), carbonaceous soil, from small basin-shaped hearth, units 1W/1S and 2W/1S, collected 1982, submitted by A.D. Wilson-Meyer.

Normalized age: 720 ± 135
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Woodland, Avonlea

Associated taxa: *Canis* sp., *Bison* sp.; Pisces (unidentified); identified by E.G. Walker.

GiMv-23, Perfume Point: 1 km downstream from Trade Lake, across the Churchill River from Frog Portage, Saskatchewan. Pottery indicated a Clearwater Lake occupation (Meyer 1978a: 37), but due to the shallow burial environment, the date, on an insoluble bone collagen extraction, is not definitely associated with the pottery. Sources: Meyer, 1978a, 1978b; Morlan, 1993.

S-969, bone collagen, from a five-foot square, associated with Clearwater Lake Punctate type vessels, collected 1974, submitted by S.J. Smailes.

Normalized age: modern
 $\delta^{13}\text{C} = -20 \text{ e}$

Significance: Woodland, Clearwater Lake, anomalous, young

GiMw-18, Trade Lake: on the southwest corner of Trade Lake in the Churchill drainage, Saskatchewan. This is a single component Clearwater Lake occupation that yielded pottery and one triangular and two side-notched points. S-1215 is believed to have been contaminated by recent bone (Meyer 1978a: 37). S-1216 is an older date, but the provenience descriptions show that both dates are derived from composite bone samples from shallow burial environments (see Meyer 1983: 165); furthermore both are based on insoluble collagen extractions. Sources: Meyer, 1978a, 1978b, 1983; Meyer and Smailes, 1975; Morlan, 1993; Rutherford et al., 1979.

S-1215 (CMC-858), bone collagen, from square 4S/0E, Levels 1 and 2, 6 cm depth in B horizon of a podzol, collected 1974, submitted by S.J. Smailes.

Normalized age: modern
 $\delta^{13}\text{C} = -20 \text{ e}$

Significance: Woodland, Clearwater Lake, anomalous, young

S-1216 (CMC-859), bone collagen, from square 4S/3E, Level 1, 5.7-8.3 cm depth, in B horizon of a podzol, collected 1974, submitted by S.J. Smailes.

Normalized age: 345 ± 70
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 265 ± 65

Significance: Woodland, Clearwater Lake

GiMx-8, Stump Bottom: on the Churchill River, Saskatchewan. This site is attributed to the Clearwater Lake phase on the basis of its pottery (Meyer 1978a: 36). The date is interesting because ^{13}C measurements on the collagen and apatite phases suggest a closed system free of contamination (Meyer 1978a: 37). Sources: Meyer 1978a, 1978b; Morlan, 1993.

GX-3693, bone collagen, from hearth containing burned bone fragments and Clearwater Lake Punctate pottery, submitted by D. Meyer.

Normalized age: modern
 $\delta^{13}\text{C} = -25.8$

Note: The apatite fraction yielded a $\delta^{13}\text{C}$ of -15.9‰.

Significance: Woodland, Clearwater Lake, anomalous, young

GkNp-2, McCallum: at the entrance to Snake Rapids channel which joins Sandy Lake to McDonald Bay of Pinehouse Lake, on the Churchill River, Saskatchewan. D. Meyer accepts S-1807 for the Clearwater Lake phase, but the test excavation also yielded a native copper point and an Oxbow point as well as pottery, suggesting a compressed sequence in a shallow burial environment. Sources: Morlan, 1993; Rutherford et al., 1984.

S-1807 (CMC-1145), bone collagen, from hearth, units 18S/0E and 19S/0E, 4.5-8.5 cm depth, collected 1979, submitted by D. Meyer.

Normalized age: 290 ± 100
 $\delta^{13}\text{C} = -20 \text{ e}$
Uncorrected age: 210 ± 100

Significance: Woodland, Clearwater Lake

GIoc-20, Martin Chartier: on the east bank of the Kisis Channel between Little Peter Pond Lake and Churchill Lake, Saskatchewan. The lowest of three components represents a southern manifestation of the Taltheilei Shale tradition, dated by charcoal from a hearth. Sources: Gordon, 1996; Millar, 1983; Morlan, 1993.

S-2240, charcoal, from cultural level 3, hearth, submitted by J.F.V. Millar.

Normalized age: 1275 ± 75
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Late Taltheilei

IjOg-2, Charlot River: at the mouth of the Charlot River where it empties into the northern side of Lake Athabasca, Saskatchewan. Wright (1975: 51) relates both components of this site to the Frank Channel complex described by Noble (1971) for Great Slave Lake as part of the Taltheilei Shale tradition. Charcoal from a hearth within a tent ring provided a date for the lower component. Sources: Gordon, 1996; Morlan, 1993; Wilmeth, 1978; Wright, 1975.

GaK-3799 (CMC-500), charcoal, from square F, hearth in tent feature, the lower of two superimposed components, collected 1971, submitted by J.V. Wright.

Normalized age: 610 ± 110
 $\delta^{13}\text{C} = -25 \text{ e}$

Significance: Late Taltheilei

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**Geological Survey of Canada
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Section II

Geological Radiocarbon Dates in Saskatchewan

collated by

R. McNeely and B.T. Schreiner

SECTION II

Geological Radiocarbon Dates in Saskatchewan

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INTRODUCTION

All dates published or provided to the authors prior to January 2000 are now available in this Date List (Fig. II-1). For ease of association the presentation of the geological dates has been organized thematically and presented from the south to the north within each theme. The geological dates relate to the following themes: pre-Holocene samples (57), deglaciation history (84), glacial lakes (22), Late Wisconsin and Holocene samples (328), and dates related to vertebrate paleontology (13). All dates related to archaeological sites are presented in Section I and the optical dates appear in Section III of this Open File.

All radiocarbon age calculations are based on the 'Libby' ^{14}C half-life of 5568 ± 30 years and 0.95 of the activity of the NBS oxalic acid standard. Ages are quoted in radiocarbon years before present (BP), where 'present' is taken to be AD 1950 (Stuiver and Polach, 1977). The error assigned to each age is conventionally reported as ± 1 sigma, **except** for the GSC Laboratory which unconventionally reports its error term as ± 2 sigma. This deviation from convention must be taken into account when calibrating the GSC dates. The GSC error must be divided by 2 prior to using the calibration program (Note: the EEM for the GSC Lab is 1.6). Please refer to WebPage <<http://sts.gsc.nrcan.gc.ca/radiocarbon/agecal_e.shtml>> for additional details.

If a $^{13}\text{C}/^{12}\text{C}$ ratio ($\delta^{13}\text{C}$) was available, a 'normalization' for isotopic fractionation was applied to the sample age, and the $\delta^{13}\text{C}$ value reported. Therefore, by convention the dates are **normalized** to a $\delta^{13}\text{C} = -25.0\text{‰}$ PDB **unless otherwise indicated**. Some laboratories, including many of the AMS laboratories, assume a $\delta^{13}\text{C}$ for the material dated and provide a normalized age only. Whenever possible, these assumptions are noted in the presentation of the data. Only about a 9% (39) of the dates have measured $\delta^{13}\text{C}$, and 22 dates have assumed $\delta^{13}\text{C}$, thus almost 90% of the dates are reported without 'normalization' (uncorrected).

Special notes:

The 'hardwater' error for freshwater shells is not well documented, therefore, the GSC Lab. does not 'correct' freshwater shell ages. The user of these dates should be aware of this complication whenever comparisons between terrestrial and freshwater dates are attempted. A correction for the 'hardwater' error must be applied to these data in order to make the comparisons valid.

The 460 geological dates have been produced by 10 laboratories for 51 different submitters. Three submitters have dated 20 samples or more, and 9 submitters have dated between 5 and 20 samples, whereas 39 submitters have dated 5 samples or less.

The age distribution of the geological samples, except for first millennium BP, is reasonably uniform back to 12 ka, i.e. immediately after deglaciation in the south of the province. A large number of late glacial and older samples have also been found in Saskatchewan.

millennium	no.	millennium	no.
modern	04	7 to 8 ka	29
0 to 1 ka	29	8 to 9 ka	27
1 to 2 ka	23	9 to 10 ka	29
2 to 3 ka	24	10 to 11 ka	44
3 to 4 ka	36	11 to 12 ka	20
4 to 5 ka	26	12 to 20 ka	39
5 to 6 ka	38	> 20 ka	28
6 to 7 ka	21	nonfinite	43

The type of materials dated are varied but certain materials (e.g. organics) are more prevalent than others and in most cases are dependent on availability rather than submitter preference.

bone	20	peat	72
charcoal	20	freshwater shells	18
lake sediment	50	soil / paleosol	50
organics	162	wood	114

The taxa dated are quite varied within the foregoing categories and are noted in Table II-1 with their frequency of occurrence.

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Taxon	no.	Taxon	no.	Taxon	no.
Arboreal plants (trees)		Freshwater shells		Plant Macrofossils	
<i>Picea</i> (spruce)	07	gastropods (snails)		<i>Chenopodium</i>	03
<i>Pinus</i> (pine)	02	<i>Fossaria</i>	02	<i>Psoralea</i>	03
coniferous undet.	04	<i>Stagnicola</i>	02	<i>Scirpus</i>	02
<i>Salix</i> (willow)	06	gastropod undet.	01	<i>Sphagnum</i>	02
<i>Betula</i> (birch)	02	<i>Lymnaea</i>	01	<i>Carex</i>	02
<i>Acer</i> (maple)	01				
<i>Populus</i> (poplar)	01	pelecypods (clams)		Vertebrates (mammals)	
<i>Prunus</i> (cherry)	01	<i>Sphaerium</i>	01	<i>Bison</i>	05
deciduous undet.	01	<i>Lampsilis</i>	01	<i>Mammuthus</i>	07
		<i>Pisidium</i>	01	<i>Equus</i>	01

Table II-1. Taxa of material dated

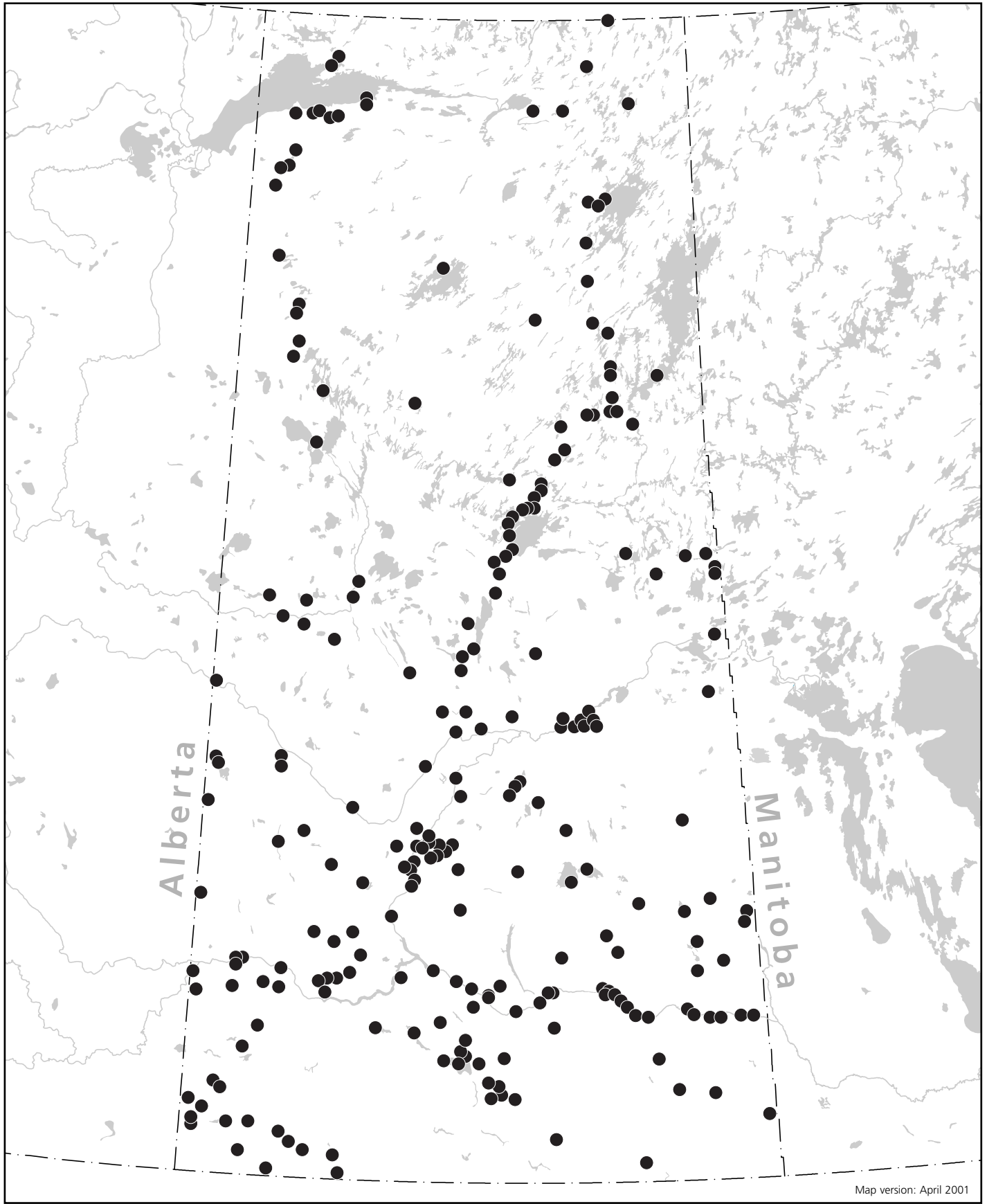


Fig. II-1. Distribution of geological sites in Saskatchewan.

GEOLOGICAL DATES

DATES RELATED TO THE PRE-HOLOCENE (Fig. II-2)

S-96	Outram		S-455	Marquis
Uncorrected age:		27 750 ± 1200	Uncorrected age:	>33 000
<p>The wood was in an intertill deposit of fine-gained sand at a depth of 51 m (170 ft) in a core. It was collected by D.L. Delorme in August, 1959 near Outram, about 25 km west of Estevan, southeastern Saskatchewan (49°10'30"N, 103°19'00"W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.</p>			<p>The organic silt/sand was enclosed in silt and sand at a depth of 18-18.9 m (59-60 ft) with till above. The sample was collected by E.A. Christiansen in 1968 near Marquis, about 30 km north-northwest of Moose Jaw, Saskatchewan (50°38'46"N, 105°47'25"W). This sample was submitted by E.A. Christiansen to gain information on an interglacial period.</p>	
S-457	Handsworth		S-117	Buffalo Pound Lake
Uncorrected age:		11 400 ± 190	Uncorrected age:	>32 000
<p>The wood and grass were enclosed in gyttja, under- and overlain by till at a depth of 13.7 m (45 ft). The sample was collected by E. Sanford in 1961 from a hummocky moraine in Handsworth, about 135 km east-southeast of Regina, southwestern Saskatchewan (49°51'02"N, 102°47'35"W). This sample was submitted by E.A. Christiansen to gain information on a non glacial period..</p>			<p>The freshwater pelecypod shells were enclosed in fine-grained fluviolacustrine sand between the second and third till. It was collected by P.P. David in August, 1960 from Buffalo Pound Lake, about 30 km north of Moose Jaw, southern Saskatchewan (50°43'N, 105°35'W). The sample was submitted by E.A. Christiansen to gain information on a nonglacial period.</p>	
<p>Comment (E.A. Christiansen): The date is too young to antedate the last glaciation as suggested by stratigraphic position. The wood was probably covered by till during the collapse of stagnant ice related to the last glaciation.</p>			<p>Comment (E.A. Christiansen): The outer layers of the shell material were dissolved in dilute acid and discarded. Since stratigraphic investigations relate all the drift in this section to the last glaciation of the area (Christiansen, 1961), the advance of which is given by the Kenaston date (S-97, below) at 10 150 ± 200 BP, it is believed that this Buffalo Pound date is too old.</p>	
S-40	Qu'Appelle Valley		S-42	Qu'Appelle Valley
Uncorrected age:		>33 000	Uncorrected age:	>30 000
<p>The organic sediment in gravel was overlying till. The sample was collected by W.O. Kupsch and E.A. Christiansen in May, 1956 from a gravel pit in an esker, Qu'Appelle Valley, Saskatchewan (50°08'N, 103°04'W). This sample was submitted by W.O. Kupsch to gain information on a nonglacial period.</p>			<p>The lake sediment was located 2.4 m (8 ft) below the top of a till that is the lowermost of three. The sample was collected by E.A. Christiansen in 1957 from the north bank of the Qu'Appelle Valley, Saskatchewan (50°44'N, 105°35'W). It was submitted by E.A. Christiansen to gain information on a nonglacial period.</p>	
S-970	Regina		GSC-987	Bliss Gravel Pit
Uncorrected age:		>31 000	Uncorrected age:	>30 000
<p>The organic silt was located at a depth of 18.3 m (60 ft). It was collected by C. Higgins and E.A. Christiansen in 1974 from D.O.E. Regina, Saskatchewan (50°27'N, 104°38'W). This sample was submitted by E.A. Christiansen to gain information on a pre Battleford interglacial period.</p>			<p>The freshwater mollusc shells were in 15 m-thick gravel and sand beds that also contained abundant vertebrate fossils. Sample SF-67-15b was collected by A.M. Stalker and E. Khan in 1967 from Bliss Gravel Pit, on the southwest side of Fort Qu'Appelle, about 70 km northeast of Regina, Saskatchewan (50°46'N, 103°48'W), at an elevation of 493 m. This sample was submitted by A.M. Stalker to gain information on an interglacial period.</p>	
S-794	Esterhazy		S-3605	Lancer Thrust Moraine
Uncorrected age:		11 260 ± 150	Uncorrected age:	31 300 ± 1400
<p>The wood was enclosed in brecciated shale, overlain by 21.3 m of till and 2.4 m of sand, and underlain by 29.9 m of till. The sample was collected by C. Higgins and E.A. Christiansen in 1973 near Esterhazy, about 180 km east of Regina in the Qu'Appelle Valley, southeastern Saskatchewan (50°31'N, 102°09'W). This sample was submitted by E.A. Christiansen to gain information on a possible non glacial period.</p>			<p>Comment (A.M. Stalker): The shell-bearing sand and gravel is overlain by thick drift including two tills and underlain by one or more tills. The intertill deposit is thought to be of Sangamon age.</p>	
<p>Comment (E.A. Christiansen): The till cover was interpreted as landslide deposits since glacier position was 160 km northwest of the site at this time.</p>			<p>The charred wood in a paleosol was enclosed in marl. The sample was collected by J.E. Campbell from the Lancer Thrust Moraine, about 95 km northwest of Swift Current, southwestern Saskatchewan (50°46'28"N, 108°41'55"W), at an elevation of 670 m. This sample was submitted by J.E. Campbell to gain</p>	

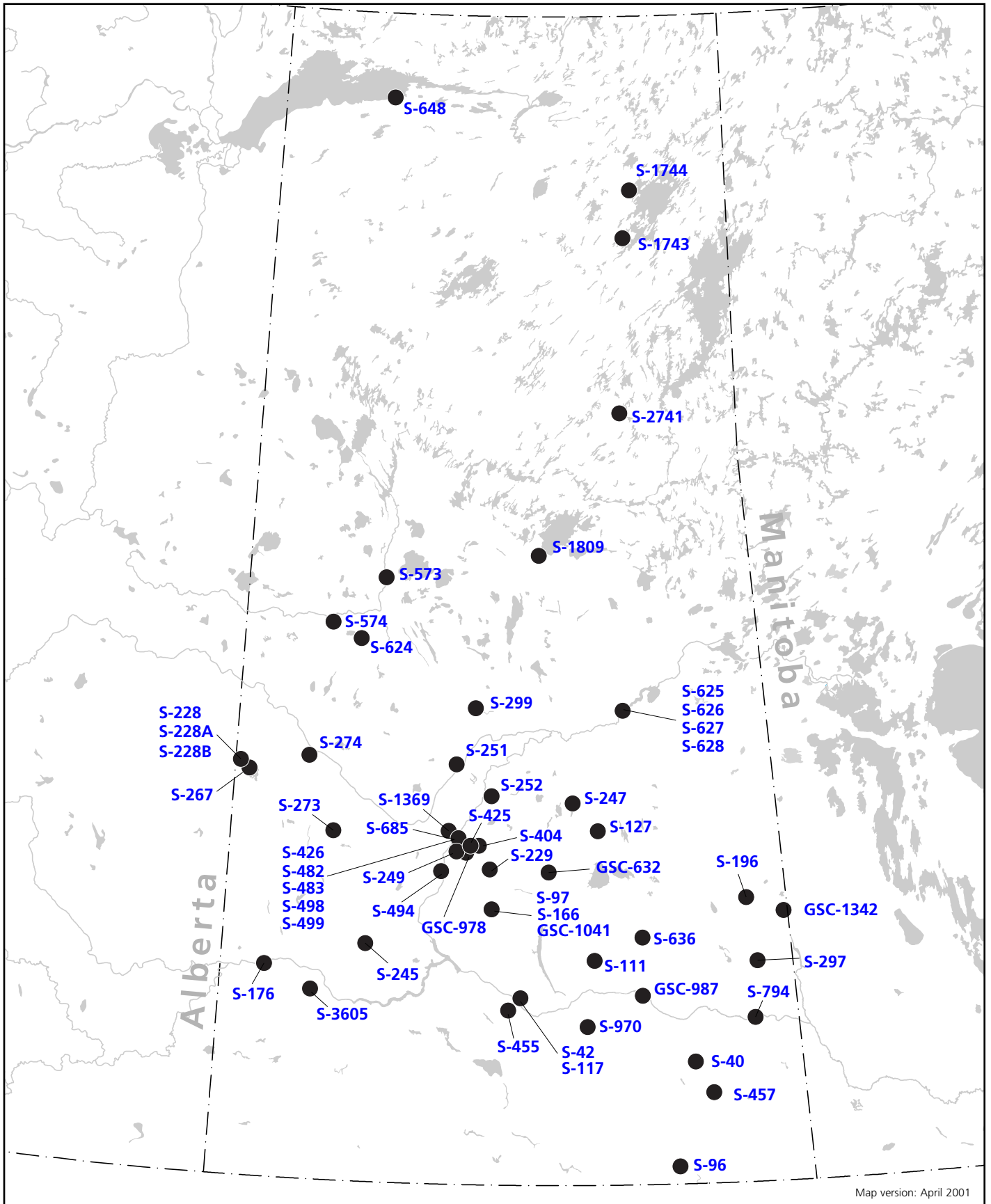


Fig. II-2. Dates related to the pre-Holocene.

information on an interglacial paleosol that was formed during the Watino stadial in the middle Wisconsin.

S-176 Leader

Uncorrected age: 20 000 ± 850

The organic sediment (A-horizon paleosol) was enclosed in a buried soil, overlain by sand, silt, till, silt and lacustrine clay. The sample was at a depth of 37 m (120 ft) in a borehole, near Leader, about 290 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°58'54"N, 109°21'47"W). This sample was submitted by E.A. Christiansen to gain information on glacial readvance.

Comment (**E.A. Christiansen**): The A-horizon is overlain by sand, silt, till, silt and lacustrine clay; underlain by a B-horizon, till, silt, sand and gravel and till. This dates the last major glacial advance.

S-297 Saltcoats area

Uncorrected age: >33 000

Wood from testhole cuttings was in sand at a depth of 27-65 m (90-236 ft), and was overlain by 12 m (40 ft) of silt and 12 m (40 ft) of till. The sample was collected by E.A. Christiansen in 1966 near Saltcoats, about 185 km east-northeast of Regina, southeastern Saskatchewan (51°03'N, 102°05'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-111 Gregherd

Uncorrected age: >30 000

The wood was in sand at a depth of 90 m (300 ft) and was overlain by till. The sample was collected by J. Gerrard in 1958, from a well at Gregherd, about 70 km north of Regina, Saskatchewan (51°06'N, 104°30'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

Comment (**E.A. Christiansen**): Since the uppermost till in the Gregherd area is correlative with the uppermost till in the Kenaston area (S-97, below: 10 150 ± 200; Christiansen 1961), a date of >30 000 in the Gregherd area must date an older glaciation.

S-245 Houghton

Uncorrected age: >27 000

The wood was in sandy clay and gravel and was overlain by drift (mainly till). The sample was at a depth of 146-158 m in a rotary drill testhole. The sample was collected by R.E. Creelman in 1962 from "Houghton", near Elrose, about 105 km north of Swift Current, southwestern Saskatchewan (51°13'N, 107°55'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-636 Kelliher

Uncorrected age: >34 500

The wood was located at a depth of 9.7 m (32 ft). The sample was collected by N. Budd in 1972 from Kelliher, about 110 km northeast of Regina, Saskatchewan (51°17'N, 103°47'W). This sample was submitted by E.A. Christiansen to gain information on a pre-Battleford interglacial period.

GSC-1342 Runnymede

Uncorrected age: 30 000 ± 490

The organic material (paleosol) was enclosed in varved clay and overlain by two tills. Sample KJ-18-69 was collected by R.W. Klassen in 1969 from along the side of the Seton Coulee, about 1.6 km north of Runnymede, 60 km northeast of Yorkton, southeastern Saskatchewan (51°30'N, 101°42'W). This sample was submitted by R.W. Klassen to gain information on geomorphic processes.

Comment (**R.W. Klassen**): The date is younger than the stratigraphic position beneath Minnedosa till and Leonard till would suggest. The dated material may have been contaminated by modern carbon.

S-97 Kenaston

Uncorrected age: 10 150 ± 200

The wood was in an unoxidized, organic-rich zone at a depth of 44 m (145 ft) in a core. The sample was collected by M. Sundin in March, 1959 from Kenaston, about 75 km south-southeast of Saskatoon, Saskatchewan (51°33'N, 106°01'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-166 Kenaston

Uncorrected age: >30 000

The wood sample (5.8 to 7.0 m depth (20')) was enclosed in gyttja (organic clay) under one till. The sample was collected by S.C. Collins on October 25, 1967 about 75 km south-southeast of Saskatoon, Saskatchewan (50°30'N, 106°18'W), location: SW11-24-29-3-W3; Ref.-file for SRC Kenaston SW11-24. This sample was submitted by E.A. Christiansen to gain information on an interglacial period.

Comment (**E.A. Christiansen**): The wood is overlain by Battleford Formation which is a till occurring in west-central Saskatchewan (Christiansen 1968a, 1968b). See GSC-1041 (below) for additional comments.

GSC-1041 Kenaston

Uncorrected age: 38 000 ± 560

The wood sample (9 m (30') depth) was enclosed in gyttja under one till. The sample was collected in 1945 by S.C. Collins from an excavation site, about 75 km south-southeast of Saskatoon, Saskatchewan, (51°30'00"N, 106°18'20"W) Location: NW11-24-29-3-W2. This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

Comment (**E.A. Christiansen**): The wood is overlain by Battleford Formation which is a till occurring in west-central Saskatchewan (Christiansen 1968a, 1968b). A hiatus prior to deposition of this till began at least 38 000 years ago.

S-196 Mikado

Uncorrected age: >33 000

The wood was located at a depth of 6.4 m in sand with 4 m of till above. The sample was collected by E. Chernoff in 1961 from Mikado, about 305 km east-southeast of Saskatoon, southeastern Saskatchewan (51°38'N, 102°14'W). This sample was submitted by E.A. Christiansen to gain information on an interglacial period before the last ice age.

GSC-632 Lanigan area
Uncorrected age: >42 000
The wood was at a depth of about 165 m, enclosed in sandy valley fill, and about 6 m above bottom of a buried valley that was cut into the bedrock. Sample P.D. 65-7-44 was collected by L.L. Price in 1965 in a mine shaft near Lanigan, about 115 km east-southeast of Saskatoon, Saskatchewan (51°55'N, 105°10'W). This sample was submitted by A.M. Stalker to gain information on an interglacial or interstadial period.

Comment (**A.M. Stalker**): The date supports the geologic inference of an interglacial or interstadial age.

S-494 Pike Lake
Uncorrected age: 22 100 ± 465
The organic silt was underlying 9.1 m of fine to medium-grained brown sand and 3 m above a till. The sample was collected by E.A. Christiansen in 1969 from a terrace near Pike Lake, about 30 km southwest of Saskatoon, Saskatchewan (51°55'N, 106°50'W). This sample was submitted by E.A. Christiansen to gain information on an interglacial period.

Comment (**E.A. Christiansen**): One cannot ascertain stratigraphically whether the sand is interglacial or postglacial, but the date suggests the sand antedates the last glaciation.

S-229 Allan
Uncorrected age: >34 000
The wood was in unoxidized till at a depth of 7.2 m (24 ft). The sample was collected by I.W. Tweddell in 1964 near Allan, about 45 km southeast of Saskatoon, Saskatchewan (51°56'N, 106°04'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

GSC-978 Patience Lake
Uncorrected age: >38 000
The wood at a depth of 34.8 to 47.6 m in a mine shaft was enclosed in sand that was overlain by two tills. The sample was collected by L.L. Price in 1967 from Patience Lake, about 20 km east-southeast of Saskatoon, Saskatchewan (52°05'N, 106°20'W). This sample was submitted by R.W. Klassen to gain information on a time when no till was deposited.

S-249 Floral
Uncorrected age: >33 000
The organic silt at a depth of 47-54 m (156-184 ft), was in silt and was overlain by two weathered zones. The sample was collected by E.A. Christiansen in 1964 from Floral, about 15 km southeast of Saskatoon, Saskatchewan (52°05'N, 106°27'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-404 St. Denis
Uncorrected age: >35 000
The organic silt, probably gyttja, was beneath 26 m (86 ft) of till. The sample was collected by E.A. Christiansen in 1966 near St. Denis, about 35 km east-southeast of Saskatoon, Saskatchewan (52°09'N, 106°12'W). This sample was submitted by E.A. Christiansen to gain information on an intertill episode.

S-425 Patience Lake
Uncorrected age: >39 000
The wood at a depth of 43.89-47.55 m was in fine-grained, well-sorted sand, underlain by till. The sample was collected by N.L. Ball in 1967 from Shaft No. 2, Potash Co. of America, Patience Lake, about 20 km east-southeast of Saskatoon, Saskatchewan (52°09'10"N, 106°22'30"W), at an elevation of 533. m. This sample was submitted by W.O. Kupsch to gain information on a glacial minimum.

Comment (**W.O. Kupsch**): The sand with wood fragments is underlain by till which is probably correlative with the Upper Till of the Sutherland group. The date is a minimum for the uppermost part of that group (Christiansen, 1970: 4).

S-426 Sutherland
Uncorrected age: >34 000
The wood at a depth of 16.7-22.8 m (55-75 ft) was in sand underlying 10.7 m of till. The sample was collected by P. Maik in 1967 in Sutherland, about 3 km north of Saskatoon, Saskatchewan (52°10'N, 106°32'W). This sample was submitted by E. A. Christiansen to gain information on a nonglacial period between the last and second last glaciation.

Saskatoon Series

A series of *Mammuthus* (insoluble collagen extraction) samples in sand within tills of the Floral Formation from Saskatoon, Saskatchewan (52°10'N, 106°35'W) was collected by Z.S. Pohorecky in 1968 and samples were submitted to gain information on vertebrate paleontology.

S-482 Saskatoon I
Uncorrected age: 12 000 ± 320
The tusk fragments were 2.4 m below the position of S-483.

S-498 Saskatoon II
Uncorrected age: 14 650 ± 360
Tusk fragments.

S-499 Saskatoon III
Uncorrected age: 20 200 ± 500
Bone sample (*Mammuthus* skull).

S-483 Saskatoon IV
Uncorrected age: >34 200
The bone sample was 2.4 m above the position of S-482.

Comment (**Z.S. Pohorecky**): There were abundant faunal remains from seven taxa: gastropod, pelecypod, *Camelops*, *Mammuthus*, *Equus* cf. *niobrarensis*, *Bison*, and Cervid (Lammers, 1968). Bone fractures may indicate the presence of man (Pohorecky and Wilson, 1968).

Comment (**A.A. Rutherford**): The samples provided inconsistent dates for an apparent homogeneous unit. S-482, and -498 are similar to other regional mammoth dates (S-232, -918) but they appear to be too recent for their geologic position. S-483 and -499

are more acceptable for the Floral Formation (E.A. Christiansen, personal communication).

S-685 Sutherland

Uncorrected age: 14 040 ± 465

The bone (insoluble collagen extraction) was in a 4.6 m gravel bed below 0.6 m of boulders, overlying the Floral Formation till. The sample at a depth of 5.2 m (17 ft) was collected by C.R. Harington in 1972, from Sutherland, about 3 km north of Saskatoon, Saskatchewan (52°12'N, 106°35'W). This sample was submitted by E.A. Christiansen to gain information on a minimum age for the underlying till.

Comment (**E.A. Christiansen**): The date and field evidence indicate the gravel was deposited by a glacier which deposited the Battleford Formation. The boulder layer is a lag concentrate from erosion of a younger till.

S-273 Wolfe

Uncorrected age: >34 000

The organic silt (paleosol) was in silt in the second weathering zone at a depth of 24 m (79 ft). The sample was collected by E.A. Christiansen in 1965 from Wolfe, about 55 km southwest of North Battleford, west central Saskatchewan (52°15'N, 108°27'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-127 Spalding

Uncorrected age: >34 000

The wood was in till at a depth of 67.4-68.3 m (221-224 ft). The sample was collected by C. Bakke in November, 1960 near Spalding, about 145 km east of Saskatoon, Saskatchewan (52°17'30"N, 104°25'00"W). This sample was submitted by E. A. Christiansen to gain information on a nonglacial period.

S-1369 Dalmeny

Uncorrected age: 30 920 ± 2060

The wood was in a sand horizon at a depth of 21.3 m and was overlain by till. The sample was collected by P. Puodziunas in 1977 in Dalmeny, about 25 km northwest of Saskatoon, Saskatchewan (52°18'N, 106°43'W). This sample was submitted by P. Puodziunas to gain information on an interglacial episode.

S-247 St. Brieux

Uncorrected age: >33 000

The wood was presumably below the uppermost till at a depth of 8 m. The sample was collected by A. Coquet in 1951 in St. Brieux, about 85 km southeast of Prince Albert, central Saskatchewan (52°34'N, 104°50'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-252 Alvena

Uncorrected age: 33 500 ± 2000

The organic silt at a depth of 56-58 m (183-189 ft) was in silt below single till. The sample was collected by E.A. Christiansen in 1964 from Alvena, about 60 km north-northeast of Saskatoon, Saskatchewan (52°36'30"N, 106°3'00"W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial, weathering interval prior to the last glaciation.

S-267 Marsden

Uncorrected age: 33 000 ± 2000

The organic lens (paleosol?) at a depth of 90 cm (3 ft) was enclosed in noncalcareous, oxidized till, beneath the uppermost till. The sample was collected by E.A. Christiansen in 1965 from Marsden, about 105 km west of North Battleford, west central Saskatchewan (52°49'N, 109°49'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial weathering interval prior to the last glaciation.

Comment (**E.A. Christiansen**): The carbonaceous till is probably a paleosol developed on a till. The date should indicate the age of the uppermost till in the Marsden area.

Marsden Series

A series of organic silt (paleosol) samples under a till at a depth of 1.2 m (4 ft) was taken from Marsden, about 105 km west of North Battleford, west central Saskatchewan (52°53'N, 109°54'W). These samples were collected by D.L. Delorme in 1963 and were submitted by E.A. Christiansen to gain information on weathering during a nonglacial period.

Comment (**E.A. Christiansen**): These samples date part of a weathering interval prior to the last glaciation which took place about 18.0 ka in the area.

S-228 A Marsden I

Uncorrected age: 18 000 ± 450

This is a carbonate fraction of the same sample as S-228B; Locality: SW4-20-45-27W3; Ref.-file for Marsden SW4-20.

S-228 B Marsden II

Uncorrected age: 19 200 ± 400

This is an organic fraction of the same sample as S-228A; Locality: SW4-20-45-27W3; Ref.-file for Marsden SW4-20.

S-228 Marsden III

Uncorrected age: 21 000 ± 800

This is an organic fraction from a different sample than S-228A and B.

S-251 Wandsworth

Uncorrected age: 34 000 ± 1800

The organic silt was overlying the 2nd weathering zone at a depth of 71-77 m (232-252 ft). The sample was collected by E.A. Christiansen in 1964 from Wandsworth, about 60 km south of Prince Albert, central Saskatchewan (52°54'N, 106°37'W). This sample was submitted by E.A. Christiansen to gain information on the 2nd to last glaciation.

S-274 Paynton

Uncorrected age: >35 000

The charcoal or coal was in sand below a till at a depth of 26 m (85 ft). The sample was collected by E.A. Christiansen in 1965 from Paynton, about 50 km northwest of North Battleford, west central Saskatchewan (52°56'N, 108°54'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

Nipawin Series

A series of samples in silt from a rotary testhole near Nipawin, Saskatchewan (53°24'N, 104°01'W) was collected by W. Clifton in 1971. Site record: Ref. file SDH Nipawin (35-17-?); 516-5: No. SI-1. These samples were submitted by W. Clifton to gain information on a pre-Battleford nonglacial period.

S-625 Nipawin I

Uncorrected age: >34 500

The organic silt sample was at a depth of 19-19.5 m (62-64 ft).

S-626 Nipawin II

Uncorrected age: >31 250

The wood sample was at a depth of 22.1-22.4 m (72.6-73.4 ft).

S-627 Nipawin III

Uncorrected age: >31 250

The organic silt sample was at a depth of 22.9-23.3 m (75-76.6 ft).

S-628 Nipawin IV

Uncorrected age: >31 250

The organic silt sample was at a depth of 24.4-24.7 m (80-81 ft).

Comment (**E.A. Christiansen**): All horizons are too old, hence the results are inconclusive.

S-299 Foxdale

Uncorrected age: >33 000

The wood at a depth of 35-36.5 m (115-120 ft) was in sand overlain by till. The sample was collected by G. Riddle in 1966 near Foxdale, about 45 km west of Prince Albert, central Saskatchewan (53°25'N, 106°20'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period.

S-624 Matchee

Uncorrected age: >31 250

The organic silt at a depth of 7.3 m (24 ft) was in stratified sediments under till. The sample was collected by E.A. Christiansen in 1971 from Matchee, about 150 km north of North Battleford, west central Saskatchewan (54°04'N, 108°08'W). This sample was submitted by E.A. Christiansen to gain information on a nonglacial period, before the last ice age.

S-574 Bridge Creek

Uncorrected age: >31 250

The peat and silt at a depth of 15.8-16.2 m (52-53 ft) was underlying till. The sample was collected by S.H. Whitaker in 1970 from Bridge Creek in the Meadow Lake area, about 205 km west northwest of Prince Albert, west central Saskatchewan (54°12'N, 108°37'W). This sample was submitted by E.A. Christiansen to gain information on the Battleford/Floral interglacial.

S-573 Beaver River

Uncorrected age: >34 500

The peat at a depth of 39-39.6 m (128-130 ft) was underlying sands, silts, clays and till. The sample was collected by S.H. Whitaker in 1970 from "Mile 242" on highway 155, Beaver River, west central Saskatchewan (54°37'N, 107°48'W). This sample was submitted by S.H. Whitaker to gain information on either the Battleford/Floral or the Floral/Sutherland interglacial.

S-1809 Rabbit Creek

Uncorrected age: >33 000

The organic residue was at the base of 2.1 m of silt in an auger test hole. The sample was collected by B.T. Schreiner in 1979 from Rabbit Creek, along highway 2, about 32 km south of La Ronge, central Saskatchewan (54°52'36"N, 105°21'36"W). This sample was submitted by B.T. Schreiner to gain information on a nonglacial period.

S-2741 Waddy Lake

Uncorrected age: 5625 ± 295

The charcoal was between two tills at a depth of 1.55 m. The sample was collected by J.E. Campbell in 1985 from Waddy Lake, southwest of Reindeer Lake, Saskatchewan (56°12'N, 103°59'W). This sample was submitted by J.E. Campbell to gain information on glacial readvance.

Comment (**J.E. Campbell**): This is an intertill date. The upper till represents a readvance into the Lake Agassiz basin, but the date appears to be too young.

S-1743 Michael Lake

Uncorrected age: >34 800

The wood fragment was in a thin organic layer of silty grey till at a depth of 10 m. The sample was collected by Gulf Min. Exp. staff in 1979 from Michael Lake, Wollaston Lake area, northern Saskatchewan (57°52'N, 103°55'W). This sample was submitted by B.T. Schreiner to gain information on an interglacial period.

S-1744 Collins Bay

Uncorrected age: >35 600

The organic silt was below regional grey till and above sorted material at a depth of 9.2 m. The sample was collected by Gulf Min. Exp. staff in 1979 from Collins Bay, Wollaston Lake, northern Saskatchewan (58°17'N, 103°37'W). This sample was submitted by B.T. Schreiner to gain information on an interglacial period.

S-648 Lake Athabasca

Uncorrected age: 4890 ± 60

The charcoal was in sand under till or silt at a depth of 30 cm. The sample was collected by R. Hermish in 1971 from the south shore of Lake Athabasca, Saskatchewan (59°10'N, 108°02'W). This sample was submitted by R. Hermish to gain information on a nonglacial lacustrine environment.

DATES RELATED TO LATE WISCONSIN DEGLACIATION (Fig. II-3)¹

TO-216 Ham site
Corrected age: 12 630 ± 80

The freshwater bivalve shells (*Pisidium*; identified by J.E. Dale) were in sandy silt. Sample KJ-66-85 (2.5 m depth) was collected by R.W. Klassen on August 7, 1985 from the "Ham site", about 15 km south of Loomis, southwestern Saskatchewan (49°04'05"N, 108°45'20"W), at an elevation of 930 m. This sample was submitted by R.W. Klassen to gain information on deglaciation in southwestern Saskatchewan.

The age was corrected to a $\delta^{13}\text{C}=0.0\text{‰}$

Horseman Site Series

A series of samples from the Horseman Site, about 17 km south and 8 km east of Robsart, 60 km south of Maple Creek, southwestern Saskatchewan (49°13'20"N, 109°10'40"W), at an elevation of about 998 m was collected by R.W. Klassen and submitted to gain information on deglaciation during the Late Wisconsinan.

GSC-4098 Horseman Site I

Normalized age: 9500 ± 80
 $\delta^{13}\text{C} = -28.9\text{‰}$

The wood (*Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-071)) was in peaty silt and clay. Sample KJ-12-85 was collected by R.W. Klassen and W.J. Vreeken on August 6, 1985.

Uncorrected age: 9560 ± 80

GSC-4273 Horseman Site II

Normalized age: 10 000 ± 130
 $\delta^{13}\text{C} = -29.8\text{‰}$

The peat sample (BH No. 1-85 : (4.5) ± (4.50-4.54)) was in a 1 m-thick peat between overlying pond sediments, and underlying gravel above till.

Uncorrected age: 10 100 ± 130

GSC-4266 Horseman Site III

Normalized age: 10 200 ± 140
 $\delta^{13}\text{C} = -29.0\text{‰}$

The peat sample (BH No. 1-85: (4.0)±(4.0-4.04)) was in clay and gravel.

Uncorrected age: 10 300 ± 140

TO-310 Horseman Site IV

Normalized age: 14 340 ± 100

The moss was in clay and gravel in Borehole 1-85 (5.0 m). It was collected by R.W. Klassen on October 22, 1985.

The age was normalized to a $\delta^{13}\text{C}=-25\text{‰}$

Comment (R.W. Klassen): These samples come from a postglacial peat bed about 1 m thick sandwiched between

overlying pond sediments (Delorme, 1986) and underlying gravel above till. GSC-4266 comes from the uppermost part and GSC-4273 and -4098 come from the middle zone of this peat bed. Peat from the lower zone yielded an age (AMS) of 14 340 ± 100 BP (TO-310) and an age of 10 000 ± 130 BP (GSC-4273) from the middle zone. A piece of wood (*Salix*) from the middle zone dated at 9500 ± 80 (GSC-4098) suggests the peat date from this zone is likely about 0.5 ka too great and that a date of 10 300 ± 140 (GSC-4266) on peat from the upper zone and 14 340 ± 130 (TO-310) on peat from the lower zone may be 1.0 ka too great. These dates along with another AMS date (12 630 ± 80; TO-216, above) on shells from a nearby moraine plateau, are particularly significant in that they are the first dates obtained from postglacial sediments in this region and suggest a Late Wisconsinan age for the drift surface (Klassen and Vreeken, 1987, Vreeken, 1985).

S-173 Ceylon

Uncorrected age: 13 000 ± 200

The lake sediment, was in fine to medium sand overlain by 90 cm (3 ft) of till. The sample was collected by R. Parizek in 1961 from knob-and-kettle topography near Ceylon, about 110 km south of Regina, southern Saskatchewan (49°25'N, 104°36'W). This sample was submitted by E.A. Christiansen to gain information on glacial readvance.

Comment (E.A. Christiansen): The sample is from the crest of a knob in an area of knob-and-kettle topography. It either dates a glacial readvance or, if the till slid over the marl during melting of underlying ice, it is a minimum for deglaciation.

Antler Series

A series of samples in an apparent buried A-horizon, from below a small upland depression in a kettled, hummocky moraine near Antler, about 120 km east-northeast of Estevan, Saskatchewan (49°35'N, 101°30'W) was collected by W. Eilers in 1979 and submitted to gain information on deglaciation and geomorphic processes. The dates relate to the final deglaciation stages and early soil formation periods.

S-1801 Antler I

Uncorrected age: 11 050 ± 860

The organic material (paleosol) sample was at a depth of 147-161 cm.

S-1802 Antler II

Uncorrected age: 11 310 ± 470

The organic material (paleosol) sample was at a depth of 161-176 cm.

S-1803 Antler III

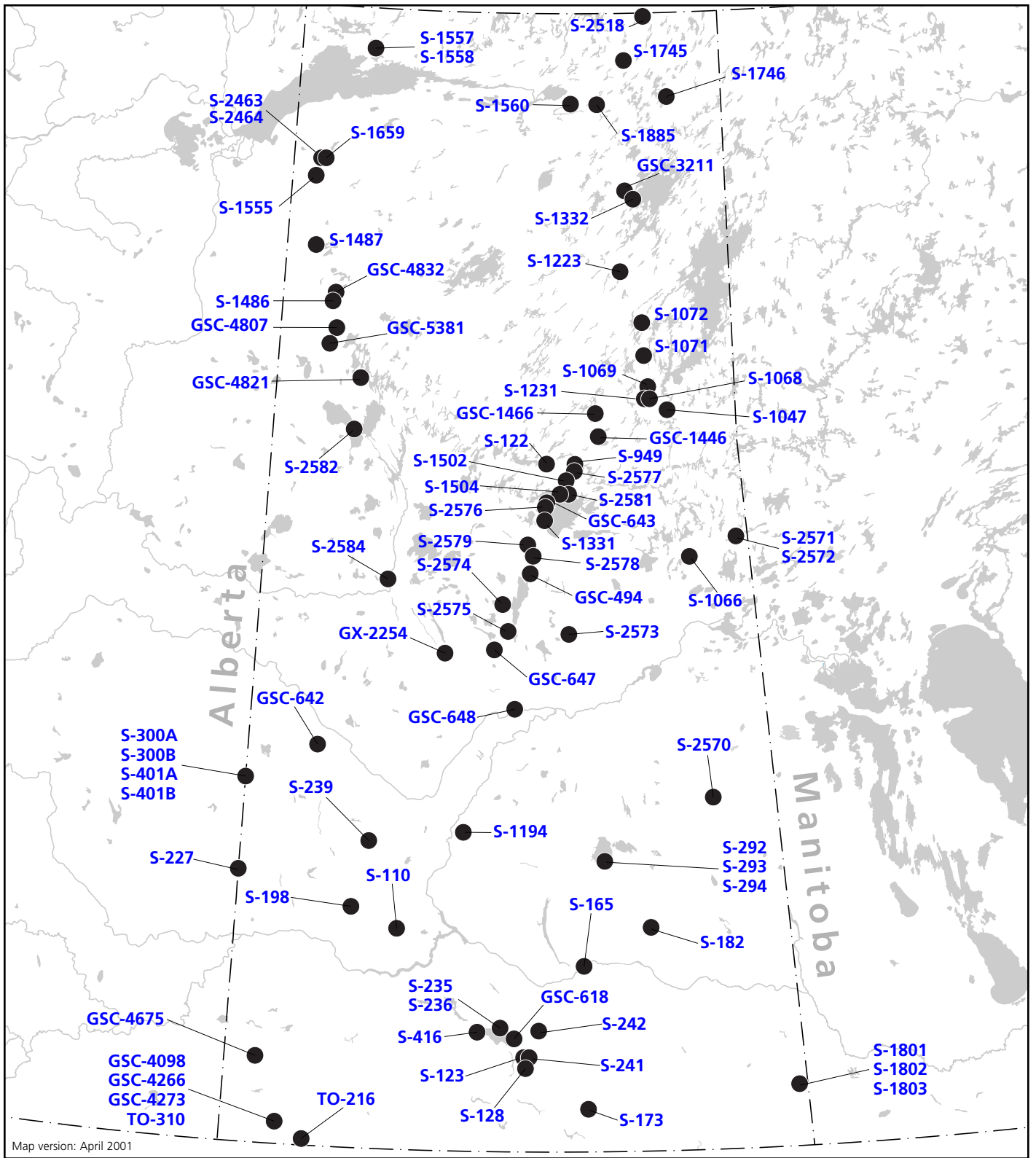
Uncorrected age: 18 140 ± 6610

The freshwater gastropod shell sample was at a depth of 190-192 cm.

S-128 Crane Valley

Uncorrected age: 10 800 ± 300

¹The locality descriptions for the samples of S.C. Zoltai were derived by McNeely from the coordinates provided by the submitter.



Map version: April 2001

Fig. II-3. Dates related to Late Wisconsin deglaciation.

The charcoal was in glaciolacustrine silt and clay sediments that were contorted by ice thrust. The sample was collected by R.R. Parizek in 1960 near Crane Valley, about 70 km south of Moose Jaw, southern Saskatchewan (49°48'N, 105°32'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.

Comment (**E.A. Christiansen**): The sample dates the third deglaciation in the Willow Bunch area. Because the Galilee Junction

marl (S-123, below: $10\,900 \pm 700$) and the lake clay at Crane Valley are believed to be correlative, the close agreement of the two dates suggests that dates from marl deposited in small ponds in this area may be reliable.

GSC-4675

Maple Creek

Normalized age:

$14\,300 \pm 340$
 $\delta^{13}C = -5.49\%$

The freshwater gastropod shells (*Stagnicola eloides* (Say, 1821); identified by J.E. Dale) were in glaciolacustrine silts underlain by silt/fine sands with diamicton intercalations. Sample Fleming Creek No. 1 was collected by W.J. Vreeken and T.G. McCulloch on August 8, 1986 from 10 km south of the town of Maple Creek, southwestern Saskatchewan (49°49'20"N, 109°29'00"W), at an elevation of 833 m. This sample was submitted by W.J. Vreeken and R.W. Klassen to gain information on lake level change in Lake Downie during deglaciation.

Uncorrected age: 14 000 ± 340

Comments (**W.J. Vreeken**): The site is located within a low-relief hummocky lake plain terrane, underlain by maximally 50 m of silts and fine sands with diamicton intercalations that were deposited in Glacial Lake Downie. These freshwater gastropod shells were confined to a 10 cm stratum, about 2.5 m beneath the land surface, exposed in an otherwise nonfossiliferous 5 m-thick sequence of normal-faulted, planar and crossbedded sands.

1. This date serves as a comparison for an accelerator date (TO-694) which gave an age of 13 120 ± 80 BP for a shell from the same species and from the same stratum. The average value of 13.5 ka is assumed to date the close of the existence of Glacial Lake Downie.
2. Glacial Lake Downie occupied formerly glaciated terrain between the Green Lake end moraine, which marks the Late Wisconsinan terminus around nonglaciated parts of the Cypress Hills (Westgate, 1968; Vreeken, 1986; Klassen and Vreeken, 1987), and the Lethbridge moraine, which marks a pause during the Late Wisconsinan glacial retreat. These ice-marginal positions were abandoned in quick succession (Vreeken, 1989).

The radiocarbon dates demonstrate that the Green Lake position was abandoned before 13.5 ka and that the Lethbridge position was abandoned between 13.5 ka and about 11.2 ka, the latter being the minimum age estimate for the Manyberries Bed of Glacier Peak tephra which was deposited on the Lethbridge moraine.

S-241 Ormiston

Uncorrected age: 15 200 ± 260

The lake sediment was in a 97 cm-thick, horizontal silt layer and was located 71 cm from the top of the layer. The sample was collected by D.L. Delorme in 1963 near Ormiston, about 75 km south-southeast of Moose Jaw, southern Saskatchewan (49°54'N, 105°27'W). This sample was submitted by W.O. Kupsch to gain information on deglaciation.

Comment (**W.O. Kupsch**): The silt layer was overlain successively by 3 ft (90 cm) of gravel, a 4 ft (120 cm) dipping silt layer, and 4 ft (120 cm) of till. The silt was believed to be deposited in a lake close to glacier ice, with final melting of buried ice causing high dips of strata and sliding or flow of the upper till on top. The deposit above the lower silt was regarded as a kame or a kame-eskerine complex. The lower silt contains the following ostracode species: *Ilyocypris gibba*, *I. bradyi*, *Candona caudata*, *C. renoensis*, *C. acutula*, *C. candida*, *C. compressa*, *C. rawsoni*, *Cypridopsis vidua*, *Cyclocypris ovum*, *C. ampla*, *Limnocythere trapeziformis*, *L. cerioturberosa*, *Cuprinotus glaucus*, *Cytherissa lacustris*. There were also abundant gastropods and charophytes. The date is a minimum for deglaciation. Dead ice was believed present when the sampled unit was deposited (Delorme, 1965: 63-65).

S-123 Galilee Junction

Uncorrected age: 10 900 ± 700

The marl was above an ablation drift of the last glaciation. The sample was collected by R.R. Parizek in September, 1960 from Galilee Junction, about 50 km south of Moose Jaw, southern Saskatchewan (49°55'N, 105°33'W). This sample was submitted by W.O. Kupsch to gain information on deglaciation.

Comment (**W.O. Kupsch**): The marl is part of a series of sediments in a thrust-moraine area, and has been deformed along with ice-contact till, gravel, sand, silt, and clay. The date is a minimum for glacier ice covering the Missouri Coteau in this area.

GSC-618 Coteau Moraine

Uncorrected age: 10 710 ± 250

The basal organic was in a basal part of pond sediments overlying and within till. The sample PC 89/65 was collected by V.K. Prest in 1965 from in a road cut in hummocky terrain, on the west flank of the Coteau Moraine, 0.8 km west of Crestwynd and 32 km south of Moose Jaw, Saskatchewan (50°06'N, 105°42'W), at an elevation of 702 m. This sample was submitted by V.K. Prest to gain information on deglaciation and buried ice.

Comment (**V.K. Prest**): The pond sediments, till, sand and gravel appear to have sunk, slid and been washed into their present positions with more than one reversal of topography. The date agrees with others from the south side of The Coteau Moraine (e.g., S-123, 10 900 ± 700 and S-128, 10 800 ± 300, Saskatchewan III; S-173, 13 000 ± 200, Saskatchewan IV; cf. Parizek, 1964 and Christiansen, 1965). The date indicates a period of pond environment prior to melting of buried ice blocks.

S-416 Courval

Uncorrected age: 5200 ± 140

The organic silt at a depth of 7.9 m (26 ft) was collected by E.A. Christiansen in 1966 near Courval, about 55 km southwest of Moose Jaw, southern Saskatchewan (50°08'N, 106°15'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.

S-242 Crestwynd

Uncorrected age: 5500 ± 120

The marl was in a 54 cm-thick silty calcareous clay at the surface of a swell. The sample was collected by D.L. Delorme in 1963 from moderately undulating terrain near Crestwynd, about 35 km south of Moose Jaw, Saskatchewan (50°10'N, 105°20'W). This sample was submitted by W.O. Kupsch to gain information on microfossils in a superglacial lake during deglaciation.

Comment (**W.O. Kupsch**): The marl was believed to be deposited near the edge of a superglacial lake on the surface of a wasting glacier. As stagnant ice melted the original attitude of the strata was disturbed. The unit contains the following ostracode species: *Candona acutula*, *C. rawsoni*, *Cyclocypris ampla*, *Ilyocypris gibba*, *Limnocythere trapeziformis*. This date should be a minimum for deglaciation, but it is believed to be too young when other evidence is considered (Delorme, 1965).

S-236 Old Wives area

Uncorrected age: 9400 ± 160

The lake sediment, organic was enclosed in a 2-5 cm-thick sandy layer, overlain by 2.1 m of till. The sample was collected by D.L. Delorme in 1964 from the north ditch of the road southeast of Old Wives, about 40 km south of Moose Jaw, southern

Saskatchewan (50°11'45"N, 105°58'40"W). This sample was submitted by W.O. Kupsch to gain information on macrofossils.

S-235 Old Wives area

Uncorrected age: 12 000 ± 180

The marl was in 30 cm of interlaminated clay and marl and underlain by unoxidized clay. The sample was collected by D.L. Delorme in 1964 in the south ditch of the road southeast of Old Wives, about 40 km south of Moose Jaw, southern Saskatchewan (50°11'30"N, 105°55'10"W). This sample was submitted by W.O. Kupsch to gain information on deglaciation.

Comment (**W.O. Kupsch**): Dates S-235 and S-236 were underlain by a minimum of 2 ft (60 cm) of exposed unoxidized clay. S-235 is marl from the south ditch of the road in 1 ft (30 cm) of interlaminated clay and marl, overlain by 3 ft (90 cm) of unoxidized clay and 1 ft (30 cm) of till. S-236 is organic material from the north ditch of the road in 1-2" (2-5 cm) thick sandy layer, overlain by 7 ft (2.1 m) of till. Exposures show structural deformations probably caused by the collapse of lacustrine sediments on melting of stagnant ice. The marl contains the following ostracode species: *Candona acutula*, *C. candida*, *C. compressa*, *C. renoensis*, *Cyclopris ampla*, *Cypridopsis vidua*, *Limnocythere trapeziformis*, *Potamocypris smaragdina*, *Notodromas monacha*, and *Dolerocypris fasciata*. The two samples are considered to be from the same stratigraphic unit, but S-236 is more reliable (Delorme 1965: 66-68). The date is a minimum for deglaciation.

S-165 Earl Grey

Uncorrected age: 10 275 ± 225

The basal wood was in gyttja, overlain by clay and overlying 2.1 m (7 ft) of clay over till. The sample was collected by P. Gulio in 1961 from the bottom of a dugout near Earl Grey, about 55 km north of Regina, Saskatchewan (50°46'20"N, 104°37'30"W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.

Comment (**E.A. Christiansen**): The gyttja layer was overlain by 13 ft (4 m) of clay. Below the sample was 7 ft (2.1 m) of clay over till. The date is a minimum for the retreat of ice from the Conde Moraine (Greer and Christiansen, 1963).

S-110 Dinsmore

Uncorrected age: 10 300 ± 140

The wood (coniferous) was in gyttja over till at a depth of 4.4 m (14 ft). The sample was collected by E. Hill from Dinsmore, about 105 km southwest of Saskatoon, Saskatchewan (51°06'40"N, 107°29'30"W). This sample was submitted by J.H. Grant to gain information on climate change during deglaciation.

Comment (**J.H. Grant**): The sample provides information on a time period when conifers grew where today there are grasses in uplands and shrubs in depressions.

S-182 Kelliher

Uncorrected age: 9600 ± 120

The wood was near the top of a gyttja overlain by 3.3 m of postglacial alluvium and underlain by till. The sample was collected by B.A. McCorquodale in 1961 near Kelliher, about 110 km northeast of Regina, Saskatchewan (51°08'N, 103°38'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.

S-198 Gunnworth

Uncorrected age: 12 140 ± 240

The charcoal was in a 60 cm-thick organic zone in an alluvial deposit beneath 2.4 m of till. The sample was collected by D.L. Delorme in 1963 near Gunnworth, about 135 km southwest of Saskatoon, southwestern Saskatchewan (51°18'08"N, 108°12'30"W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and glacial readvance.

S-227 Greene

Uncorrected age: 10 800 ± 160

The charcoal was in calcareous lake silt at least 2.4 m (8 ft) thick at a depth of 78-80 cm. The sample was collected by D.L. Delorme in 1963 near Greene, about 230 km west-southwest of Saskatoon, western Saskatchewan (51°36'N, 109°57'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.

Quill Lake Series

A series of lake sediment samples from Quill Lake, about 160 km east of Saskatoon, Saskatchewan (51°48'N, 104°19'W) was collected by E.A. Christiansen in 1966 from locality: NE16-34-32-17-W2. The samples were submitted by E.A. Christiansen to gain information on deglaciation and the rate of accumulation of sediments.

S-294 Quill Lake I

Uncorrected age: 3500 ± 85

The sample was at a depth of 3.6 m (12 ft) below the water surface.

S-293 Quill Lake II

Uncorrected age: 5970 ± 85

The sample was at a depth of 5.1 m (17 ft) below the water surface.

S-292 Quill Lake III

Uncorrected age: 11 000 ± 150

The sample was at a depth of 8.2 m (27 ft) below the water surface.

Comment (**E.A. Christiansen**): A linear relationship between depth intervals and age suggest a uniform sedimentation at rate of 1 ft (30 cm) in 500 years. S-292 indicates that area was deglaciated more than 11 000 years ago.

S-239 Biggar

Uncorrected age: 9200 ± 150

The marl was in a 51 cm-thick lacustrine calcareous silty clay at a depth of 23 cm. The sample was collected by D.L. Delorme in 1963 from a lake in a hummocky moraine near Biggar, about 95 km west of Saskatoon, western Saskatchewan (51°56'30"N, 107°59'00"W). This sample was submitted by W.O. Kupsch to gain information on deglaciation.

Comment (**W.O. Kupsch**): The marl unit contained the following ostracode species: *Candona acutula*, *C. candida*, *C. compressa*, *C. rawsoni*, *Cyclopris ovum*, *C. ampla*, *Cypridopsis vidua*, *Ilyocypris*

gibba, *I. bradyi*, *Limnocythere trapeziformis*, and *Potamocypris smaragdina*. The date is a minimum for deglaciation (Delorme, 1965: 80-84).

S-1194 Agar Slough

Uncorrected age: 10 560 ± 255

The organic silt was in silt at a depth of 4.88 m in an augerhole in the slough bottom. The sample was collected by E.A. Christiansen in 1976 from Agar Slough, about 8 km east-southeast of junction of highway 16 and 11 in Saskatoon, Saskatchewan (52°03'N, 106°30'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and the rate of accumulation of sediments.

S-2570 Tall Pines area

Uncorrected age: 3415 ± 165

The basal fen peat was collected near Tall Pines, northeast of Big Quill Lake, east central Saskatchewan (52°22'N, 102°37'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

Evesham Series

A series of samples from Evesham, about 220 km west of Saskatoon, western Saskatchewan (52°29'N, 109°57'W) was collected by E.A. Christiansen in 1965 from locality: NW12-34-40-28-W3. These samples were submitted by E.A. Christiansen to gain information on deglaciation.

S-401 A Evesham I

Uncorrected age: 12 725 ± 135

The calcareous silt and clay sample (90 cm (3 ft) depth) was in silt and clay overlying till from a collapsed pond deposit on stagnant ice.

S-300 A Evesham II

Uncorrected age: 14 670 ± 240

The freshwater gastropod shells at a depth of 1.8 m (6 ft) were in lacustrine silt and clay over till.

S-300 B Evesham III

Uncorrected age: 15 850 ± 225

The organic silt and clay from 1.8 m (6 ft) depth was in lacustrine silt and clay over till.

S-401 B Evesham IV

Uncorrected age: 18 000 ± 275

The organic silt and clay from 90 cm (3 ft) depth was in silt and clay over till from a collapsed pond deposit on stagnant ice.

Comment (**E.A. Christiansen**): The close agreement of S-300A and B suggests that the dates are acceptable. S-401A is also an acceptable date because it is stratigraphically higher and therefore younger. S-401B, however, does not fit the stratigraphic sequence and is therefore unacceptable. S-402A and B were run on separate portions of same sample. The difference in measurements suggests the material is not homogeneous. Because the glacial lake in which samples 402A and B were deposited must predate the Quill Lake date (S-292, above: 11.0 ka BP), it is concluded that S-402A and B

were contaminated by recent carbon through soil-forming processes. S-300A and B show glacier retreat from the area more than 15 000 years ago.

GSC-642 near Atton Lake

Uncorrected age: 11 090 ± 160

The basal organic silt at a depth of 881-894 cm had sand below and marly gyttja above. The sample was collected by R.J. Mott in 1966 from a lake about 0.8 km (0.5 mile) west of Atton Lake and 5.6 km (3.5 miles) east-northeast of "Cutknife Hill", about 40 km west-northwest of North Battleford, southwestern Saskatchewan (52°50'30"N, 108°53'00"W), at an elevation of 523 m. This sample was submitted by R.J. Mott to gain information on deglaciation.

Comment (**R.J. Mott**): The date gives a minimum age for deglaciation. As the lake is in a dune area and within the maximum limit of a glacial lake, an unknown interval elapsed between deglaciation and the start of organic deposition.

GSC-648 North Saskatchewan River

Uncorrected age: 11 560 ± 640

The basal organic at a depth of 590 to 620 cm was overlain by marly gyttja and underlain by sand. The sample was collected by R.J. Mott in 1966 from a lake on the north bank of the North Saskatchewan River, 5 km northeast of centre of Prince Albert, Saskatchewan (53°14'15"N, 105°43'30"W), at an elevation of 442 m. This sample was submitted by R.J. Mott to gain information on deglaciation.

Comment (**R.J. Mott**): The date is a minimum for deglaciation. Following deglaciation a stage of Glacial Lake Agassiz covered the area for an unknown length of time and was followed by dune building before the first organic sediments were deposited.

GX-2254 Ladder Valley

Uncorrected age: 11 610 ± 450

The organic silt at a depth of 10 m (33 ft) was collected by E.A. Christiansen in 1970 from Ladder Valley, about 100 km northwest of Prince Albert, central Saskatchewan (53°46'N, 106°54'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and glacial readvance.

GSC-647 Waskesiu

Uncorrected age: 10 260 ± 170

The basal organic at a depth of 496-504 cm was overlain by banded marl and gyttja and underlain by coarse sand and pebbles. The sample was collected by R.J. Mott in 1966 from a small lake about 14 km south of Waskesiu, Prince Albert National Park, central Saskatchewan (53°48.0'N, 106°04.2'W), at an elevation of about 519 m. This sample was submitted by R.J. Mott to gain information on deglaciation.

Comment (**R.J. Mott**): The date is a minimum age for deglaciation.

S-2573 Noyes Lake area

Uncorrected age: 3750 ± 120

The basal fen peat was from the Noyes Lake area, near Nepawin Provincial Park, Saskatchewan (53°58'N, 104°52'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2575 Nikik Lake
Uncorrected age: 3470 ± 230
The basal fen peat was near Nikik Lake, east of Prince Albert National Park, central Saskatchewan (54°00'N, 105°52'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2574 Dunster Lake
Uncorrected age: 5215 ± 140
The basal fen peat was from Dunster Lake, near Montreal Lake, Saskatchewan (54°15'N, 105°57'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2584 Green Lake
Uncorrected age: 4215 ± 175
The basal fen peat was collected north of Green Lake, east of Meadow Lake Provincial Park, west central Saskatchewan (54°28'N, 107°51'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

GSC-494 Molanosa
Uncorrected age: 4200 ± 130
The basal peat was enclosed in boulders and sand with 1.2 m of peat above. Sample MS-65-20 was collected by R.J. Mott in 1965, from a drainage ditch in a bog beside highway 2, about 5 km (3 miles) north of Molanosa, about 145 km north of Prince Albert, central Saskatchewan (54°33'N, 105°32'W), at an elevation of about 509 m. This sample was submitted by R.J. Mott to gain information on deglaciation and the initiation of peat accumulation.

Comment (**R.J. Mott**): The sample was dated to provide a minimum age for deglaciation. The young date gives the age for the beginning of peat accumulation at the site.

S-1066 Hanson Lake
Uncorrected age: 5570 ± 95
The basal peat at a depth of 3 m (10 ft) was overlain by peat and underlain by silty clay. The peat was collected by E.A. Christiansen in 1975, from Hanson Lake, about 60 km west of Flin Flon, east central Saskatchewan (54°42'N, 102°53'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and the initiation of peat accumulation.

S-2578 Lac la Ronge
Uncorrected age: 6240 ± 165
The basal fen peat was southwest of Lac la Ronge, near Molanosa, central Saskatchewan (54°43'N, 105°28'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2579 Gasat Lake
Uncorrected age: 7400 ± 170
The basal fen peat was collected near Gasat Lake, northeastern Saskatchewan (54°49'N, 105°33'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

Flin Flon Series
A series of peat samples from west of Flin Flon, northeastern Saskatchewan (54°53'N, 102°05'W) was collected and submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2571 Flin Flon I
Uncorrected age: 5975 ± 210
A basal fen peat sample.

S-2572 Flin Flon II
Uncorrected age: 7255 ± 250
A basal limnic peat sample.

S-1331 Marl Pond
Uncorrected age: 10 200 ± 200

The basal marl sample was collected by M. Wilson in 1976 from Marl Pond, near Naniskak Lakes, 4.5 km south of La Ronge in central Saskatchewan (55°03'N, 105°18'W). This sample was submitted by M. Wilson to gain information on deglaciation.

S-2576 English Creek
Uncorrected age: 8010 ± 170

The basal fen peat was near English Creek, west of Lac la Ronge in central Saskatchewan (55°11'N, 105°20'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

GSC-643 Cycloid Lake
Uncorrected age: 8520 ± 170

The lake sediment at a depth of 323-328 cm was underlying brown organic clay grading into stiff, gray, inorganic clay at 340 cm. A core was collected by R.J. Mott in 1966 from a small lake in bedrock depression, Cycloid Lake, about 19 km north of La Ronge, central Saskatchewan (55°15'N, 105°16'W), at an elevation of 396 m. This sample was submitted by R.J. Mott to gain information on deglaciation.

Comment (**R.J. Mott**): Organic matter was present in the clay below the material that was used for dating. The date is a minimum for deglaciation.

S-2581 Lac la Ronge
Uncorrected age: 6405 ± 255

The basal fen peat was from Lac la Ronge Provincial Park in central Saskatchewan (55°20'N, 104°55'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-1504 'Lake A'
Uncorrected age: 8060 ± 160

The basal gyttja was in organic clay in pond sediments at a depth of 350 cm. A core was collected by M. Wilson and J. Terasmae in 1977 from an unnamed lake ('Lake A') 36 km north of La Ronge in central Saskatchewan (55°20'N, 105°03'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the rate of accumulation of sediments.

- S-1502** Naniskak Lakes
Uncorrected age: 7680 ± 90
- The lake sediment, basal gyttja, was in organic clay in pond sediments at a depth of 450 cm. A core was collected by M. Wilson and J. Terasmae in 1977, from west Naniskak Lakes, about 45 km north of La Ronge, central Saskatchewan (55°26'N, 104°56'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and rate of accumulation of sediments.
- S-2577** Lac la Ronge
Uncorrected age: 5270 ± 205
- The basal fen peat was from Lac la Ronge Provincial Park in central Saskatchewan (55°32'N, 104°48'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and initiation of peat accumulation.
- S-949** Wheeler Creek
Uncorrected age: 7305 ± 95
- The basal gyttja was overlying sand and silt at a depth of 3.7 m. The sample was collected by E.A. Christiansen, D.W. Alley and B.T. Schreiner in 1974 from an augersite on road fill of highway 102 at the bridge crossing Wheeler Creek, about 60 km northeast of La Ronge, Saskatchewan (55°35'N, 104°47'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.
- S-122** La Ronge area
Uncorrected age: 5050 ± 80
- The wood was in bog sediments at a depth of 2.4 m (7'3"), 20.3 cm (9 inches) above the underlying silty clay. The sample was collected by J.S. Maini in August, 1960, from the La Ronge area in central Saskatchewan (55°36'N, 105°17'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation.
- GSC-1446** McLennan Lake area
Normalized age: 8590 ± 230
 $\delta^{13}\text{C} = -29.1\text{‰}$
- The lake sediment was in silty clay and algal gyttja overlying coarse gravel at 500 cm depth. Sample MS-70-3 (489-494 cm) was collected by R.J. Mott in 1970, from a small unnamed lake in a bedrock basin on the northwest side of McLennan Lake, south of the Cree Lake Moraine, about 110 km north-northeast of La Ronge, central Saskatchewan (55°53'20"N, 104°24'30"W), at an elevation of 485 m. This sample was submitted by R.J. Mott to gain information on deglaciation.
- Uncorrected age: 8650 ± 230
- Comment (**W. Blake, Jr.**): Originally a date of 8640 ± 240 ($\delta^{13}\text{C} = -29.1\text{‰}$; normalized age 8580 ± 240) was used by Mott (1971). The same gas was re-counted, and the result, given here is considered a better estimate (cf. GSC-1466, below).
- Comment (**R.J. Mott**): The date is a minimum for deglaciation.
- S-2582** Buffalo Narrows
Uncorrected age: 6855 ± 160
- The basal fen peat was near Buffalo Narrows in western Saskatchewan (55°54'N, 108°35'W). This sample was submitted by
- S.C. Zoltai to gain information on deglaciation and initiation of peat accumulation.
- S-1047** Royal Lake
Uncorrected age: 5455 ± 80
- The sample at a depth of 1 m was overlying blue clay (81 cm) and under peat (20 cm), and 1.27 m humus-clay, in permafrost. The peat was collected by W.G.Q. Johnston in 1974, from Royal Lake, about 30 km south of the Southend Reindeer, northeastern Saskatchewan (56°07'N, 103°11'W). This sample was submitted by E. A. Christiansen to gain information on deglaciation and the initiation of peat accumulation.
- GSC-1466** Lake 1570
Normalized age: 8560 ± 260
 $\delta^{13}\text{C} = -19.2\text{‰}$
- The lake sediment, basal organic, had silty clay with organic silt below and algal gyttja above. Sample MS-70-6 (562-572 cm) was collected by R.J. Mott in 1970 from a bay at the east end of an unnamed lake, "Lake 1570", about 142 km north-northeast of La Ronge, central Saskatchewan (56°07'30"N, 104°24'29"W), at an elevation of about 480 m. This sample was submitted by R.J. Mott to gain information on deglaciation.
- Uncorrected age: 8470 ± 260.
- Comment (**W. Blake, Jr.**): This sample was originally dated 8230 ± 250 years ($\delta^{13}\text{C} = -19.2\text{‰}$; normalized age, 8320 ± 250). The same gas was re-counted and this date is considered to be a better estimate. The age of the basal organic material is nearly identical to the value obtained for an unnamed lake near McLennan Lake, south of the Cree Lake moraine (GSC-1446, 8590 ± 230 years, Lowdon and Blake, 1975), as well as for 'Cycloid Lake' still farther south and only 19 km north of La Ronge (GSC-643, 8520 ± 170 years; Lowdon et al., 1967, p. 167; Mott, 1973). The sample from 'Lake 1570' most closely approximates the time of deglaciation.
- Comment (**R.J. Mott**): This lake is north of the Cree Lake moraine. The date is a minimum for the time of formation of the moraine and for deglaciation (Mott, 1971).
- S-1068** Southend Road
Uncorrected age: 4560 ± 80
- The basal peat at a depth of 3 m (10 ft) was overlain by peat and underlain by silt and till. The sample was collected by D.W. Alley in 1975 from Southend (Reindeer) Road, northeastern Saskatchewan (56°15'N, 103°30'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.
- S-1231** Reindeer Lake
Uncorrected age: 6420 ± 115
- The basal peat was located at a depth of 1.8 m was in peat and overlying silt. The sample was collected by D.W. Alley in 1976 from palsa on a topographic high, at the junction of highways 102 and 105, Reindeer Lake, northeastern Saskatchewan (56°15'N, 103°35'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.
- S-1069** Wollaston Lake Road
Uncorrected age: 2090 ± 70

The peat at a depth of 3 m (10 ft) was overlain by peat and underlain by silt and till. The sample was collected by D.W. Alley in 1975 from "Mile 8" on Wollaston Lake road, northeastern Saskatchewan (56°22'N, 103°32'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

GSC-4821 Nipawin Bay

Normalized age: 10 600 ± 120
 $\delta^{13}\text{C} = -28.4\text{‰}$

The basal gyttja was in greenish-grey gyttja over organic streaked clay and laminated and banded grey clay. Sample AP-88-4 (957-964 cm) was collected by T.W. Anderson on August 17, 1988 from Nipawin Bay, Frobisher Lake, about 12 km southeast of Turnor Lake, about 408 km east-southeast of La Loche, northwestern Saskatchewan (56°24'28"N, 108°33'00"W), at an elevation of 408 m. This sample was submitted by T.W. Anderson to gain information on lake level change in Glacial Lake Agassiz during deglaciation.

Uncorrected age: 10 600 ± 120.

Comment (T.W. Anderson): The sediment sample occurs at the base of greenish-grey gyttja above organic streaked clay, which in turn, overlies laminated and banded grey and reddish-grey clay. The laminated and banded clay sequence implies deposition in a large proglacial lake that was in contact with the Laurentide ice. The gradational change from clay to organic lake sediment suggests that the site changed gradually to the shallower and more restricted basin of the present embayment with initiation of organic deposition. The date for the basal organic sediments indicates that the Laurentide ice margin had retreated north of the Frobisher Lakes lowland which connects to the Clearwater River valley and the proglacial lake had drained prior to this date, i.e. about 11 000 BP (Anderson and Lewis, 1992). See also comments for Long Lake (GSC-4807, below) which is located in the same topographic lowland.

S-1071 Wollaston Lake Road

Uncorrected age: 6910 ± 100

The basal peat was overlain by peat and underlain by silt and silty sand units. The sample at a depth of 2.7 m (9 ft) below the surface, in permafrost, was collected by D.W. Alley in 1975 from Wollaston Lake Road, northeastern Saskatchewan (56°40'N, 103°35'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

GSC-5381 McBeath Lake

Normalized age: 9800 ± 100
 $\delta^{13}\text{C} = -20.6\text{‰}$

The basal gyttja had light brown gyttja above and greenish-brown sandy silt below. Sample AP-88-3 (579-583 cm) was collected by T.W. Anderson on October 10, 1988 from McBeath Lake about 40 km northeast of La Loche, northwestern Saskatchewan (56°42'40"N, 109°05'00"W), at an elevation of 472 m. This sample was submitted by T.W. Anderson to gain information on deglaciation.

Uncorrected age: 9730 ± 100.

GSC-4807 Long Lake

Normalized age: 11 100 ± 150
 $\delta^{13}\text{C} = -23.5\text{‰}$

Sample AP-88-1 (basal detrital gyttja, 695-701 cm) was in sandy clay. The sample was collected by T.W. Anderson on August 10, 1988 from Long Lake, about 50 km northwest of La Loche, northwestern Saskatchewan (56°51'40"N, 108°59'20"W), at an elevation of 414.8 m. This sample was submitted by T.W. Anderson to gain information on lake level change in Glacial Lake Agassiz during deglaciation.

Uncorrected age: 11 000 ± 150.

Comment (T.W. Anderson): The sediment sample occurs at the base of a detritus-rich clay interval over interbedded sandy clay and sand which, in turn, overlies laminated to varved grey clay. The sequence of laminated clay and interbedded, massive sandy clays imply deposition in a large proglacial lake that was in contact with the Laurentide ice. The sand at the top of the sequence was probably a lag deposit that accumulated during the drawdown phase of the proglacial lake. The overlying detritus-rich clay is thought to represent reworked glaciolacustrine clay that was washed into the Long Lake basin prior to stabilization of the slopes by vegetation and the onset of organic deposition in the lake. The date for the basal organic sediments indicates that the Laurentide ice margin had retreated north of the topographic lowland (in which Long Lake is situated) connecting to the Clearwater River valley and the proglacial lake had drained by 11 000 years BP (Anderson and Lewis, 1992). Isobases on Lake Agassiz suggest that the topographic lowland which lies 20 to 30 m below the projected Agassiz water surface (Campbell level, here 440-450 m above sea level) could have connected the Agassiz basin to the Clearwater valley. Further studies are in progress and others are being planned to confirm if the proglacial lake was Glacial Lake Agassiz.

S-1072 Wollaston Lake Road

Uncorrected age: 4285 ± 70

The peat at a depth of 2.1 m (7 ft) was collected by D.W. Alley in 1975 from Wollaston Lake Road, northeastern Saskatchewan (56°59'N, 103°36'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

S-1486 Mile 60

Uncorrected age: 1800 ± 70

The basal peat was in peat overlying gravels. Sample BS-1745: 1-3 (3 m depth (10 ft)) was collected by B.T. Schreiner in 1978 from "Mile 60" on the winter road to Cluff Lake, northeast of Descharme Lake, Saskatchewan (57°08'N, 109°05'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

GSC-4832 Fontaine Lake

Normalized age: 9230 ± 120
 $\delta^{13}\text{C} = -27.0\text{‰}$

The basal woody gyttja was in black gyttja above sandy stony clay (till). Sample AP-88-5 No.2 (12.05-12.09 m) was collected by T.W. Anderson on August 19, 1988 from Fontaine Lake, about 80 km northwest of La Loche, and about 36 km north of the Clearwater River valley, northwestern Saskatchewan (57°12'52"N, 109°03'24"W), at an elevation of 467 m. This sample was submitted by T.W. Anderson to gain information on deglaciation.

Uncorrected age: 9260 ± 120.

Comment (T.W. Anderson): The sediment sample occurs at the base of black gyttja above sandy stony clay which is interpreted to

be till. The date provides a minimum age for deglaciation of the area just north of the Clearwater River spillway.

S-1223 Mile 100

Uncorrected age: 5660 ± 70

The basal peat containing charcoal d seeds was in 1.4 m of peat over sandy till laden with pebbles, overlain by 0.6 m of fill. Sample BS-1241 (1.8 m depth (6 ft)) was collected by B.T. Schreiner in 1976 from "Mile 100" on highway 105, Wollaston Lake area, northeastern Saskatchewan (57°29'N, 103°58'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1487 Mile 106

Uncorrected age: 6980 ± 100

The basal peat was in peat overlying sandy silt. Sample BS-1752: 1-4 (2.4 m below surface) was collected by B.T. Schreiner in 1978 from "Mile 106" on the winter road to Cluff Lake, near Sholte Lake, Saskatchewan (57°40'N, 109°28'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1332 Rabbit Lake

Uncorrected age: 8340 ± 160

The basal peat was in lacustrine peat over till. Sample BS-1740 was collected by B. Geddes in 1977 from the north end of "Rabbit Lake", Wollaston Lake area, Saskatchewan (58°12'N, 103°42'W), at an elevation of 420 m. This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

Comment (**B.T. Schreiner**): This probably dates the formation of the lake. It was sampled from an open-cut through the basin of Rabbit Lake (drained).

GSC-3211 McClean Lake

Uncorrected age: 6960 ± 80

The basal peat sample 64L801328 (190-194 cm) was collected by R.N.W. DiLabio and W.B. Coker in 1980 from McClean Lake, west of Wollaston Lake, northeastern Saskatchewan (58°16'N, 103°52'W), at an elevation of 435 m. This sample was submitted by R.N.W. DiLabio to gain information on deglaciation and the initiation of peat accumulation.

Comment (**R.N.W. DiLabio**): The date is a minimum age for deglaciation and organic accumulation at the site. Unpublished GSC Plant Macrofossil Report 81-7 and unpublished GSC Fossil Arthropod Report 81-8 by J.V. Matthews, Jr. indicate that the fossil assemblage is typical of a poorly drained site within the spruce treeline.

S-1555 Cluff Lake

Uncorrected age: 3680 ± 100

The peat was enclosed in a small organic lens above green basal till and underlying sandy till. Sample BS-2328 (1.2 m (4') depth) was collected by B.T. Schreiner in 1978 from near Cluff Lake, about 140 km south of Lake Athabasca, northern Saskatchewan (58°20'N, 109°35'W), at an elevation of 375 m. This sample was submitted by B.T. Schreiner to gain information on paleobotany and deglaciation.

Amok Mine Series

A series of samples from a peat bog, Amok Mine Site, south of Lake Athabasca, Saskatchewan (58°30'15"N, 109°32'10"W) was collected by S. Wilson in 1983 and samples were submitted by B.T. Schreiner to gain information on deglaciation.

S-2463 Amok Mine I

Uncorrected age: 5085 ± 100

The peat sample was 300 cm below the surface.

S-2464 Amok Mine II

Uncorrected age: 8055 ± 125

The peat sample was 300 cm below the surface.

S-1659 Carswell Lake

Uncorrected age: 4690 ± 70

The basal black peat with wood chips was in fibrous peat overlying sand and till. Sample BS-2361 1-5 (depth 2.4 m) was collected by B.T. Schreiner in 1979 from the south shore of Carswell Lake, about 110 km south of Lake Athabasca, Saskatchewan (58°31'N, 109°24'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1885 Karen Lake

Uncorrected age: 3690 ± 90

The organic material and plant debris from between sandy tills at a depth of 60 cm was collected by S. Earle in 1980 from a former bog area, "Karen Lake", east of Stony Rapids, northern Saskatchewan (59°07'N, 104°23'W). This sample was submitted by S. Earle to gain information on deglaciation.

S-1560 Black Lake

Uncorrected age: 6860 ± 110

The basal peat was underlain by ground ice in a discontinuous permafrost zone. The sample was collected at a depth of 0.9 m by D.W. Alley in 1978 from a palsa at Black Lake, about 35 km east of Stony Rapids, northern Saskatchewan (59°08'N, 104°53'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

S-1746 Flatt Lake

Uncorrected age: 5850 ± 70

The peat (sample SM-153 (depth 3 m)) was collected by S. McNamara in 1979 from Phelps Lake (Flatt Lake), northeastern Saskatchewan (59°10'36"N, 103°06'11"W). This sample was submitted by S. McNamara to gain information on deglaciation and peat accumulation. See cover photo.

S-1745 Wapiyao Lake

Uncorrected age: 3510 ± 80

The peat was overlain by 20 cm of till. Sample SM-128 (70 cm depth in a test pit) was collected by S. McNamara in 1979 from near Wapiyao Lake, about 125 km east-northeast of Stony Rapids,

northern Saskatchewan (59°33'N, 103°52'W). This sample was submitted by S. McNamara to gain information on deglaciation.

Fredette Lake Series

A series of peat samples from a road cut exposure in a 2 m organic horizon that was frozen near the base and overlying rock., near Fredette Lake, about 7 km from Uranium City, northern Saskatchewan (59°36'N, 108°35'W) was collected by B.T. Schreiner in 1978 and samples were submitted to gain information on deglaciation and the initiation of peat accumulation.

S-1557 Fredette Lake I

Uncorrected age: 3430 ± 100

The peat sample (BS-1891: 1-1) was at a depth of 2 m.

S-1558 Fredette Lake II

Uncorrected age: 3220 ± 100

The peat sample (BS-1891: 1-2) was at a depth of 3 m.

S-2518 Hatle Lake

Uncorrected age: 6560 ± 85

The peat was in peat and overlying bedrock. Sample EN-T4029 (depth 6 m) was collected by B.T. Schreiner in 1984 from Hatle Lake, 155 km northeast of Stony Rapids, Saskatchewan (59°57'N, 103°27'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initialization of peat accumulation

DATES RELATED TO LATE WISCONSIN GLACIAL LAKES (Fig. II-4)

Lake Agassiz

GX-10669 Nipawin
Uncorrected age: 9490 ± 540

The wood was enclosed in silty clay at a depth of 12.2 m. The sample was collected by B.T. Schreiner in 1984, from Nipawin, Saskatchewan (53°16'40"N, 103°55'2"W). This sample was submitted by B.T. Schreiner to gain information on Nipawin delta sedimentation and lake level change in Lake Agassiz.

S-2416 Nipawin
Uncorrected age: 9585 ± 115

The wood was enclosed in silt at a depth of 11.3 m (37 ft) with sand above and silt, clay and sand below. The sample was collected by E.A. Christiansen from the shoulder of a distributary channel, Nipawin, Saskatchewan (53°20'N, 103°56'W). This sample was submitted by B.T. Schreiner to gain information on lake level change in Lake Agassiz and delta formation.

S-638 Nipawin
Uncorrected age: 15 250 ± 230

The organic silt was located at a depth of 5.2-7.3 m (17-24 ft) and was collected by E.A. Christiansen in 1971 in Nipawin, Saskatchewan (53°20'N, 104°01'W). This sample was submitted by E.A. Christiansen to gain information on lake level change in Lake Agassiz.

S-2933 Boot Lake
Uncorrected age: 3575 ± 115

The basal peat at a depth 6.7 m was overlying glaciolacustrine sediments. Sample 310 was collected by M. Simpson on September 28, 1987 from Boot Lake on West Arm Mine Road, 7 km southeast of Creighton, near Flin Flon, Saskatchewan (54°39'55"N, 101°54' 30"W), at an elevation of 326 m. This sample was submitted by J.E. Campbell to gain information on the draining of Lake Agassiz and the initiation of peat accumulation.

S-2934 Flin Flon
Uncorrected age: 2720 ± 105

The basal peat at a depth 7.2 m was overlying glaciolacustrine sediments. Sample 306 was collected by M. Simpson on September 27, 1987 from West Arm Mine Road, southeast of Creighton, near Flin Flon, Saskatchewan (54°44'20"N, 101°53'50"W), at an elevation of 333 m. This sample was submitted by J.E. Campbell to gain information on the draining of Lake Agassiz and the initiation of peat accumulation.

Rabbit Creek Series

A series of organic silt samples from Rabbit Creek, along highway 2, about 32 km south of La Ronge, central Saskatchewan (54°53'N, 105°22'W) was collected by B.T. Schreiner in 1979 and samples were submitted to gain information on lake level change in Lake Agassiz and glacial readvance. The samples were regarded to be contaminated with coal during deposition.

S-1808 Rabbit Creek I
Uncorrected age: >33 000

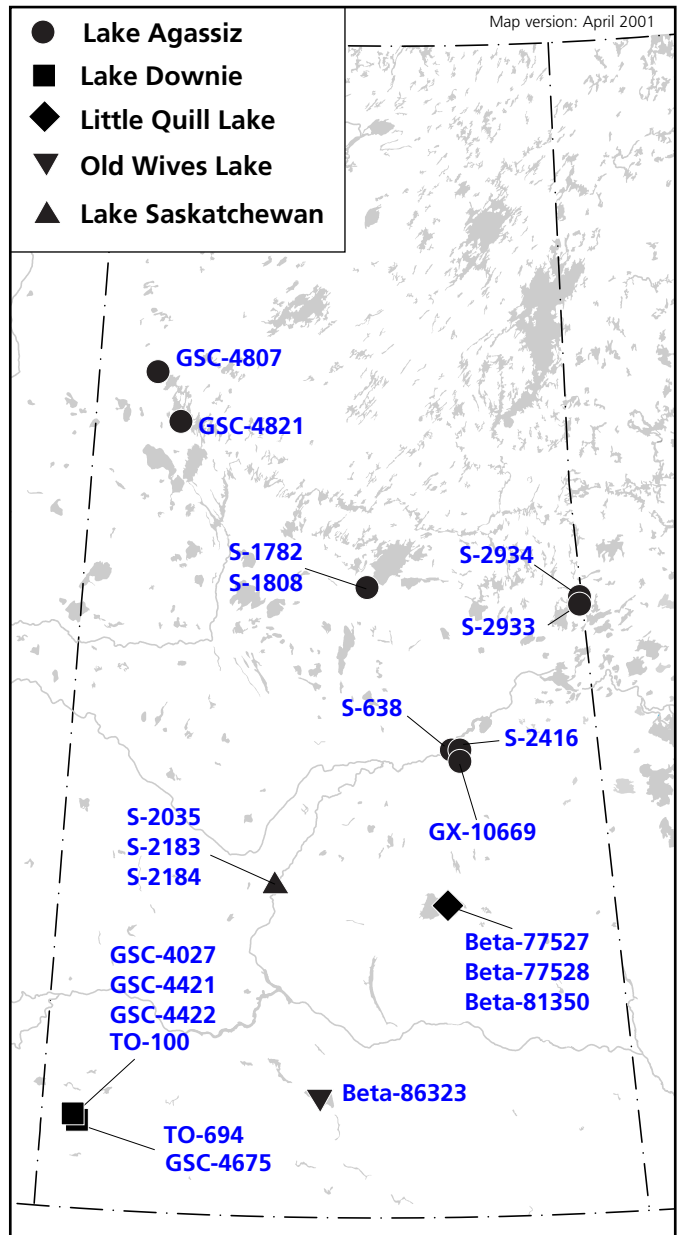


Fig. II-4. Dates related to Late Wisconsin glacial lakes: Lake Agassiz; Lake Downnie; Little Quill Lake; Old Wives Lake and Lake Saskatchewan

The organic silt sample (9.4 m depth) was in the top of clayey silt which was underlying 6.4 m of sandy glacial till.

S-1782 Rabbit Creek II
Uncorrected age: >35 550

The organic silt sample (17 m depth) was enclosed in silty clay overlying glacial till.

GSC-4821 Nipawin Bay
Normalized age: 10 600 ± 120
 $\delta^{13}C = -28.4\text{‰}$

The lake sediment was enclosed in greenish-grey gyttja over organic streaked clay over laminated and banded grey clay. Sample

AP-88-4 (957-964 cm) was collected on August 17, 1988 by T.W. Anderson from Nipawin Bay, Frobisher Lake, about 12 km southeast of Turnor Lake, and 55 km east-southeast of La Loche, northwestern Saskatchewan (56°24'28"N,108°33'00"W), at an elevation of 830 m. This sample was submitted by T.W. Anderson to gain information on lake level changes in Lake Agassiz during deglaciation.

Uncorrected age: 10 600 ± 120.

Comment (**T.W. Anderson**): The sediment sample occurs at the base of greenish-grey gyttja, organic streaked clay, which in turn, overlies laminated and banded grey and reddish-grey clay. The laminated and banded clay sequence implies deposition in a large proglacial lake that was in contact with Laurentide ice. The gradational change from clay to organic lake sediment suggests that the site changed gradually to the shallower and more restricted basin of the present embayment with the initiation of organic deposition. The date for the basal organic sediments indicates that the Laurentide ice margin had retreated north of the Frobisher Lakes lowland which connects to the Clearwater River valley and the proglacial lake had drained prior to this date, i.e. about 11 000 BP (Anderson and Lewis, 1992). See also comments for Long Lake (GSC-4807) which is located in the same topographic lowland.

GSC-4807 Long Lake

Normalized age: 11 100 ± 150
 $\delta^{13}\text{C} = -23.5\text{‰}$

The lake sediment, basal detrital gyttja, was enclosed in sandy clay. Sample AP-88-1 (695-701 cm) was collected by T.W. Anderson on August 10, 1988, from Long Lake, about 50 km northwest of La Loche, northwestern Saskatchewan (56°51'40"N,108°59'20"W), at an elevation of 414.8 m. This sample was submitted by T.W. Anderson to gain information on lake level change in Lake Agassiz during deglaciation.

Uncorrected age: 11 000 ± 150

Comment (**T.W. Anderson**): The sediment sample occurs at the base of a detritus-rich clay interval overlying interbedded sandy clay and sand which, in turn, overlies laminated to varved grey clay. The sequence of laminated clay and interbedded, massive sandy clay imply deposition in a large proglacial lake that was in contact with the Laurentide ice sheet. Sand at the top of the sequence was probably a lag deposit that accumulated during the drawdown phase of the proglacial lake. The overlying detritus-rich clay is thought to represent reworked glaciolacustrine clay that was washed into the Long Lake basin prior to the stabilization of the slopes by vegetation and onset of organic deposition in the lake. The date for the basal organic sediments indicates that the Laurentide ice margin had retreated north of the topographic lowland of Long Lake which connects to the Clearwater River valley and therefore the proglacial lake had drained by 11 000 BP (Anderson and Lewis, 1992). Isobases on Lake Agassiz suggest that the topographic lowland which lies 20 to 30 m below the projected Agassiz water surface (Campbell level, here 440-450 m above sea level) could have connected the Agassiz basin to the Clearwater valley. Further studies are in progress and others are being planned to confirm if the proglacial lake was Glacial Lake Agassiz.

Lake Downie

Maple Creek Series

A series of freshwater shell samples from 10 km south of the town of Maple Creek, southwestern Saskatchewan (49°49'20"N,

109°29'00"W), at an elevation of 833 m, was submitted to gain information on lake level change during deglaciation.

GSC-4675 Maple Creek I

Normalized age: 14 300 ± 340
 $\delta^{13}\text{C} = -5.49\text{‰}$

The gastropod shells (*Stagnicola eloides* (Say, 1821); identified by J.E. Dale) were in glaciolacustrine silts underlain by silt/fine sands with diamicton intercalations. Sample "Fleming Creek No. 1" was collected by W.J. Vreeken and T.G. McCulloch on August 8, 1986 and was submitted by W.J. Vreeken and R.W. Klassen.

Uncorrected age: 14 000 ± 340.

TO-694 Maple Creek II

Corrected age: 13 120 ± 80

The sample (*Stagnicola* cf. *eloides*; identified by J.E. Dale) was enclosed in the uppermost part of a very thick sequence of lacustrine sediments. Sample KJ-287-86 was collected by W.J. Vreeken, T.G. McCulloch, and R. Klassen on August 8, 1987 and was submitted by W.J. Vreeken.

The age was corrected to $\delta^{13}\text{C} = 0.09\text{‰}$

Comments (**W.J. Vreeken**): The site is located within a low-relief hummocky lake plain terrane, underlain by up to 50 m of silts and fine sands with diamicton intercalations, all deposited in Glacial Lake Downie. These freshwater gastropod shells were confined to a 10 cm stratum, about 2.5 m beneath the land surface. They were exposed in an otherwise nonfossiliferous 5 m thick sequence of normal-faulted, planar-and crossbedded sands.

1. This date serves as a comparison for an accelerator date (TO-694) which gave an age of 13 120 ± 80 BP for a shell from the same species and from the same stratum. The average value of 13.5 ka is assumed to date the end of the existence of Glacial Lake Downie.
2. Glacial Lake Downie occupied formerly glaciated terrain between the Green Lake end moraine, which marks the Late Wisconsinan terminus around nonglaciated parts of the Cypress Hills (Westgate, 1968; Vreeken, 1986; Klassen and Vreeken, 1987), and the Lethbridge moraine, which marks a pause during the Late Wisconsinan glacial retreat.

These ice-marginal positions were abandoned in quick succession (Vreeken, 1989). The radiocarbon dates demonstrate that the Green Lake position was abandoned before 13.5 ka and that the Lethbridge position was abandoned between 13.5 ka and about 11.2 ka, the latter being the minimum age estimate for the Manyberries Bed of the Glacier Peak tephra which was deposited on the Lethbridge moraine.

GSC-4421 Maple Creek

Normalized age: 45 ± 50
 $\delta^{13}\text{C} = -24.7\text{‰}$

The charred wood fragments (*Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-16)) were enclosed in sandy loam. Sample "Gap Creek, Site 3B" was collected by W.J. Vreeken and T.G. McCulloch on August 6, 1986. It was taken from the right bank of the creek, 10 km southwest of the town of Maple Creek, southwestern Saskatchewan (49°51.05'N, 109°35.25'W), at an elevation of about 830 m. This sample was submitted by

R.W. Klassen to gain information on lake level change in Glacial Lake Downie.

Uncorrected age: 40 ± 50.

See GSC-4027 (below) for additional comments.

GSC-4422 Maple Creek

Normalized age: 7220 ± 80
 $\delta^{13}\text{C} = -27.2\text{‰}$

The wood fragments (*Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-17)) were in gravelly sand. Sample "Gap Creek, Site 2" was collected by W.J. Vreeken and T.G. McCulloch on August 6, 1986. The sample was taken from the left bank of the creek, near The Weir, 10 km southwest from town of Maple Creek, southwestern Saskatchewan (49°51'05"N, 109°35'25"W), at an elevation of 790 m. This sample was submitted by W.J. Vreeken and R.W. Klassen to gain information on lake level change in Glacial Lake Downie.

Uncorrected age: 7270 ± 80.

See GSC-4027 (below) for additional comments.

TO-100 Maple Creek

Normalized age: 3600 ± 80

The bone was enclosed in sandy alluvium. Sample "Gap Creek (2 m depth)" was collected by W.J. Vreeken and T.G. McCulloch. The sample was taken from the bank of the creek at The Weir, 10 km southwest of the town of Maple Creek, southwestern Saskatchewan (49°51'33"N, 109°35'00"W), at an elevation of about 785 m. This sample was submitted by W.J. Vreeken and R.W. Klassen to gain information on lake level change of Glacial Lake Downie.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

See GSC-4027 (below) for additional comments.

GSC-4027 Gap Creek

Normalized age: 3190 ± 60
 $\delta^{13}\text{C} = -9.30\text{‰}$

The freshwater shells (*Sphaerium* cf. *simile* (Say, 1816); identified by J. Dale) were enclosed in cross-bedded fluvial sands. Sample KJ-13-83(1984), Gap Creek Site 1, was collected by W.J. Vreeken and B.M.J. Friske on August 20, 1984. It was taken from the right bank of Gap Creek, 1200 m upstream from The Weir dam, 9 km southwest of Maple Creek, southwestern Saskatchewan (49°51'33"N, 109°35'00"W), at an elevation of 785 m. This sample was submitted by W.J. Vreeken and R.W. Klassen to gain information on lake level change in Glacial Lake Downie.

Uncorrected age: 2940 ± 60.

Comment (**R.W. Klassen**): Gap Creek dates (GSC-4027, -4421, -4422) refer to postglacial fluvial sediments from the Gap Creek valley, between 9 and 10 km southwest of the town of Maple Creek. The basin upland is the bottom of Glacial Lake Downie, at about 830 m elevation, and is separated from the present day stream bed, at about 788 m elevation, by three fluvially formed surfaces (L1, L2 and L3). The L3-surface, at 800 m, marks a relict alluvial fan underlain by 8 m of fine-sandy fan sediments with an intercalation of 6800-year old Mazama tephra, 5 m above the base. The fan unit is underlain by a 1.5 m thick unit of fluvial gravel and sand, with wood fragments (GSC-4422) in the top part, resting on bedrock. The

L2-surface is a paired fluvial terrace at 795 m elevation and is the most extensive alluvial surface in the valley. It is underlain by a 4 to 7 m-thick alluvial sand unit resting on the same gravelly sediment as is present beneath the fan sediment unit. The alluvial unit contains bivalve shells (GSC-4027) from one to two meters above its base. The L1-surface, at 793 m elevation, is a minor alluvial surface directly along the creek. Its' sandy cut-and-fill sequence is 3 m-thick and contained charcoal (GSC-4421) marking a hearth site at a depth of 30 cm.

Comment (**W.J. Vreeken**): Fluvial incision of the Gap Creek, 40 m below the plain of Glacial Lake Downie, occurred between 13.51 and 7.65 ka (GSC-4675 and -4422). Shortly after this, part of the alluvial surface was buried beneath alluvial fan sediments issuing from a tributary valley. Subsequent rapid fan aggradation, inferred from the absence of buried soils, proceeded until some time after 6.8 ka. The fan toe was truncated by fluvial action before 3.2 ka (GSC-4027). The main alluvial surface in the valley is less than 2.94 ka and was incised about 5 m in recent times. The youngest surface formed as a result of very recent aggradation (GSC-4421).

Old Wives Lake

Beta-86323 Regina

Normalized age: 2220 ± 50
 $\delta^{13}\text{C} = -10.4\text{‰}$

The freshwater shell fragments (gastropod, unidentified) were enclosed in the top of a 5 cm organic layer within bedded sand and gravel, at a depth of 0.9 m. It was collected by G.A. Tackman about 105 km west-southwest of Regina, south central Saskatchewan (50°06'N, 106°00'W). This sample was submitted by G.A. Tackman to gain information on lake level change and postglacial rebound.

Uncorrected age: 1980 ± 50.

Comment (**G.A. Tackman**): The shell fragments were high spiral gastropods; all less than 2 cm in length with 5.5 whorls.

Little Quill Lake

Little Quill Lake Series

A series of samples from Little Quill Lake, about 170 km north of Regina and about 175 km east of Saskatoon, southeastern Saskatchewan (51°55'N, 104°05'W) was collected and submitted by G.A. Tackman to gain information on lake level change in Little Quill Lake and postglacial rebound.

Beta-77527 Little Quill Lake I

Normalized age: modern

The freshwater shell sample (*Fossaria*; identified by G.A. Tackman) was a surface collection from prairie dog holes in a beach.

Beta-81350 Little Quill Lake II

Normalized age: 210 ± 50
 $\delta^{13}\text{C} = -28.0\text{‰}$

The charred wood sample was located under a large boulder (ice push) on a beach crest. The calibrated age = modern (1655 AD -1950 AD).

Uncorrected age: 260 ± 50.

Comment (**G.A. Tackman**): Collected from under a large boulder (ice push) on a beach crest on the south shore of Little

Quill lake. This is not a meaningful date as the shoreline could be much older.

Beta-77528 Little Quill Lake III

Normalized age: 460 ± 50
 $\delta^{13}\text{C} = -5.8\text{‰}$

The freshwater shell sample (*Fossaria*; identified by G. A. Tackman) was in surface collection from prairie dog holes in clean sand on a beach crest. The calibrated age = 1440 AD (1425 AD -1460 AD).

Uncorrected age: 150 ± 50 .

Lake Saskatchewan

S-2035 Gowen Site

Uncorrected age: 9460 ± 240

The organic clay was enclosed in clay at the base of eolian and fluvial sands. Sample BS-10003 (3 m depth in cut exposure) was collected by B.T. Schreiner in 1980 from the Gowen archaeological site on a terrace of the South Saskatchewan River, within Saskatoon city limits, Saskatchewan (52°05'45"N, 106°42'20"W). This sample was submitted by B.T. Schreiner to gain information on lake level change in Glacial Lake Saskatchewan, as well as eolian and fluvial information.

Gowen Archaeological Series

A series of organic clay samples from an auger test hole at the Gowen archaeological site on a terrace of the South Saskatchewan River, within Saskatoon city limits, Saskatchewan (52°05'47"N, 106°42'23"W) was collected by B.T. Schreiner in 1981 and samples were submitted to gain information on lake level change in Glacial Lake Saskatchewan.

S-2183 Gowen I

Uncorrected age: 8020 ± 290

The organic clay sample (4.1 m depth) was in clay below stratified sands. This is a probable high water marker for the adjacent river or a temporary glacial lake. This sample dates glacial lake retreat from the area.

S-2184 Gowen II

Uncorrected age: 8930 ± 320

The organic clay sample (4.3 m depth) was in clay below a non-organic clay zone.

Comment (**B.T. Schreiner**): This sample provides an approximate age of glacial lake retreat from the area.

DATES RELATED TO THE LATE WISCONSIN AND HOLOCENE

Dates related to eolian activity (Fig. II-5)

Frontier Series

A series of organic-rich sediment (paleosol) samples from a backhoe trench adjacent to a moraine plateau at "HAM I site", Frontier, about 130 km southwest of Swift Current, southwestern Saskatchewan (49°04'05"N, 108°45'20"W), at an elevation of 930 m was collected by W.J. Vreeken in August, 1985. They provide a high-resolution soil-geomorphic record in the Palliser Triangle region. These samples were submitted by W.J. Vreeken to gain information on eolian geomorphic processes.

CAMS-22368 Frontier I

Normalized age: 1500 ± 60

The organic-rich sediment (paleosol) (WVRC-8503; HAM 8 No. 50 (55-75 cm)) was enclosed in bottomland sediments with paleosols, about 0.7 m above the Mazama ash.

The age was normalized assuming $\delta^{13}\text{C} = -25\text{‰}$

CAMS-22369 Frontier II

Normalized age: 2860 ± 50

The organic-rich sediment (paleosol) (WVRC-8504; HAM 4 No. 22 (30-40 cm)) was enclosed in hillslope sediments with paleosols.

The age was normalized assuming $\delta^{13}\text{C} = -25\text{‰}$

GSC-5930 Bigstick Sand Hills

Normalized age: modern
 $\delta^{13}\text{C} = -25.8\text{‰}$

The organic detritus (probably dominantly *Psoralea agrophylla*; identified by S.A. Wolfe) in a paleosol was overlain and underlain by eolian sand and was exposed along the edges of a blowout. Sample 94-SAW-84 (2-5 m below dune surface) was collected by D. Lemmen and S.A. Wolfe on September 29, 1994 from Bigstick Sand Hills -Central Dune about halfway between Bigstick and Crane Lakes, triangulated to be 34 km northeast of Maple Creek, 37 km southeast of Fox Valley and 51 km west-northwest of Gull Lake, southwestern Saskatchewan (50°11'15"N, 109°11'37"W), at an elevation of 730 m. This sample was submitted by D.S. Lemmen and S.A. Wolfe to gain information on eolian activity and formation of a modern blowout.

See GSC-5943 (below) for comments.

Laboratory Comment: The count on the sample would suggest that the material formed between 1950 and 1960, certainly pre-1960 (cf. McNeely, 1994).

S-175 Boyer Lake

Uncorrected age: 9250 ± 150

The organic silt was in black organic silt (2.7 m) overlain by organic sand and underlain by silt over sand. The sample was collected by P.P. David in 1961 from "Boyer Lake" in the Great Sand Hills area, about 245 km west of Moose Jaw, southwestern Saskatchewan (50°23'39"N, 108°58'26"W). This sample was submitted by E.A. Christiansen to gain information on lacustrine and eolian activity.

Comment (E.A. Christiansen): Black organic silt is overlain by 44 ft (13.5 m) of organic sand and underlain by 17 ft (5.1 m) of silt

over sand. This sample dates the silt in the lacustrine complex of the Great Sand Hills area.

GSC-5943 Burstall Sand Hills

Normalized age: modern
 $\delta^{13}\text{C} = -18.9\text{‰}$

The organic detritus (probably dominantly *Psoralea agrophylla*; identified by S.A. Wolfe) was in a paleosol overlain and underlain by eolian sand, and exposed along the edges of a blowout. Sample 94-SAW-85 (4 m below the dune surface) was collected by D.S. Lemmen and S.A. Wolfe on September 30, 1994 from Burstall Sand Hills, 4.9 km north of highway 321 from the town of Burstall, near the Alberta border, southwestern Saskatchewan (50°42'08"N, 109°54'50"W), at an elevation of 740 m. This sample was submitted by D.S. Lemmen and S.A. Wolfe to gain information on eolian activity and the formation of a modern blowout.

Uncorrected age: 10 ± 100.

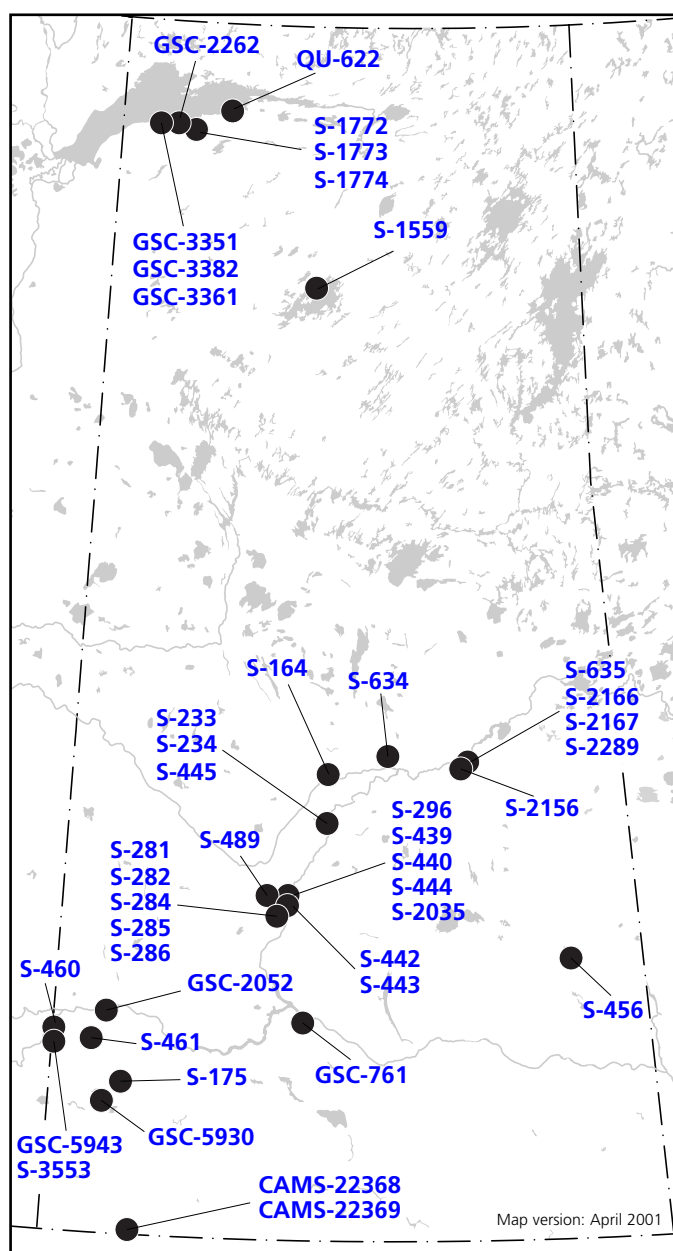


Fig. II-5. Dates related to eolian activity.

Comment (**D.S. Lemmen** and **S.A. Wolfe**): GSC-5930 and -5943 confirm that the formation of the blowouts is a very recent event following a period of regionally extensive sand dune activity which optical dating places within the last 200 years. The radiocarbon dates generally support the optical dating chronology, although GSC-5930 suggests that zeroing of blowout sands may not always be complete. See Section III of this open file report.

S-3553 Burstall Sand Hills

Uncorrected age: 2620 ± 140

The bone (*Bison bison*; identified by B. Kooyman) was enclosed in eolian and shallow lacustrine sand, exposed on the south face of blowout. Sample SW6-01 (about 11 m below the surface of the dune) was collected by S.A. Wolfe on October 10, 1993 from Burstall Sand Hills, 4.9 km north of highway 321 from town of Burstall, near the Alberta border, southwestern Saskatchewan (50°42'08"N, 109°54'50"W). This sample was submitted by S.A. Wolfe to gain information on eolian activity.

Comment (**S.A. Wolfe**): The sample dates an interval of low eolian activity and provides a maximum age estimate on the last interval of extensive eolian activity (optically dated at 310 years). The date is consistent with optical dating chronology from the same site, and therefore provides an important corroboration of dates.

S-461 Prelate

Uncorrected age: 9500 ± 150

The organic material (paleosol) was in a dark layer underlying loess at a depth of 2.1 m (7 ft). The sample was collected by P.P. David in 1968 from Prelate, about 240 km southwest of Saskatoon, southwestern Saskatchewan (50°45'N, 109°24'W). This sample was submitted by P.P. David to gain information on climate change.

S-460 Empress

Uncorrected age: 10 060 ± 160

The organic material (paleosol) was in an A-horizon underlying eolian sediments at a depth of 2.1 m. The sample was collected by P.P. David in 1968 from east of Empress (Alberta), about 265 km southwest of Saskatoon, southwestern Saskatchewan (50°51'N, 109°58'W). This sample was submitted by P.P. David to gain information on geomorphic processes.

GSC-761 Qu'Appelle Valley

Uncorrected age: 1460 ± 140

The organic detritus was overlain by 3 m of sand. Sample KJ-21-66 was collected by R.W. Klassen in 1966 from in the Qu'Appelle Valley, about 6.4 km north of Bridgeford, about 85 km northeast of Moose Jaw, south central Saskatchewan (50°58'N, 106°26'W). This sample was submitted by R.W. Klassen to gain information on geomorphic processes and sand deposition.

Comment (**R.W. Klassen**): The material was collected to determine the rate of sediment accumulation in the divide area of the abandoned valley. The young date suggests a probable eolian origin for the sand.

GSC-2052 Prelate

Uncorrected age: >29 000

The humic matter was in a paleosol in a leached and oxidized till. Sample S-215-68 (70) was collected by P.P. David in 1968 from about

18.4 km north and 9.6 km east of Prelate, about 230 km southwest of Saskatoon, southwestern Saskatchewan (51°1.5'N, 109°15.3'W), at an elevation of about 642 m. This sample was submitted by P.P. David to gain information on geomorphic processes.

Comment (**P. David**): The paleosol, developed in oxidized and leached till, was dated to verify the 20 000 ± 850 BP finite date (S-176 (above), McCallum and Wittenberg, 1965) obtained on a sample from its reference section (David, 1966) situated about 14.5 km west of present site. The dated Ahb horizon shows evidence of ice thrust not recognized at time of sampling in 1961 and the previous sample was not carefully prepared and probably contained undetected root hairs. The stratigraphic sequence above the paleosol at the reference section comprises three units of nonglacial deposits interstratified with two till sheets, while at the presently sampled site, the paleosol is overlain (from base up) by 30 cm of stratified marl, 8.2 m of sand and 30 cm of clay, followed by 35 m of till with lag boulders at the top. The single till unit has been correlated with the two tills at the reference section (David, 1987). The new date places the time of burial of the soil beyond the 29 000 years BP range. The soil was formed at the end of the "prolonged interval of non-glaciation" (David, 1964, p. 107), formally named the Prelate Ferry Interval (David, 1966). It probably corresponds in time with the Watino nonglacial period (Fenton, 1984).

S-456 Good Spirit Lake

Uncorrected age: 5040 ± 90

The organic silt was underlying sand at a depth of 3.6 m (16.2 m above the till). The sample was collected by A.A. Rutherford in 1968 from the south shore of Good Spirit Lake in the Qu'Appelle Valley, about 185 km east of Regina, southeastern Saskatchewan (51°31'N, 102°37'W). This sample was submitted by A.A. Rutherford to gain information on lake level changes and geomorphic processes.

Comment (**A.A. Rutherford**): The sample was from the upper carbonaceous horizon, the second horizon occurs at 5.8 m depth. This dates the upper of two former shore surfaces, during a period of stable sand prior to the last dune activity.

Pike Lake Series

A series of organic sediment (paleosol) samples enclosed in buried A horizons in clean eolian fine sand from northwest of Pike Lake, about 30 km southwest of Saskatoon, Saskatchewan (51°56'N, 106°50'W) was collected by L.E. Hodgins in 1964 and submitted to gain information on dune development and climate change.

S-286 Pike Lake I

Uncorrected age: 820 ± 60

The sample was at a depth of 1.5 m (5 ft).

S-285 Pike Lake II

Uncorrected age: 2450 ± 70

The sample was at a depth of 2.7 m (9 ft).

S-284 Pike Lake III

Uncorrected age: 2400 ± 70

The sample was at a depth of 3 m (10 ft).

S-282 Pike Lake IV

Uncorrected age: 3470 ± 70

The sample was at a depth of 4.8 m (16 ft).

S-281 Pike Lake V

Uncorrected age: 3510 ± 70

The sample was at a depth of 6 m (20 ft).

Comment (**L.E. Hodgins**): Dark carbonaceous horizons, each 2-16" (5-40 cm) thick and clearly separated from other horizons by "clean" eolian fine sand, were exposed in a road cut at depths ranging from 20 ft (6 m) to 5 ft (1.5 m) below the crest of a 30 ft (9 m) high sand dune. The minor horizons at 15 and 11 ft (4.5 and 3.4 m) are not dated. The buried soils indicate periods of well-established vegetation, stabilized dunes, and relatively moist conditions. Intervening clean sand accumulations indicate periods of dune building and relatively dry conditions. The thickness of organic horizons dated by S-281 (6-9", 15-23 cm) and S-286 (6-16", 15-40 cm) and organic content of S-286 horizon are greater than those of other horizons and reflect longer periods of moist conditions and dune stability. Some accumulation of sand may have occurred during the soil development.

Beaver Creek Series

A series of organic material (paleosol) samples from Beaver Creek, about 15 km south of Saskatoon, Saskatchewan (51°59'N, 106°43'W) was collected by E.A. Christiansen in 1968 and samples were submitted to gain information on regional dune (eolian) activity. (locality: NW16-1-35-6-W3; site record: Ref. file Beaver Creek NW16-1: section; samples correlated to auger T.H.'s -1, 2, 3.)

S-443 Beaver Creek I

Uncorrected age: 7640 ± 150

The sample (0.9 m (3 ft) depth) was in an A-horizon underlying 0.9 m of eolian sand.

S-442 Beaver Creek II

Uncorrected age: 9940 ± 160

The sample (1.8 m (6 ft) depth) was in an A-horizon underlying 1.8 m of eolian sand.

S-2035 Gowen Site

Uncorrected age: 9460 ± 240

The organic clay was at the base of eolian and fluvial sands. Sample BS-10003 (3 m depth in cut exposure) was collected by B.T. Schreiner in 1980 from "Gowen archaeological site" on a terrace of the South Saskatchewan River, within Saskatoon city limits, Saskatchewan (52°05'45"N, 106°42'20"W). This sample was submitted by B.T. Schreiner to gain information on eolian activity.

Saskatoon A Series

A series of organic material (paleosol) samples from a storm-sewer trench, Saskatoon, Saskatchewan (52°07'N, 106°42'W). They were collected by E.A. Christiansen in 1968 (locality: SW4-30-36-5-W3; site record: Ref. file Saskatoon SW4-30 excavation). These samples were submitted by E.A. Christiansen to gain information on eolian activity.

S-440 Saskatoon A I

Uncorrected age: >32 600

The sample was in sand at a depth of 3 m. This sample was Comment (**E.A. Christiansen**): S-440 presumably contains coal particles.

S-439 Saskatoon A II

Uncorrected age: 8990 ± 145

The sample (1.5 m (5 ft) depth) was in an A-horizon underlying 1.5 m of eolian sand.

Saskatoon B Series

A series samples from Saskatoon, Saskatchewan (52°08'N, 106°40'W). They were collected by E.A. Christiansen in 1966 (locality: NE13-28-36-5-W3; site record: Ref.-File for SRC Saskatoon NE13-28: CN excavation). These samples were submitted by E.A. Christiansen to gain information on the youngest eolian activity in the area.

S-444 Saskatoon B I

Uncorrected age: 3150 ± 80

The organic material sample (0.6 m depth) was in an A-horizon underlying 0.6 m of eolian sand.

S-296 Saskatoon B II

Uncorrected age: 8160 ± 125

The organic silt sample (46 cm (18") depth) was in gray, clayey silt, or ablation till overlain by 46 cm (18") of massive, clean sand.

Comment (**E.A. Christiansen**): This sample resembles the Leipzig till (Battleford) and is correlative with sample S-444. The carbonaceous material is interpreted as part of a solom.

S-489 Grandora

Uncorrected age: 3730 ± 80

The organic sand was in an A-horizon under massive wind-blown sand at a depth of 1.4 m (4.5 ft). The sample was collected by E.A. Christiansen in 1969 from Grandora, about 25 km southwest of Saskatoon, Saskatchewan (52°08'N, 107°00'W). This sample was submitted by E.A. Christiansen to gain information on the deposition of the overlying sand.

South Saskatchewan River Series

A series of samples from the South Saskatchewan River at the Batoche Ferry Crossing, about 55 km south-southwest of Prince Albert, central Saskatchewan (52°46'N, 106°08'W) was collected by E.A. Christiansen in 1968 (locality: NE14-19-43-1-W3: section; Ref. file SRC Batoche NE14-19). These samples were submitted by E.A. Christiansen to gain information on eolian activity.

S-445 South Saskatchewan River I

Uncorrected age: 7070 ± 115

The organic material sample (1.5 m (5 ft) depth) was in an A-horizon in eolian sand.

S-234 South Saskatchewan River II

Uncorrected age: 8100 ± 120

The organic material sample was in an A-horizon overlying fluvial sand, underlying eolian sand.

S-233 South Saskatchewan River III

Uncorrected age: >32 000

The charcoal or coal sample was in fluvial sand over till and under an A-horizon (paleosol), overlain by eolian sand.

Comment (**E.A. Christiansen**): The sampled layers were overlain by 24 ft (7.1 m) of eolian sand. Because sample S-233, which was derived from datable surficial stratified drift, is beyond the datable range, its carbonaceous material is interpreted as reworked coal. Sample S-234 dates the deposition of the overlying eolian sand.

The organic silt sample (No.108) was overlain and underlain by eolian sand (locality: SE2-30-50-14-W2; site record: Ref. SRC rad. carb. file for Nipawin No.-108; Quaternary Geology of Nipawin Area, SRC Report 0075-002).

Comment (**E.A. Christiansen**): The sample could be contaminated; it gave an anomalously old date.

S-634 Strong Pine River

Uncorrected age: 4140 ± 105

The paleosol was in an A-horizon in dune sand at a depth of 2.1-2.4 m (7-8 ft). The sample was collected by E.A. Christiansen in 1971 from a roadcut along the Strong Pine River, about 35 km northeast of Prince Albert, central Saskatchewan (53°21'35"N, 105°15'00"W). This sample was submitted by E.A. Christiansen to gain information on the last period of dune formation.

S-1559 Cree Lake

Uncorrected age: 2180 ± 70

The paleosol was in an Ah-horizon of buried soil in glaciofluvial sands capped by eolian sands. Sample EC 54 (5.8 m (19') depth) was collected by E.A. Christiansen in 1978 from a shoreline exposure on Cree Lake, north central Saskatchewan (57°36'N, 106°30'W), at an elevation of 480 m. This sample was submitted by B.T. Schreiner to gain information on glaciofluvial, geomorphic processes and eolian activity.

Archibald Lake Series

A series of organic material (paleosol) samples from Archibald Lake, 86 km southwest of Fond-du-lac, south of Lake Athabasca, Saskatchewan (59°00'N, 108°40'W) was collected. The present and buried soils were weakly developed, eluviated dystic Brunisols. The samples were collected by D.F. Acton in 1979 and were submitted to gain information on eolian geomorphic processes.

S-1773 Archibald Lake I

Uncorrected age: 380 ± 150

The sample (40 cm depth) was in a buried soil LH6 horizon underlying sand dunes.

S-1774 Archibald Lake II

Uncorrected age: 1670 ± 150

The sample (75 cm depth) was in a buried soil LH61 horizon underlying sand dunes.

S-1772 Archibald Lake III

Uncorrected age: 2820 ± 100

The paleosol sample (90-100 cm depth) was in a buried soil LH62 horizon underlying sand dunes.

These are acceptable dates for dune activity of present back slope and earlier ridges.

William Point series

A series of wood samples from 10 km southwest of William Point, south shore of Lake Athabasca, Saskatchewan (59°02'N, 109°20'W), at an elevation of 270 m was collected by P.A. Maclean

S-164 Prince Albert

Uncorrected age: 1800 ± 80

The charcoal was enclosed in dune sand. The sample was collected by H. Kagis and E.A. Christiansen in 1960 from near Prince Albert, central Saskatchewan (53°12'45"N, 106°08'30"W). This sample was submitted by E.A. Christiansen to gain information on sand deposition.

Nipawin A Series

A series of paleosol samples from Nipawin, Saskatchewan (53°18'N, 104°04'W) was collected by E.A. Christiansen in 1981 and samples were submitted to gain information on eolian activity.

S-2167 Nipawin A I

Uncorrected age: 9240 ± 525

The paleosol sample ((202) depth 9.5-9.8 m (31-32 ft)) was in an A-horizon under eolian sands.

S-2166 Nipawin A II

Uncorrected age: 10 265 ± 585

The paleosol sample (10 m depth (33-33.5 ft)) was in sandy silt over fluvio-lacustrine sediments and under eolian sand.

S-2156 Nipawin

Uncorrected age: 3600 ± 90

The paleosol was underlying 0.6 m of eolian sand. The sample (103) was collected by E.A. Christiansen in 1981, from Nipawin, Saskatchewan (53°18'N, 104°10'W). This sample was submitted by E.A. Christiansen to gain information on eolian deposition of the sands.

Nipawin B Series

A series samples from Nipawin, Saskatchewan (53°20'N, 104°02'W) was collected by E.A. Christiansen in 1971. These samples were submitted by E.A. Christiansen to gain information on eolian activity in the area.

S-635 Nipawin B I

Uncorrected age: 6610 ± 95

The paleosol (1.5 m depth (5 ft)) was in an A-horizon in a dune sand. Locality: SE2-30-50-14-W2; site record: Ref. file SRC Nipawin SE2-30.

S-2289 Nipawin B II

Uncorrected age: 7725 ± 165

on August 15, 1981. These samples were submitted by M.A. Carson to gain information on the rate of migration of dunes.

GSC-3382 William Point I

Normalized age: 110 ± 60
 $\delta^{13}\text{C} = -24.8\text{‰}$

The wood sample (C14-No. 3; *Betula*; identified by R.J. Mott (unpublished GSC Wood Report No. 81-36)) was enclosed in sand.

Uncorrected age: 110 ± 60 .

GSC-3361 William Point II

Uncorrected age: 200 ± 100

The wood sample (C14-No. 5; deciduous; identified by R.J. Mott (unpublished GSC Wood Report No. 81-36)) was enclosed in sand.

GSC-3351 William Point III

Normalized age: 230 ± 120
 $\delta^{13}\text{C} = -26.9\text{‰}$

The wood sample (C14-No. 1; *Populus*; identified by R.J. Mott (unpublished GSC Wood Report No. 81-36)) was enclosed in sand.

Uncorrected age: 260 ± 120 .

Comment (**P.A. MacLean**): When converted to calendar years and used in conjunction with surveyed profiles across the dunes, the dates provide estimates of long-term dune migration rates towards the northeast. These range from 0.3 to 0.6 m per year for the last few centuries, and they are consistent with observed, short-term rates of southwest slope scour and northeast slope accretion (MacLean, 1984; see also unpublished manuscript by M.A. Carson and P.A. MacLean, Development of hybrid aeolian dunes: The William River Dunefield, Northwest Canada).

GSC-2262 Thomson Bay

Uncorrected age: 770 ± 80

The charcoal (*Pinus banksiana*; identified by R.J. Mott (unpublished GSC Wood Report No. 75-75)) was in a charcoal layer partly covered by 12 cm of sand and a superficial ventifact layer. Sample 5E was collected by G.W. Argus on August 8, 1975 near the southern edge of the Thomson Bay dune field just northeast of Little Gull Lake, about 80 m above the present level of Lake Athabasca, 60 km south-southeast of Uranium City, Saskatchewan (59°03'N, 109°00'W), at an elevation of 300 m. This sample was submitted by G.W. Argus to crosscheck a previous date.

Comment (**G.W. Argus**): A sample was obtained from this site in an effort to corroborate a previous radiocarbon date of 4890 ± 60 years (S-648; Rutherford et al., 1975, p. 332) that was obtained from a similar elevation near Yakow Lake, 55 km to the east. The deposit, however, no doubt merely represents the burial of a forest by sand, possibly by blowouts following the fire that produced the charcoal (Raup and Argus, 1982).

QU-622 Yakow Lake

Uncorrected age: modern

The wood (*Pinus*) in dune sand was collected by P.P. David in 1977 from a blowout depression in active dunes near Yakow Lake, about 50 km west-southwest of Fond-du-Lac, south of Lake Athabasca, northern Saskatchewan (59°12'N, 108°03'W). This sample was

submitted by P.P. David to gain information on actively advancing dunes.

Dates related to materials of lacustrine, pond and pothole origin (Fig. II-6)

S-2907 Benson Creek

Uncorrected age: 1445 ± 320

The basal lake sediment was located at a depth of 1.75 m. The sample was collected by D.A. Sauchyn from a pond on the Benson Creek landslide, on the north side of Battle Creek valley, about 50 km south of Maple Creek, southwestern Saskatchewan (49°26'N, 109°51'W). This sample was submitted by D.A. Sauchyn to gain information on climate change and geomorphic processes.

(Comment **D.A. Sauchyn**): The interpretation of pollen, organic matter content, and sedimentation rates from Harris Lake and a review of published descriptions of recent sediments suggest a transition in dominant Holocene geomorphic processes in the western Cypress Hills from fluvial and eolian erosion before 5100 BP to rotational landsliding after 4500 BP. This corresponds to a significant mid-Holocene climatic change from the dry conditions and phytostability of the alithermal to a maximum humidity during the period 4500-3000 BP.

The lake sediment core discussed is considerably older and longer than any obtained previously from the southern Canadian Interior Plains. A Holocene climatic history for this region is proposed here in the absence of other paleoenvironmental data of comparable detail and duration. However, unlike the western Cypress Hills, late Holocene climatic change did not result in the establishment of forests on the surrounding plains. Thus, any post-Altithermal decline in regional erosion rates probably was less pronounced and was certainly counteracted by agricultural land use in this century. On the other hand, extrapolation of a landslide chronology to valleys on the semi-arid plains may be justified, but there are no data at present to test the hypothesis that episodes of slope instability in these valleys and the Cypress Hills were coeval.

J. Scrimbit Farm Series

A series of wood in a buried forest samples from a glacial kettle on J. Scrimbit's farm, near Kayville, about 90 km south of Regina, southern Saskatchewan (49°46'N, 105°11'W) was collected by B.A. McCorquodale in 1958. These samples were submitted by B.A. McCorquodale to gain information on climate change.

S-85 Scrimbit I

Uncorrected age: $10\,400 \pm 250$

The wood (3.6 m depth) in a layer of gyttja was from limbs in a horizontal orientation. The time span was correlated with the gyttja laminae count.

S-80 Scrimbit II

Uncorrected age: $11\,500 \pm 300$

The wood sample (3.9 m depth) in a layer of gyttja was a poorly preserved, 10 cm diameter, conifer tree trunk in a horizontal position. The date is anomalous when the time span is correlated with the gyttja laminae count.

S-81 Scrimbit III

Uncorrected age: $10\,000 \pm 250$

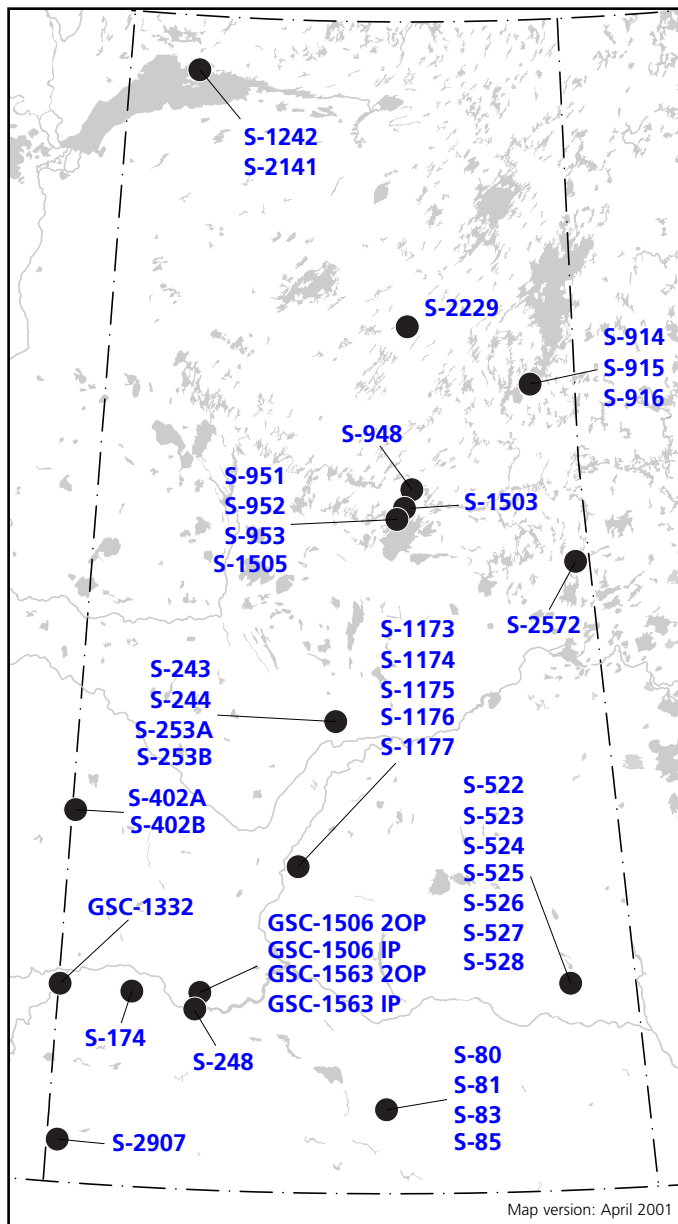


Fig. II-6. Dates on materials of lacustrine, pond and pothole origin.

The wood sample (4.6 m depth; *Picea*; identified by C. Keith) was in a layer of gyttja. It was the root of a stump 1.2 m high, preserved in an upright position in a layer of cones and needles. The time span was correlated with gyttja laminae count.

S-83 Scrimbit IV

Uncorrected age: 11 700 ± 300

The wood (5.2 m depth; coniferous) was enclosed in a layer of gyttja from a cones and needles horizon. The time span was correlated with the gyttja laminae count.

S-248 Matador

Uncorrected age: 11 620 ± 130

The organic clay (paleosol) in what is probably an A-horizon (30 cm thick) was under massive clay and over contorted clay and till. The sample, at a depth of 1.2 m (4'), was collected by E.A. Christiansen in 1964 from Matador, about 175 km west-northwest of Moose Jaw,

southwestern Saskatchewan (50°44'N, 108°02'W). This sample was submitted by E.A. Christiansen to gain information on lake level change.

Comment (**E.A. Christiansen**): The A-horizon is under 4 ft (120 cm) of massive clay and overlies 5 ft (150 cm) of contorted clay and till. This dates the inundation of soil by a glacial lake in which the overlying clay was deposited.

S-174 Lancer

Uncorrected age: 10 250 ± 150

The freshwater gastropod/pelecypod shells in medium-grained calcareous sand (3.6 m thick) were overlain by 1.2 m of lacustrine silt. The sample was collected by P.P. David in 1961 from Lancer, about 95 km northwest of Swift Current, southwestern Saskatchewan (50°48'52"N, 108°56'14"W). This sample was submitted by E.A. Christiansen to gain information on nonglacial lake level change.

GSC-1332 South Saskatchewan River

Normalized age: 10 700 ± 180
 $\delta^{13}C = -10.28\text{‰}$

The freshwater shells (*Lymnaea elodes*; identified by A.M. Stalker) were in lake silt overlying varved silt and clay and 0.3-1 m below a thick buried soil. Sample SF-69-8 (depth: 2.1 m) was collected by C.S. Churcher and A.M. Stalker in 1969, from 120 m above the South Saskatchewan River, about 11.5 km south-southeast of Empress (Alberta), about 265 km southwest of Saskatoon, southwestern Saskatchewan (50°50'50"N, 109°58'00"W), at an elevation of about 715 m. This sample was submitted by A.M. Stalker to gain information on lake level change and geomorphic processes.

Uncorrected age: 10 500 ± 180

Comment (**A.M. Stalker**): The sample dates the last phase of proglacial ponding in the area and is a maximum age for postglacial soil.

Clearwater Moraine Series

A series of samples from a small kettle hole lake in a ridged moraine of the Clearwater Moraine system about 74 km north of Swift Current, southwestern Saskatchewan (50°52'25"N, 107°56'00"W), at an elevation of 686 m was in a maximum water depth of 6 m and 1270 cm of sediment core was recovered. These samples were submitted by R.J. Mott to gain information on climate change. They were collected by R.J. Mott in 1966.

GSC-1563 IP Clearwater Moraine I A

Normalized age: 1700 ± 190
 $\delta^{13}C = +2.88\text{‰}$

The marl (MS-70-15) was at a depth of 60-70 cm.

Uncorrected age: 260 ± 190

GSC-1563 2 OP Clearwater Moraine I B

Normalized age: 1170 ± 190
 $\delta^{13}C = -22.20\text{‰}$

Uncorrected age: 1120 ± 190

GSC-1506 IP Clearwater Moraine II A

Uncorrected age: 9310 ± 150

The marl (MS-70-15) was at a depth of 1250-1260 cm.

GSC-1506 2 OP Clearwater Moraine II B
Normalized age: 7580 ± 190
 $\delta^{13}\text{C} = -26.0\text{‰}$
Uncorrected age: 7590 ± 190

Comments (**R.J. Mott**): The upper sample is interpreted, on the basis of sediment and pollen spectral changes, as an indication of the beginning of the influence of European man on the area some 60 to 70 years ago. This suggests that the date on the organic portion is anomalously old by about 1100 radiocarbon years. An error of the same order of magnitude is indicated for the date on the organic portion of the sample from 1250 to 1260 cm depth; thus these basal sediments are probably no older than 6500 years (Mott, 1973).

Markham's Crater Lake Series

A series of lake sediment samples from Markham's Crater Lake, about 160 km east-northeast of Regina, southeastern Saskatchewan (50°57'N, 102°27'W), at an elevation of 516.6 m: (locality: NE8-2-23-4-W2; see Christiansen (1971) for chronologic profile) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on the rate of accumulation of sediments.

S-522 Markham's Crater Lake I
Uncorrected age: 2470 ± 85

The gyttja sample (7.62 m (25 ft) below the lake surface) was in gyttja.

S-528 Markham's Crater Lake II
Uncorrected age: 8190 ± 110

The organic silt sample (8.8 m (29 ft) below the lake surface) was in silt.

S-523 Markham's Crater Lake III
Uncorrected age: 4820 ± 130

The gyttja sample (10.67 m (35 ft) below the lake surface) was in gyttja.

S-524 Markham's Crater Lake IV
Uncorrected age: 6425 ± 110

The gyttja sample (12.19 m (40 ft) below the lake surface) was in gyttja.

S-525 Markham's Crater Lake V
Uncorrected age: 8590 ± 115

The gyttja sample (15.24 m (50 ft) below the lake surface) was in gyttja.

S-526 Markham's Crater Lake VI
Uncorrected age: 11 715 ± 150

The gyttja sample (17.68 m (58 ft) below the lake surface) was in gyttja.

S-527 Markham's Crater Lake VII
Uncorrected age: 22 410 ± 485

The organic silt sample (18.59-19.81 m (61-65 ft) below the lake surface) was in silt.

Goodale Farm Series

A series of samples from an augerhole in the slough bottom were enclosed in gyttja. Samples were taken from Goodale Farm, about 8 km east-southeast of the junction of highway 16 and 11 in Saskatoon, Saskatchewan (52°03'N, 106°30'W), Locality: NE16-33-35-4-W3; site: 026; no Palynological Report (cf. GSC PL-77.027). They were collected by E.A. Christiansen in 1976 and submitted to gain information on the rate of accumulation of sediments.

S-1173 Goodale Farm I
Uncorrected age: 1355 ± 80

The gyttja sample was at a depth of 1.83 m.

S-1174 Goodale Farm II
Uncorrected age: 3225 ± 50

The gyttja sample was at a depth of 2.13 m.

S-1175 Goodale Farm III
Uncorrected age: 4815 ± 70

The gyttja sample was at a depth of 2.74 m.

S-1176 Goodale Farm IV
Uncorrected age: 5480 ± 75

The freshwater mollusc shells were at a depth of 2.74 m.

S-1177 Goodale Farm V
Uncorrected age: 7160 ± 110

The gyttja sample was at a depth of 3.66 m.

Evesham Series

A series of lake sediment samples from Evesham, about 220 km west of Saskatoon, western Saskatchewan (52°29'N, 109°57'W) was collected by E.A. Christiansen in 1965. Samples were enclosed in silt and clay over till from a collapsed pond deposit on stagnant ice (Locality: NW12-34-40-28-W3). These samples were submitted by E.A. Christiansen to gain information on lake level change.

S-402 A Evesham I
Uncorrected age: 4100 ± 100

The sample was at a depth of 30 cm (1 ft).

S-402 B Evesham II
Uncorrected age: 5230 ± 100

The sample was at a depth of 30 cm (1 ft).

Comment (**E.A. Christiansen**): S-402A and B were run on separate portions of same sample. The difference in measurements

suggests the material is not homogeneous. Because the glacial lake in which samples 402A and B were deposited must predate the Quill Lake date (S-292, 11.0 ka BP), it is concluded that S-402A and B were contaminated by recent carbon through soil-forming processes.

Sturgeon River Series

A series of samples from a terrace cut-bank along the north side of the Sturgeon River, at the east end of Sturgeon Lake, Prince Albert National Park, central Saskatchewan (53°25'N, 106°00'W) was collected by D.L. Delorme in 1963 and the samples contained abundant gastropods, charophytes, diatoms, and ostracods. These samples were submitted by W.O. Kupsch to gain information on macrofossils.

S-244 Sturgeon River I
Uncorrected age: 5900 ± 100

The marl (2.5 cm below soil) was in "Member B".

S-243 Sturgeon River II
Uncorrected age: 9100 ± 150

The marl (76 cm below soil) was in "Member B".

S-253 A Sturgeon River III
Uncorrected age: 8950 ± 150

The marl (153 cm below soil and 150 cm above base) was in "Member A".

S-253 B Sturgeon River IV
Uncorrected age: 8550 ± 130

The charcoal sample (153 cm below soil and 150 cm above base) was in "Member A".

Comment (**W.O. Kupsch**): There are two main stratigraphic units in this section: (1) Member B, 2'6" (76 cm) of interbedded calcareous sands and clays grading into a marl of varying purity, overlying; (2) Member A, over 7'8" (234 cm) thick, predominantly composed of marl with interbedded calcareous sands and clays.

The beds are horizontal, and a disconformity separates Member B from Member A which is distinctly ocherous near the top. Both members contain abundant gastropods, charophytes, diatoms, and the following ostracodes: *Candona acutula*, *C. decora*, *C. distincta*, *C. compressa*, *C. ohioensis*, *C. rawsoni*, *Lymnocythere staplini*, *L. trapeziformis*, *Cyclocypris ampla*, *C. ovum*, *Cypridopsis vidua*, *Potamocypris pallida*, and *Cyprinotus salinus*. S-253A (marl) and S-253B (charcoal) agree with the date of the lower marl. The age of S-243, which dates a time of local drying producing ocherous staining at the unconformity, is probably too great. All dates are post-glacial for this area (Delorme, 1965: 102-106).

S-2572 Flin Flon
Uncorrected age: 7255 ± 250

The basal lake sediment was in lake sediment overlying mineral soil at a depth of 400 cm. The sample was collected from about 20 km west of Flin Flon, east central Saskatchewan (54°53'N, 102°05'W). This sample was submitted by S.C. Zoltai to gain information on organic accumulation.

Anglo-Rouyn Series

A series of lake sediment (gyttja) samples from the Anglo-Rouyn Mine Site, about 30 km east of La Ronge, central Saskatchewan (55°20'N, 104°58'W) was enclosed in 1.2 m of grey and dark grey gyttja which was underlain by 3.4 m of silty till. Water depth = 1.2 m (4 ft); site record: Ref. SRC Hwy 102 file; EC: 1-1, 1-2, 1-3. The samples were collected by E.A. Christiansen in 1974 and were submitted to gain information on the rate of accumulation of sediments.

S-951 Anglo-Rouyn I
Uncorrected age: 1605 ± 60

Sample 1-1 was located at a depth of 1.8 m (6 ft).

S-952 Anglo-Rouyn II
Uncorrected age: 3265 ± 115

Sample 1-2 was located at a depth of 2.1 m (7 ft).

S-953 Anglo-Rouyn III
Uncorrected age: 3075 ± 70

Sample 1-3 was located at a depth of 2.4 m (8 ft).

Comment (**E.A. Christiansen**): This date should be older than S-952 because it is deeper in the core.

S-1505. La Ronge area
Uncorrected age: 3270 ± 110

The gyttja was enclosed in organic clay from pond sediments at a depth of 217-234 cm (mid-core). The sample was collected by M. Wilson and J. Terasmae in 1977 from an unnamed lake ('Lake A') 36 km north of La Ronge, central Saskatchewan (55°20'N, 105°03'W). This sample was submitted by B.T. Schreiner to gain information on the rate of accumulation of sediments.

S-1503 Naniskak Lakes
Uncorrected age: 3840 ± 130

The lake sediment was in gyttja at a depth of 167-184 cm (mid-section of core). The sample was collected by M. Wilson and J. Terasmae in 1977, from west Naniskak Lakes, about 45 km north of La Ronge, central Saskatchewan (55°26'N, 104°56'W). This sample was submitted by B.T. Schreiner to gain information on the rate of accumulation of sediments.

S-948 Wheeler Creek
Uncorrected age: 945 ± 60

The lake sediment sample was at a depth of 2.4 m in an augerhole. It was collected by E.A. Christiansen in 1974 from highway 102 at the bridge crossing Wheeler Creek, about 60 km northeast of La Ronge, Saskatchewan (55°35'N, 104°47'W). This sample was submitted by E.A. Christiansen to gain information on the rate of accumulation of sediments.

Reindeer Lake Series

A series of lake sediment samples, enclosed in carbonaceous lake sediment, from Reindeer Lake, northeastern Saskatchewan

(56°35'N, 102°45'W) was collected by R.E. Hecky in 1974 and samples were submitted to gain information on lake sediment accumulation.

S-914 Reindeer Lake I
Uncorrected age: 1440 ± 100

The sample was located at a depth of 15-20 cm.

S-915 Reindeer Lake II
Uncorrected age: 4250 ± 130

The sample was located at a depth of 65-70 cm.

S-916 Reindeer Lake III
Uncorrected age: 5370 ± 130

The sample was located at a depth of 95-100 cm.

This site was reported as "Reindeer Lake, Manitoba" in Rutherford et al., 1984, but the coordinates would place it in Saskatchewan.

S-2229 Way Lake
Uncorrected age: 5180 ± 100

The gyttja was in an organic layer at a depth of 2 m below the mud-water interface. The sample was collected by T. Donkes and E.A. Christiansen in 1982 from Way Lake, about 250 km northeast of La Ronge, central Saskatchewan (57°08'N, 104°52'W). This sample was submitted by B.T. Schreiner to gain information on the rate of accumulation of sediments.

Lorado Series

A series of organic samples was collected by B. Eckel and E.A. Christiansen in 1981 from the Lorado Site, 8 km from Uranium City, Saskatchewan (59°31'00"N, 108°41'25"W). These samples were submitted by E.A. Christiansen to gain information on the rate of accumulation of sediments.

S-2141 Lorado I
Uncorrected age: 5965 ± 110

The organic matter was under 3.45 m of Lorado tailings (site No. 2), 55cm below the top and 5cm above the bottom of the pond deposit.

S-1242 Lorado II
Uncorrected age: 7345 ± 130

The lake (pond) sediment organic matter was overlain by 3.2 m of Lorado tailings (site No. 8) and 1.4 m of pond deposits.

Dates on materials of paleobotanical interest (Fig. II-7)

Andrews Site Series

A series organic samples from the Andrews site, 7 km west of The Missouri Coteau escarpment, 22 km southwest of Moose Jaw, Saskatchewan (50°20'N, 105°52'W), at an elevation of 770 m was collected by C.H. Yansa in 1995. These samples were submitted by

C.H. Yansa and J. Basinger to gain information on climate and macrofossil preservation.

TO-5018 Andrews Site I
Normalized age: 5770 ± 80

The charcoal and plant fragments sample (164 (310 cm depth); unidentifiable according to C.H. Yansa) was in sandy clay. The sample was taken 85 cm above TO-4780; calibrated age is 4645 BC.

The age was normalized to $\delta^{13}C = -25\text{‰}$

Comment (C.H. Yansa): Charcoal flakes and plant fragments were sampled from a level that contains poorly preserved plant macrofossils in sandy clay, at a depth of 310 cm below present day surface. The overlying 310 cm of sediment lacks plant macrofossils. This date marks the end of the semi-permanent slough phase in southern Saskatchewan and plant macrofossil preservation at the Andrews site.

TO-4780 Andrews Site II
Normalized age: 7670 ± 80

The charcoal and plant fragments sample (179 (395 cm depth); unidentifiable according to C.H. Yansa) was in sandy clay. The sample was taken 15 cm above TO-5019; calibrated age is 6460 BC.

The age was normalized to $\delta^{13}C = -25\text{‰}$

Comment (C.H. Yansa): Charcoal flakes and plant fragments from charcoal-rich sandy clay, at a depth of 395 cm below present day surface, unconformably overlies laminated silty clay with plant macrofossils of parkland and permanent wetland taxa. The two dates, TO-5019 and -4780, bracket the Hypsithermal interval in

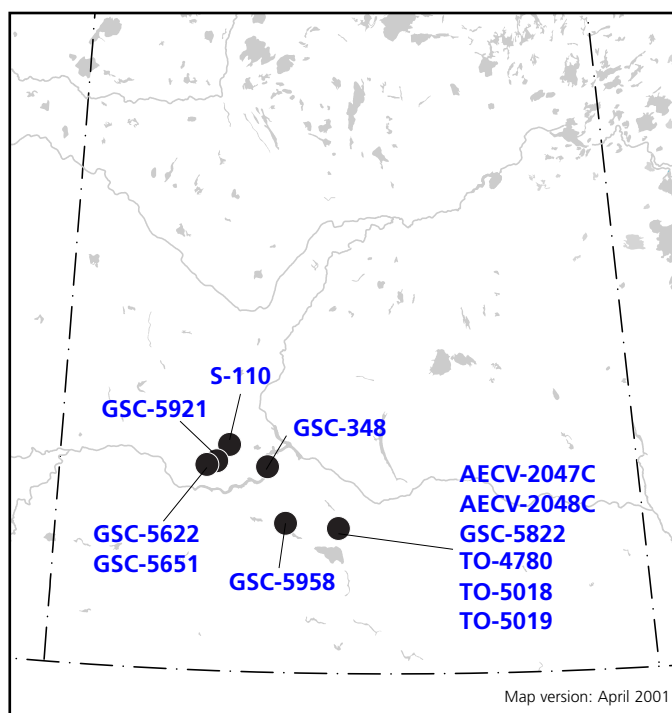


Fig. II-7. Dates on materials of paleobotanical interest.

southern Saskatchewan between 8790 ± 140 and 7670 ± 80. This date marks the end of the Hypsithermal interval in southern Saskatchewan and onset of conditions wetter than present with the development of a semi-permanent slough phase between 7670 ± 80 and 5770 ± 80 BP (TO-4780 and -5018).

TO-5019 Andrews Site III

Normalized age: 8790 ± 140

The plant seeds and fruits sample (56 (410 cm depth); *Chenopodium salinum* and *Scirpus americanus*; identified by C.H. Yansa) was in laminated silty clay. This sample was taken 15 cm below TO-4780 and 45 cm above AECV-2048C; calibrated age is 7755 BC.

The age was normalized to δ¹³C = -25‰

Comment (C.H. Yansa): Saline goosefoot seeds and three-square bulrush achenes, in excellent condition, were taken from the top of a laminated silty clay unit, at a depth of 410 cm. The sample was overlain by 10 cm of non-laminated silty clay and 10 cm of charcoal-rich sandy clay. This sample dates the end of the parkland-permanent pond phase and onset of the Hypsithermal interval in southern Saskatchewan.

AECV-2048C Andrews Site IV

Normalized age: 10 200 ± 140
δ¹³C = -23.9‰

The tree trunk sample (51b (ASA-D95-2; 455 cm depth); *Picea* (spruce); identified by C.H. Yansa) was in laminated silty clay (gyttja). This white spruce sample was taken 35 cm above GSC-5822 and 45 cm above AECV-2047C.

Comment (C.H. Yansa): The *Picea* wood, from a large trunk, was found 455 cm below the present day surface. This sample documents the first appearance of *Populus tremuloides* (aspen poplar), and *Populus balsamifera* (balsam poplar). *Betula* cf. *B. occidentalis* (river birch) macrofossils were found at the same level as this topmost layer of *Picea* trunks. This sample dates the end of the white spruce woodland and the onset of the parkland-permanent wetland phase in southern Saskatchewan.

AECV-2047C Andrews Site V

Normalized age: 10 230 ± 140
δ¹³C = -23.9‰

The root sample (30c (ASA-D95-1; 500 cm depth); *Picea* (spruce); identified by C.H. Yansa) was in silty clay. This white spruce sample was taken 5 cm below GSC-5822 and 45 cm below AECV-2048C.

Comment (C.H. Yansa): Fossils were exposed when a kettle depression in a hummocky moraine of the Missouri Coteau was excavated for a cattle watering hole. The *Picea* root was situated at 500 cm below the present day surface and found *in situ* penetrating a 10 cm thick litter layer composed primarily of *Picea glauca* needles, cones, and seeds.

GSC-5822 Andrews site VI

Normalized age: 10 200 ± 90
δ¹³C = -25.2‰

The wood sample (34b (4.9 m depth); *Picea glauca*; identified by C.H. Yansa (cf. unpublished GSC Wood Report No. 94-81)) was in silty clay. The *Picea glauca* wood was situated east of an adjacent larger log at 2.1 m lateral west along the trench at 0-10 cm below the dugout exposed surface.

Uncorrected age: 10 300 ± 90

See GSC-5958 (below) for additional comments.

General Comment (C.H. Yansa): Plant macrofossil studies and associated ¹⁴C dating of a kettle deposit in hummocky moraine terrain of southern Saskatchewan revealed that an open white spruce woodland was established in the area by 10.2 ka BP (AECV-2047C, AECV-2048C, GSC-5822). Subsequently, a deep pond developed in a parkland setting that lasted until 8.8 ka BP (TO-5019). This phase was followed by a period of low water levels, frequent prairie fires and slopewash from unstable slopes from 8.8 ka BP (TO-5019) until 7.7 ka BP (TO-4780) which is interpreted as the Hypsithermal interval. Water levels then began to rise and a semi-permanent slough was established until 5.8 ka BP (TO-5018) when the wetland became ephemeral as it is today.

General Assessment of the Andrews Site (C.H. Yansa):

Lab. No.	Depth (cm)	Age rcybp	Environmental Conditions
TO-5018	310	5770 ± 80	ephemeral wetland
TO-4780	395	7670 ± 80	'slough' phase
TO-5019	410	8790 ± 140	Hypsithermal
AECV-2048C	455	10 200 ± 140	'pond' phase
GSC-5822	490	10 200 ± 90	'open' white spruce woodland
AECV-2047C	500	10 230 ± 140	

GSC-5958 Newfield Site

Normalized age: 9860 ± 120
δ¹³C = -25.1‰

The wood (*Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 95-17)) was in silty clay. The sample (CY-94-01N 001) was collected by C.H. Yansa on May 10, 1994 from the Newfield Site, 9.5 km northeast of the eastern city limits of Swift Current, and 0.6 km south of the TransCanada Highway, southwestern Saskatchewan (50°23.0'N, 106°39.2'W), at an elevation of 810 m. This sample was submitted by C.H. Yansa and D.S. Lemmen to gain information on climate change

Uncorrected age: 9860 ± 120

Comment (C. Yansa): These five dates (GSC-5622, -5651, -5822, -5921, -5958) from similar settings all document the presence of *Picea glauca* woodlands on the Missouri Coteau for a relatively short period between about 10.3 and 9.8 ka. Abundant water resulting from the melting of buried glacier ice is believed critical to the establishment of coniferous trees at these sites. Detailed macrofossil analyses are available for one of the sites (Andrews site) in Yansa, 1995.

Kyle Series

A series of wood samples from about 14 km southeast of Clearwater Lake, in the vicinity of Kyle, about 175 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°53'N, 107°50'W), at an elevation of 720 m was collected by J. Basinger and C.H. Yansa on August 20, 1988. These samples were submitted by D.S. Lemmen and C.H. Yansa to gain information on climate change.

GSC-5651 Kyle I
 Normalized age: 10 200 ± 90
 $\delta^{13}\text{C} = -27.6\text{‰}$

The wood sample (US-600-5602; unidentifiable according to H. Jetté (unpublished GSC Wood Report No. 94-04)) was enclosed in wood and organics. The sample was exposed in a dugout about 4 m below the ground surface.

Uncorrected age: 10 300 ± 90

See GSC-5958 (above) for comments.

GSC-5622 Kyle II
 Normalized age: 10 300 ± 90
 $\delta^{13}\text{C} = -24.1\text{‰}$

The wood sample (US-600-5601 (about 4 m depth); *Picea glauca*; identified by J. Basinger (cf. unpublished GSC Wood Report No. 93-31)) was in a 1 m thick organic-rich unit. The sample was exposed in a dugout about 4 m below the ground surface.

Uncorrected age: 10 300 ± 90.

See GSC-5958 (above) for comments.

GSC-5921 Beechy site
 Normalized age: 10 300 ± 90
 $\delta^{13}\text{C} = -25.8\text{‰}$

The wood (*Picea*; identified by C.H. Yansa) was in silty clay. Sample CY-94-02B-001 was collected by C.H. Yansa on November 5, 1993 from the Beechy Site, 6 km north of highway 342, 30 km west-northwest of Beechy, and 27 km northeast of Kyle, about 175 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°55'N, 107°40'W), at an elevation of 808 m. This sample was submitted by C.H. Yansa and D.S. Lemmen to gain information on climate change.

Uncorrected age: 10 300 ± 90

See GSC-5958 (above) for comments.

GSC-348 Riverhurst
 Uncorrected age: 129 ± 128

The wood (*Acer* and *A. negundo*; identified by R.J. Mott (unpublished GSC Wood Report No. 65-02)) was collected by R. VanEverdinger and J. Scott in 1964, from Riverhurst, about 110 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°54'N, 106°52'W). This sample was submitted by W. Dyck to gain information on paleobotany.

S-110 Dinsmore
 Uncorrected age: 10 300 ± 140

The wood (coniferous) was in gyttja above till at a depth of 4.4 m (14 ft). The sample was collected by E. Hill from Dinsmore, about 105 km southwest of Saskatoon, Saskatchewan (51°06'40"N, 107°29'30"W). This sample was submitted by J.H. Grant to gain information on climate change during deglaciation.

Comment (**J.H. Grant**): The sample provides information on a time period when conifers grew where today there are grasses in uplands and shrubs in depressions.

Dates providing chronologic control of pollen sequences (Fig. II-8)

Val Marie Site series

A series of seeds and organic material samples from a depression in a hummocky moraine, "Val Marie Site", southwestern Saskatchewan (49°03'30"N, 107°41'50"W), at an elevation of about 780 m was collected by R.W. Klassen in 1989 and samples were submitted to gain information on microfossils and pollen.

TO-2212 Val Marie I
 Normalized age: 9880 ± 110

The seeds and organic material sample (KJB-76-89 (12 m depth)) was in clayey loam over till.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

TO-1711 Val Marie II
 Normalized age: 9910 ± 80
 $\delta^{13}\text{C} = -25\text{‰}$

The seeds and organic material sample (KJB-76-89 (6 m depth); *Carex*; identified by A. Duk-Rodkin) were in clayey loam over till.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

S-2772 Benson Creek
 Uncorrected age: 1745 ± 85

The sediment was collected by D.A. Sauchyn from Benson Creek, north side of Battle Creek valley, about 50 km south of Maple Creek, southwestern Saskatchewan (49°26'N, 109°51'W). This sample was submitted by D.A. Sauchyn to gain information on climate change and geomorphic processes.

Harris Lake Series

A series of samples from Harris Lake, western Cypress Hills, southwestern Saskatchewan (49°40'N, 109°54'W), at an elevation of 123 m was collected by D.A. Sauchyn in February, 1987. These samples were submitted by D.A. Sauchyn to gain information on climate change.

TO-1053 Harris Lake I
 Normalized age: 1470 ± 40

The plant macrofossils (organic) sample (40 cm depth) was in 9.6 m of sediment in a core in 1.5 m of water.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

TO-1054 Harris Lake II
 Normalized age: 3450 ± 50

The plant macrofossils (organic) sample (236 cm depth) was in 9.6 m of sediment in a core in 1.5 m of water. This sample was submitted by D.A. Sauchyn to gain information on climate change.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

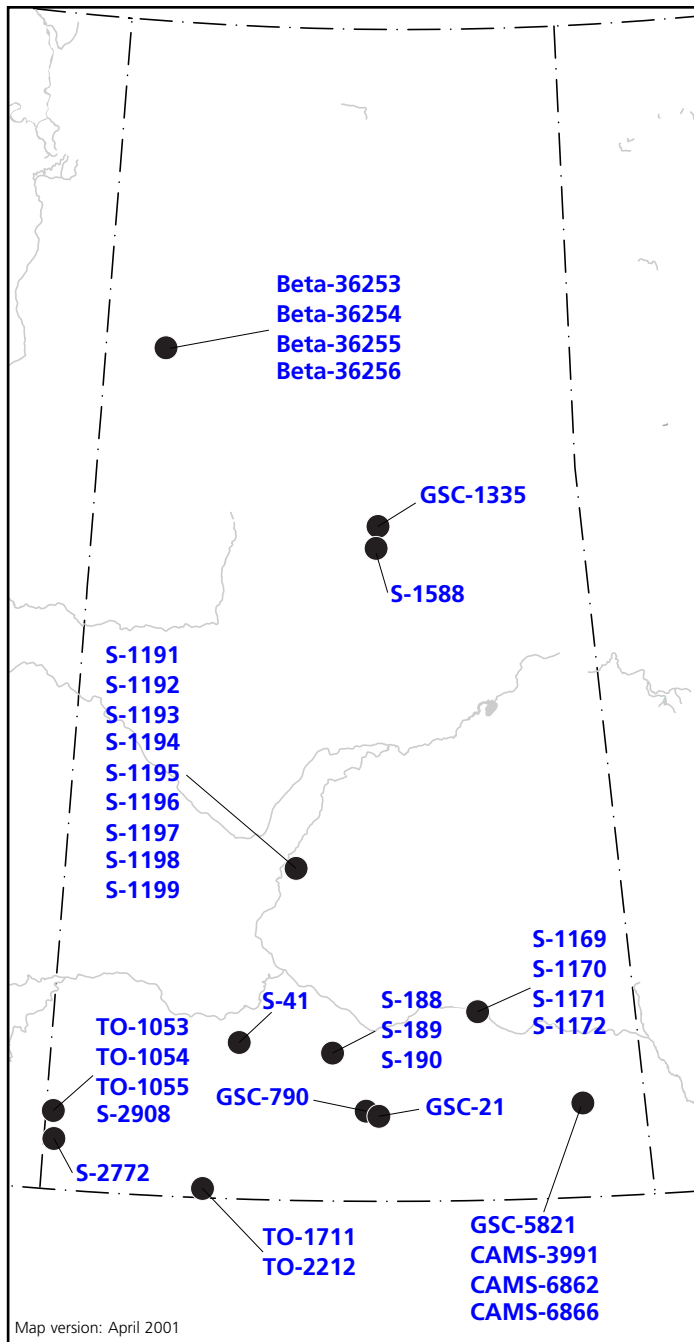


Fig. II-8. Dates providing chronologic control for pollen sequences.

TO-1055 Harris Lake III
 Normalized age: 5120 ± 60
 The plant macrofossils (organic) sample (520 cm depth) was in 9.6 m of sediment in a core in 1.5 m of water. This sample was submitted by D.A. Sauchyn to gain information on climate change.
 The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

S-2908 Harris Lake IV
 Uncorrected age: 9120 ± 250
 The basal lake sediment sample (964 cm) was in 9.6 m of sediment in a core in 1.5 m of water.

(Comment **D.A. Sauchyn**): The interpretation of pollen, organic matter content, and sedimentation rates from Harris Lake and a review of published descriptions of recent sediments suggest a transition in dominant Holocene geomorphic processes in the western Cypress Hills from fluvial and eolian erosion before 5100 BP to rotational landsliding after 4500 BP. This corresponds to a significant mid-Holocene climatic change from the dry conditions and phytostability of the altithermal to maximum humidity during the period 4500-3000 BP.

GSC-21 Scrimbit Farm
 Uncorrected age: 10 400 ± 140

The wood (conifer) was in gyttja in a glacial kettle deposit. The sample was collected by B.A. McCorquodale in 1958 from the "Scrimbit (farm) Site", near Kayville, about 90 km south of Regina, southern Saskatchewan (49°46'N, 105°11'W). This sample was submitted by J. Terasmae to gain information on a fossil forest.

GSC-790 Spring Valley
 Uncorrected age: >38 000

The organic material was in southeast dipping layers or lenses within silty-clayey beds overlain by brown till. Sample PC 90/65 was collected by V.K. Prest in 1965 from a roadside cut, 5 km southeast of Spring Valley, about 55 km south of Moose Jaw, southern Saskatchewan (49°49'N, 105°22'W), at an elevation of 793 m. This sample was submitted by V.K. Prest to gain information on geomorphic processes.

Comment (**V.K. Prest**): The uncompressed peat is believed to be related to other occurrences of buried organic material in this region (cf. Parizek, 1964; also GSC-618, 10 710 ± 250, Lowdon et al., 1967). They occur within and beneath glacial drift that slumped as dead ice melted, in postglacial time, to produce a markedly hummocked and kettled surface. "Old" age of GSC-790 indicates the presence of older sediments within the ice-thrust moraine; pollen studies suggest sediments are early Holocene.

Kenosee Lake Series

A series of organic samples from Kenosee Lake, about 250 km southeast of Regina, on the Moose Mountain Upland of southeastern Saskatchewan (49°49'01"N, 102°17'07"W), at an elevation of 740 m was collected by R.E. Vance on May 14, 1992. These samples were submitted by R.E. Vance to gain information on climate change and water level rise.

CAMS-6866 Kenosee Lake I
 Normalized age: 3910 ± 80
 $\delta^{13}\text{C} = -25\text{‰}$

The seed (organic) sample (KN1: 60-70 cm; *Betula* (5) and *Carex*-type (1); identified by R.E. Vance) was in lake sediment. The sample was screened and selected plant macrofossils were picked from the residue with forceps.

Comment (**R.E. Vance**): The sample's age is out-of-sequence with CAMS-6862 and -3911, likely due to a redeposited *Carex* seed enclosed with a *Betula* seed to bring this sample to minimum weight required for dating. The *Carex* seed did bear some evidence of reworking (rounded edges, piece missing, discoloured).

GSC-5821 Kenosee Lake II
 Normalized age: 2030 ± 80
 $\delta^{13}\text{C} = -26.4\text{‰}$

The lake sediment sample (KN1: 80-75 cm) was in clay and silt and consisted of *Betula* pollen and plant macrofossils.

Uncorrected age: 2050 ± 80.

Comment (R.E. Vance): This date is out-of-sequence with CAMS-6862 and -3991.

Laboratory Comment: The fact that the sample was very calcareous when treated would suggest that there is a strong possibility that the age is anomalously old.

CAMS-6862 Kenosee Lake III

Normalized age: 2760 ± 60
 $\delta^{13}\text{C} = -25\text{‰}$

The seed (organic) sample (KN1: 160-165 cm; *Scirpus*-type (1) and *Chenopodium*-type (5); identified by R.E. Vance) was in lake sediment. The lake sediment sample was screened and selected plant macrofossils were picked from the screened residue with forceps.

CAMS-3991 Kenosee Lake IV

Normalized age: 4090 ± 110
 $\delta^{13}\text{C} = -25\text{‰}$

The seed (organic) sample (KN1:195-198cm; *Chenopodium*-type (20); identified by R.E. Vance) was in lake sediment. The lake sediment sample was screened and selected plant macrofossils were picked from the screened residue with forceps.

Lillestrom Series

A series of lake sediment samples from near Lillestrom, about 30 km southwest of Moose Jaw, southern Saskatchewan (50°20'N, 105°54'W) was collected by J.C. Ritchie in 1962 and samples were submitted to gain information on climate change and palaeobotany.

S-188 Lillestrom I

Uncorrected age: 10 270 ± 150

The lake sediment (2.85 m depth) was in gyttja.

S-189 Lillestrom II

Uncorrected age: 10 630 ± 150

The lake sediment (3.90 m depth) was in gyttja.

S-190 Lillestrom III

Uncorrected age: 11 650 ± 150

The lake sediment (4.95 m depth) was in gyttja.

Comment (J.C. Ritchie): Macro-and micro-plant remains in the gyttja indicate that there was spruce associated with poplar. Pollen indicates a cool wet period followed by a warmer interval and then a return to cool and wet. As the site lies south of the Moose Jaw Moraine, the sample possibly dates the time between the retreat from that moraine and the readvance to the Condie Moraine (Christiansen, 1961).

S-41 Herbert

Uncorrected age: 10 000 ± 300

The wood (*Salix*) was enclosed in postglacial sediments at a depth of 3.4 m (11 ft). The sample was collected by E.A. Christiansen and W.O. Kupsch in 1956 from Herbert, 45 km east of Swift Current, southern Saskatchewan (50°25'N, 107°15'W). This sample was submitted by W.O. Kupsch to gain information on paleobotany.

Comment (J. Terasmae): Associated flora and fauna indicate the quiet water of a small lake in a spruce-pine parkland with a few northern broadleaved trees.

Mission Lake Series

A series of organic silt samples from Mission Lake was enclosed in silt and overlying till. The lake is about 70 km northeast of Regina, southeastern Saskatchewan (50°43'N, 103°46'W). These samples were collected by E.A. Christiansen on March 10, 1976 at locality: NE16-20-20-13-W2; Palynological Report GSC PL-77.068 indicates very poor pollen content. These samples were submitted by E.A. Christiansen to gain information on geomorphic processes and rates of sedimentation.

S-1169 Mission Lake I

Uncorrected age: 2950 ± 80

The sample was at a depth of 0.3 m in the slough bottom.

S-1170 Mission Lake II

Uncorrected age: 4980 ± 85

The sample was at a depth of 0.91 m in the slough bottom.

S-1171 Mission Lake III

Uncorrected age: 7040 ± 115

The sample was at a depth of 1.52 m in the slough bottom.

S-1172 Mission Lake IV

Uncorrected age: 9735 ± 120

The sample was at a depth of 2.13 m in the slough bottom.

Comment (E.A. Christiansen): Dates indicate recent sedimentation over the dated interval was constant at 2.54 cm/100 year.

Marten Slough Series

A series of organic silt samples from Marten Slough, Saskatchewan (52°02'N, 106°29'W) was collected by E.A. Christiansen in 1976 at locality: NE16-27-35-4-W3; site: 01; site record: Ref.-file for SRC Martens Slough NE16-27 testhole; Palynological Report No. 78-07 (R.J. Mott). These samples were submitted by E.A. Christiansen to gain information on rate of accumulation of sediments.

S-1197 Marten Slough I

Uncorrected age: 8350 ± 200

The sample was at a depth of 2.74 m in the slough bottom.

S-1198 Marten Slough II

Uncorrected age: 10 240 ± 250

The sample was at a depth of 4.57 m in the slough bottom.

S-1199 Marten Slough III
 Uncorrected age: 11 070 ± 245
 The sample was at a depth of 6.40 m in the slough bottom.

Agar Slough Series

A series of organic silt samples from Agar Slough, about 8 km east-southeast of junction of highway 16 and 11 in Saskatoon, Saskatchewan (52°03'N, 106°30'W) was collected by E.A. Christiansen in 1976 from an augerhole (locality: NE12-34-35-4-W3; site: 01; site record: Ref.-file for SRC Agar Slough NE12-34; no Palynological Report (cf. GSC PL-77.026)). These samples were submitted by E.A. Christiansen to gain information on rate of sediment accumulation.

S-1191 Agar Slough I
 Uncorrected age: 3295 ± 125
 The sample was at a depth of 0.61 m in the slough bottom.

S-1195 Agar Slough II
 Uncorrected age: 1570 ± 115
 The sample was at a depth of 1.22 m in the slough bottom.

S-1192 Agar Slough III
 Uncorrected age: 9300 ± 220
 The sample was at a depth of 4.27 m in the slough bottom.

S-1196 Agar Slough IV
 Uncorrected age: 9620 ± 210
 The sample was at a depth of 4.27 m in the slough bottom.

S-1193 Agar Slough V
 Uncorrected age: 9630 ± 230
 The sample was at a depth of 4.57 m in the slough bottom.

S-1194 Agar Slough VI
 Uncorrected age: 10 560 ± 255
 The sample was at a depth of 4.88 m in the slough bottom.

S-1588 Naniskak Lakes
 Uncorrected age: 10 200 ± 110

The lake sediment was a marl 350-366 cm below the mud-water interface. The sample was collected by M. Wilson and J. Terasmae in 1977 from a small unnamed lake near Naniskak Lakes, 4.5 km south of La Ronge, central Saskatchewan (55°03'N, 105°18'W). This sample was submitted by B.T. Schreiner to gain information on paleobotany.

GSC-1335 Cycloid Lake
 Uncorrected age: 6000 ± 170

The organic lake sediment, at a depth of 257-262 cm, was collected by R.J. Mott in 1966 from "Cycloid Lake" (small lake in

bedrock depression), about 19 km north of La Ronge, central Saskatchewan (55°15'N, 105°16'W), at an elevation of 396 m. This sample was submitted by R.J. Mott to gain information on microfossils.

Comment (**R.J. Mott**): The sample dates the beginning of a rapid *Pinus* pollen increase indicating migration of pine into the area (Mott, 1973).

Long Lake Series

A series of lake sediment (gyttja) samples, enclosed in gyttja, from Long Lake, about 50 km northwest of La Loche, northwestern Saskatchewan (56°51'40"N, 108°59'20"W), at an elevation of 414 m was collected by T.W. Anderson on August 8, 1988. The samples were submitted by G.M. MacDonald to gain information on the rate of sediment accumulation.

Beta-36253 Long Lake I
 Normalized age: 5670 ± 50
 $\delta^{13}\text{C} = -25\text{‰}$

The lake sediment sample (AP-88-1 (394.5-405.5 cm)) was in gyttja.

Beta-36254 Long Lake II
 Normalized age: 7360 ± 90
 $\delta^{13}\text{C} = -25\text{‰}$

The lake sediment sample (AP-88-1 (494.5-505.5 cm)) was in gyttja.

Beta-36255 Long Lake III
 Normalized age: 8800 ± 150
 $\delta^{13}\text{C} = -25\text{‰}$

The lake sediment sample (AP-88-1 (595-605 cm)) was in gyttja.

Beta-36256 Long Lake IV
 Normalized age: 9910 ± 130
 $\delta^{13}\text{C} = -25\text{‰}$

The lake sediment sample (AP-88-1 (645-655 cm)) was in gyttja.

Dates related to fluvial activity (Fig. II-9)

TO-4412 Frontier
 Normalized age: 7650 ± 160

The organic-rich sediment was in bottomland sediments with paleosols, about 1 m below the Mazama ash. Sample WVRC-8502; HAM 8 No. 50 (235-255 cm) was collected by W.J. Vreeken in August, 1985 from a backhoe trench adjacent to a moraine plateau at "HAM I site", Frontier, about 130 km southwest of Swift Current, southwestern Saskatchewan (49°04'05"N, 108°45'20"W), at an elevation of 930 m. This sample was submitted by W.J. Vreeken to gain information on geomorphic processes.

The age was normalized to $\delta^{13}\text{C} = -25\text{‰}$

S-2932 Val Marie
 Uncorrected age: 11 460 ± 250

The wood from rotary cuttings was in alluvial and colluvial sand, silt, and clay. The sample (35-37 m depth in a 44 m hole) was collected by L. Sinclair on September 9, 1987 from 4 km south of Val Marie, Frenchman Valley, southwestern Saskatchewan (49°13'N, 107°49'W). This sample was submitted by B.T. Schreiner to gain information on the rate of sedimentation.

See S-2821 (below) for comments.

S-2930

Climax A

Uncorrected age:

3440 ± 165

The wood from rotary cuttings was in alluvial and colluvial sand, silt and clay. Sample "Eagle 115-455-4.85" Test Hole No. 4: 4.6-4.9m was collected by L. Sinclair on August 6, 1987 from Climax, Frenchman Valley, southwestern Saskatchewan (49°20'N, 108°24'W). This sample was submitted by B.T. Schreiner to gain information on the rate of sedimentation.

See S-2821 (below) for comments.

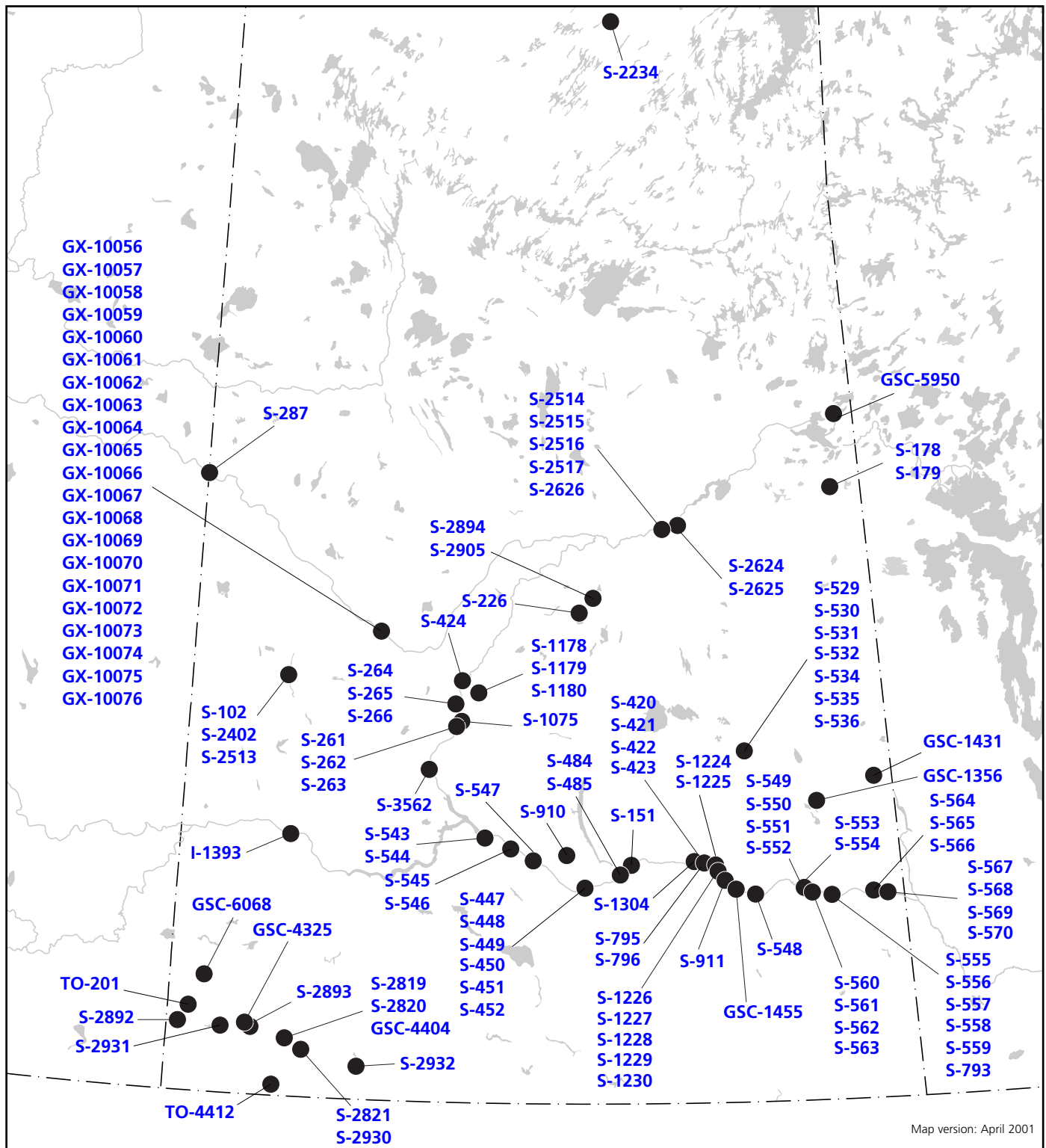


Fig. II-9. Dates related to fluvial activity.

S-2821 Climax B
Uncorrected age: 7245 ± 580

The wood was in alluvial and colluvial sand, silt, and clay. The sample (14-15 m) was collected by E.A. Christiansen from Climax, Frenchman Valley, southwestern Saskatchewan (49°20'N, 108°25'W). This sample was submitted by E.A. Christiansen to gain information on the rate of sedimentation.

Summary and Conclusions (**E.A. Christiansen**):

1. The Frenchman Valley, which in places contains at least 80 m of landslide debris, channel sand and gravel, and alluvial and colluvial deposits, is 340 km long, locally 3 km wide, and at least 100 m deep.
2. Alluvial and colluvial sedimentation commenced more than 11.5 ka, which suggests that Frenchman Valley was formed during Late Wisconsinan deglaciation.
3. The average rate of sedimentation from 11.5 to 3.5 ka was 4.5 mm/year. The rate of sedimentation diminished markedly after 3.5 ka BP.
4. The youngest glacial deposits south of the Cypress Hills are interpreted as Late Wisconsinan.

Frenchman Valley Series

A series of samples from the modern flood plain along Frenchman River about 12 km downstream from Eastend townsite, 22 km south of Dollard, about 110 km southeast of Swift Current, southwestern Saskatchewan (49°25'N, 108°36'W), at an elevation of 900 m was collected by V. Levson and L. Smith on June 6, 1986.

GSC-4404 Frenchman Valley I
Normalized age: 1370 ± 80
 $\delta^{13}\text{C} = -25.7\%$

The wood charcoal sample (KS-185-86 (depth of 7 m in borehole 29-86); *Salix* and *Prunus*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-09)) was in sand and gravel. This sample was submitted by R.W. Klassen to gain information on an alluvial fan.

Uncorrected age: 1380 ± 80.

Comment (**R.W. Klassen**): This date indicates that substantial parts of the alluvial fans encroaching on the Frenchman valley bottom were formed during the late Holocene.

S-2819 Frenchman Valley II
Uncorrected age: 3800 ± 165

The wood sample (Test Hole No. 3 (5 m)) was in alluvial and colluvial sand, silt and clay. This sample was submitted by E.A. Christiansen to gain information on the rate of sedimentation.

S-2820 Frenchman Valley III
Uncorrected age: 7395 ± 590

The wood sample (Test Hole No. 3 (24-26 m)) was enclosed in alluvial and colluvial sand, silt and clay. This sample was submitted by E.A. Christiansen to gain information on the rate of sedimentation.

S-2931 Cypress Lake
Uncorrected age: 9225 ± 330

The wood was in alluvial and colluvial sand, silt and clay at a depth of 13 m (43 ft). The sample was collected by L. Sinclair on September 9, 1987 from 2 km east of Cypress Lake, Frenchman Valley, southwestern Saskatchewan (49°29'N, 109°22'W). This sample was submitted by B.T. Schreiner to gain information on the rate of sedimentation.

See S-2821 (above) for comments.

GSC-4325 Frenchman River
Normalized age: 4580 ± 60
 $\delta^{13}\text{C} = -10.00\%$

The freshwater shells (*Lampsilis*; identified by J.E. Dale) were in sands and fine gravel at a depth of 7 m in an alluvial-colluvial fan. Sample KJ-262-86 was collected by R.W. Klassen and V. Levson on July 23, 1986 from a 10 m high cut-bank along the Frenchman River, near confluence with Conglomerate Creek, about 2 km northeast of Ravenscrag townsite, about 130 km southwest of Swift Current, southwestern Saskatchewan (49°29'55"N, 109°2'50"W), at an elevation of 948 m. This sample was submitted by R.W. Klassen to gain information on geomorphic processes related to an alluvial fan.

Uncorrected age: 4340 ± 60

Comment (**R.W. Klassen**): GSC-4325 indicates that substantial parts of the alluvial fans encroaching on the Frenchman valley bottom were formed during the late Holocene.

S-2893 Conglomerate Creek
Uncorrected age: 6570 ± 95

The bone was in silty loam at a depth of 1 m. The sample was collected from Conglomerate Creek valley near the confluence with Frenchman River, about 55 km southeast of Maple Creek, southwestern Saskatchewan (49°30'30"N, 109°02'30"W), at an elevation of about 950 m. This sample was submitted by R.W. Klassen to gain information on fluvial geomorphic processes.

S-2892 Battle Creek
Uncorrected age: 6570 ± 95

The bone was in silty loam at a depth of 4 m. The sample was collected from the Battle Creek terrace 8 m above the creek bottom, Fort Walsh, about 50 km south of Maple Creek, southwestern Saskatchewan (49°31'0"N, 109°51'15"W), at an elevation of about 1080 m. This sample was submitted by R.W. Klassen to gain information on fluvial geomorphic processes.

TO-201 Black site
Corrected age: 8590 ± 100

The freshwater gastropod shells were in a 7 m-thick silty loam at a depth of 3 m. The sample was collected from "Black site", The Gap, about 40 km southwest of Maple Creek, southwestern Saskatchewan (49°37'00"N, 109°43'05"W). This sample was submitted by R.W. Klassen to gain information on alluvial geomorphic processes.

The age was corrected to a $\delta^{13}\text{C} = 0.0\%$

GSC-6068 Gap Creek
Normalized age: 7230 ± 100
 $\delta^{13}\text{C} = -26.7\%$

The wood (unidentifiable according to R.J. Mott (unpublished GSC

Wood Report No. 96-29) was in sand. Sample WVRC-9409 was collected by W.J. Vreeken in 1994 from along the western (left) cut bank of Gap Creek, 10 km southwest of the town of Maple Creek, southwestern Saskatchewan (49°51'15"N, 109°35'20"W), at an elevation of 789 m. This sample was submitted by W.J. Vreeken to gain information on stream incision and the rate of sedimentation.

Uncorrected age: 7250 ± 100.

Spy Hill Series

A series of organic silts from Spy Hill in the Qu'Appelle Valley, about 210 km east of Regina, southeastern Saskatchewan (50°31'N, 101°40'W) (locality: SE4-11-18-31-W1; site record: Ref. file SRC Spy Hill SE4-11) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on rates of sedimentation.

S-567 Spy Hill I

Uncorrected age: 13 505 ± 295

The organic silt was at a depth of 10.4-10.7 m (34-35 ft).

S-569 Spy Hill II

Uncorrected age: 13 985 ± 320

The organic silt was at a depth 19.8 m (65 ft).

S-568 Spy Hill III

Uncorrected age: 14 630 ± 320

The organic silt was at a depth of 15.5 m (51 ft).

S-570 Spy Hill IV

Uncorrected age: 12 930 ± 265

The organic silt was at a depth of 23.8 m (78 ft).

Ochapowace Series

A series of samples from Ochapowace (Indian Reserve 71) in the Qu'Appelle Valley, about 155 km east of Regina, southeastern Saskatchewan (50°31'N, 102°18'W) (locality: SW10-14-18-10-3-W2; site record: ref. file SRC Ochapowace SW10-14: Rot. T.H) was collected by E.A. Christiansen in 1981 and samples were submitted to gain information on alluvial geomorphic processes.

S-555 Ochapowace I

Uncorrected age: 16 495 ± 325

The organic silt was at a depth of 17.4-17.7 m (57-58 ft).

S-556 Ochapowace II

Uncorrected age: 17 105 ± 315

The organic silt was at a depth of 23.8 m (75 ft).

S-557 Ochapowace III

Uncorrected age: 22 820 ± 640

The organic silt was at a depth of 28.4-29 m (93-95 ft).

S-558 Ochapowace IV

Uncorrected age: 8930 ± 145

The wood was at a depth of 36.6-38.4 m (120-126 ft) (locality: SW10-14-18-10-3-W2; site record: ref. file SRC Ochapowace SW10-14: Rot. T.H).

Uncorrected age: 11 120 ± 150.

S-559 Ochapowace V

Uncorrected age: 28 915 ± 1140

The organic silt was at a depth of 41.5-42 m (136-138 ft).

S-793 Camp Mackay

Uncorrected age: 11 120 ± 150

The wood sample (43.6-44.2 m (143-145 ft) below the valley bottom) was in Qu'Appelle Alluvium (locality: NW16-14-18-3-W2; site record: Ref. file SRC Camp McKay testhole).

Tantallon Series

A series of organic silt samples from Tantallon in the Qu'Appelle Valley, about 200 km east of Regina, southeastern Saskatchewan (50°32'N, 101°50'W) (locality: NE3-16-18-32-W1; site record: Ref. file SRC Tantallon NE3-16) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on rates of alluvial sedimentation.

S-564 Tantallon I

Uncorrected age: 16 070 ± 360

The sample was at a depth of 13 m (43 ft).

S-565 Tantallon II

Uncorrected age: 23 565 ± 840

The sample was at a depth of 25.9-26.2 m (85-86 ft).

S-566 Tantallon III

Uncorrected age: 23 875 ± 900

The sample was at a depth of 30.2-30.5 m (99-100 ft).

Kahkewistahaw Series

A series of samples from Kahkewistahaw (Indian Reserve 72), about 150 km east of Regina, southeastern Saskatchewan (50°32'N, 102°32'W) (locality: NE6-20-18-4-W2; site record: ref. file SRC Kahkewistahaw NE6-10) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on alluvial geomorphic processes.

S-560 Kahkewistahaw I

Uncorrected age: 11 170 ± 325

The wood sample was at a depth of 38.5-41 m (126-135 ft).

S-561 Kahkewistahaw II

Uncorrected age: 14 080 ± 325

The organic silt sample was at a depth of 39 m (128 ft).

S-562 Kahkewistahaw III

Uncorrected age: 23 620 ± 865

The organic silt sample was at a depth of 47.6 m (156 ft).

S-563 Kahkewistahaw IV

Uncorrected age: 28 445 ± 1595

The organic silt sample was at a depth of 49.7-50.3 m (163-165 ft).

S-548 Ellisboro

Uncorrected age: 12 860 ± 170

The organic silt was at a depth of 36-36.3 m (118-119 ft). The sample was collected by E.A. Christiansen in 1970 from Ellisboro, about 100 km east of Regina, southeastern Saskatchewan (50°32'N, 103°13'W). This sample was submitted by E.A. Christiansen to gain information on rates of sedimentation.

GSC-1455 Qu'Appelle River

Uncorrected age: 4320 ± 220

The charcoal was in alluvium at a depth of 240 cm. The sample was collected by R.W. Klassen in 1966 from a drainage ditch about 30 m from the Qu'Appelle River channel, about 3.2 km south of Blackwood, about 85 km east of Regina, southeastern Saskatchewan (50°34'N, 103°25'W), at an elevation of about 475 m. This sample was submitted by R.W. Klassen to gain information on rates of deposition.

Comment (**R.W. Klassen**): The date suggests a slower rate of deposition (0.3 m per 500 years) along this part of the Qu'Appelle Valley than along parts of the Assiniboine Valley (0.3 m per 100 to 300 years).

Marieval Series

A series of samples from Marieval, about 140 km east of Regina, southeastern Saskatchewan (50°35'N, 102°39'W) (locality: NE12-4-19A-5-W2; site record: Ref. SRC Marieval NE12-4) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on alluvial geomorphic processes.

S-549 Marieval I

Uncorrected age: 15 460 ± 400

The organic silt was at a depth of 23.5-23.8 m (77-78 ft).

S-550 Marieval II

Uncorrected age: 11 200 ± 160

The organic silt was at a depth of 26.5-26.8 m (87-88 ft).

S-551 Marieval III

Uncorrected age: 14 325 ± 230

The organic silt was at a depth of 31-31.4 m (102-103 ft).

S-552 Marieval IV

Uncorrected age: 10 290 ± 145

The wood chip sample was at a depth of 34.8-35.4 m (114-116 ft).

S-553 Marieval V

Uncorrected age: 12 025 ± 205

The wood was at a depth of 48.8-50.6 m (160-166 ft).

S-554 Marieval VI

Uncorrected age: 28 890 ± 310

The wood chips were at a depth of 53.4 m (175 ft).

Qu'Appelle Valley Series

A series of organic silt samples from the Qu'Appelle Valley, near Regina, Saskatchewan (50°36'15"N, 105°12'00"W) (locality: SW8-13-19-24-W2; site record: file Qu'Appelle Valley SW8-13) was collected by E.A. Christiansen in 1968 and samples were submitted to gain information on alluvial rates of deposition.

S-447 Qu'Appelle Valley I

Uncorrected age: 9450 ± 250

The sample was at a depth of 7.6-8.5 m (25-28 ft).

S-448 Qu'Appelle Valley II

Uncorrected age: 7530 ± 110

The sample was at a depth of 10.4-11.6 m (34-38 ft).

S-449 Qu'Appelle Valley III

Uncorrected age: 5230 ± 90

The sample was at a depth of 21-22 m (70-72 ft).

S-450 Qu'Appelle Valley IV

Uncorrected age: 5850 ± 110

The sample was at a depth of 25-25.6 m (82-84 ft).

S-451 Qu'Appelle Valley V

Uncorrected age: 10 560 ± 170

The sample was at a depth of 29-30 m (96-98 ft).

S-452 Qu'Appelle Valley VI

Uncorrected age: 10 865 ± 215

The sample was at a depth of 29-30 m (96-98 ft).

Comment (**E.A. Christiansen**): The samples are likely contaminated as the oldest wood date in Qu'Appelle alluvium is about 12 ka BP. The organic silt dates should be rejected.

S-911 Katepwa Lake

Uncorrected age: 7295 ± 145

The organic silty clay was at a depth of 1.5 m (5 ft) in an augerhole. The sample was collected by E.A. Christiansen and W.A. Meneley in 1972 from Katepwa Lake, about 75 km east-northeast of Regina, Qu'Appelle River valley, southeastern Saskatchewan (50°38'N, 103°32'W). This sample was submitted by E.A. Christiansen to gain information on the rate of sediment accumulation.

Katepwa Beach Series

A series of wood cutting samples from Katepwa Beach, about 75 km east-northeast of Regina, Qu'Appelle River valley, southeastern Saskatchewan (50°42'N, 103°38'W). They were collected by E.A. Christiansen in 1975 and were submitted to gain

information on alluvial geomorphic processes.

S-1226 Katepwa Beach I

Uncorrected age: 5250 ± 110

The sample was at a depth of 5.2-5.8 m (17-19 ft) (locality: SW4-9-20-12-W2; site record: ref. file for SRC Katepwa Beach (#3) SW4-9).

S-1228 Katepwa Beach II

Uncorrected age: 4260 ± 90

The sample was at a depth of 5.5 m in Qu'Appelle Alluvium (locality: SW1-8-20-12-W2; site record: Ref. file for SRC Katepwa Beach SW1-9, No. 04).

S-1229 Katepwa Beach III

Uncorrected age: 4730 ± 85

The sample was at a depth of 6.4 m in Qu'Appelle Alluvium (locality: SW1-8-20-12-W2; site record: Ref. file for SRC Katepwa Beach SW1-9, No. 04).

S-1227 Katepwa Beach IV

Uncorrected age: 3085 ± 150

The sample was at a depth of 9.1-10.7 m (30-35 ft) (locality: SW4-9-20-12-W2; site record: ref. file for SRC Katepwa Beach (#3) SW4-9).

S-1230 Katepwa Beach V

Uncorrected age: 4965 ± 80

The sample was at a depth of 10.1 m in Qu'Appelle Alluvium (locality: SW1-8-20-12-W2; site record: Ref. file for SRC Katepwa Beach SW1-9, No. 04).

Comment (**E.A. Christiansen**): The dates indicate a diminishing sedimentation rate of Qu'Appelle Alluvium.

Craven Series

A series of organic silt samples from Craven, about 30 km north-northwest of Regina, Saskatchewan (50°42'N, 104°48'W) (locality: NW16-14-20-21-W2; site record: Ref. file Craven NW16-14) was collected by E.A. Christiansen in 1969 and the samples were submitted to gain information on the rate of deposition of alluvial sediments.

S-484 Craven I

Uncorrected age: 5300 ± 220

The sample was at a depth of 35-38.5 m (115-126 ft).

S-485 Craven II

Uncorrected age: 21 075 ± 690

The sample was at a depth of 51.5-52 m (169-171 ft).

Lebret Series

A series of wood samples from Lebret, about 75 km east-northeast of Regina, Qu'Appelle River valley, southeastern Saskatchewan (50°45'N, 103°41'W) (locality: SW4-1-21-13-W2; site record: Ref.-file for U of S Lebret SW4-1: No. 4 testhole) was

collected by C. Higgins and E.A. Christiansen in 1976 and samples were submitted to gain information on the rate of deposition of the Qu'Appelle Alluvium.

S-1224 Lebret I

Uncorrected age: 5740 ± 85

The wood sample was at a depth of 6.4 m in Qu'Appelle Alluvium.

S-1225 Lebret II

Uncorrected age: 7380 ± 110

The wood sample was at a depth of 22.6 m in Qu'Appelle Alluvium.

Comment (**E.A. Christiansen**): Deposition of Qu'Appelle Alluvium started before 7380 BP with the sedimentation rate diminishing with time.

Fort Qu'Appelle Series

A series of samples from near Fort Qu'Appelle, about 70 km northeast of Regina, Saskatchewan (50°46'N, 103°48'W) was collected by C. Higgins and E.A. Christiansen in 1973 and samples were submitted by E.A. Christiansen to gain information on the Qu'Appelle Alluvium.

S-795 Fort Qu'Appelle I

Uncorrected age: 6445 ± 135

The freshwater mollusc shell sample (4.0 m (13 ft) below valley bottom) was in Qu'Appelle Alluvium (locality: NE12-7-21-13-W2; site record: Ref. file SRC Fort Qu'Appelle testhole).

S-420 Fort Qu'Appelle II

Uncorrected age: 14 100 ± 200

The organic silt sample was at a depth of 10.4-11 m (34-36 ft) (locality: NW14-7-21-13-W2; site record: Ref. file SRC Ft. Qu'Appelle NW14-7).

See S-423 (below) for comment.

S-796 Fort Qu'Appelle III

Uncorrected age: 8395 ± 115

The freshwater mollusc shell sample (12.2-12.8 m (40-42 ft) below valley bottom) was in Qu'Appelle Alluvium (locality: NE12-7-21-13-W2; site record: Ref. file SRC Fort Qu'Appelle testhole).

S-421 Fort Qu'Appelle IV

Uncorrected age: 18 500 ± 300

The organic silt sample was at a depth of 32-33 m (105-108 ft) (locality: NW14-7-21-13-W2; site record: Ref. file SRC Ft. Qu'Appelle NW14-7).

See S-423 (below) for comment.

S-422 Fort Qu'Appelle V

Uncorrected age: 18 200 ± 350

The organic silt sample was at a depth of 46-46.3 m (150-152 ft) in testhole (locality: NW14-7-21-13-W2; site record: Ref. file SRC

Ft. Qu'Appelle NW14-7: testhole).

See S-423 (below) for comment.

S-423 Fort Qu'Appelle VI

Uncorrected age: 28 900 ± 1050

The organic silt sample was at a depth of 59-59.5 m (193-195 ft) (locality: NW14-7-21-13-W2; site record: Ref. file SRC Ft. Qu'Appelle NW14-7: testhole).

Comment (**E.A. Christiansen**): This sample was likely contaminated, the oldest wood date in Qu'Appelle alluvium is about 12 ka BP.

S-151 Qu'Appelle Valley

Uncorrected age: 12 100 ± 160

The calcareous sediment (travertine) was collected by W.H.W. Husband in 1961 from the south slope of Qu'Appelle Valley, Saskatchewan (50°46'N, 104°39'W). This sample was submitted by E.A. Christiansen to gain information on the valley formation.

Comment (**E.A. Christiansen**): The Qu'Appelle Valley was apparently cut between 10 150 ± 200 (S-97) and 12 140 ± 240 (S-198), as the travertine must post-date the valley formation. Contamination with older carbon may have occurred.

S-1304 Sioux Crossing

Uncorrected age: 10 110 ± 185

The wood was in Qu'Appelle Alluvium at a depth of 52.5 m (172 ft). The sample was collected by C. Higgins and E.A. Christiansen in 1974 from Sioux Crossing, about 65 km northeast of Regina, Qu'Appelle River valley, southeastern Saskatchewan (50°48'N, 103°54'W). This sample was submitted by E.A. Christiansen to gain information on the Qu'Appelle Alluvium.

Comment (**E.A. Christiansen**): Deposition started in this location before 10.1 ka.

S-547 Keeler

Uncorrected age: 14 670 ± 235

The organic silt at a depth of 26.8 m (88 ft) was collected by E.A. Christiansen in 1970 from Keeler, about 40 km northwest of Moose Jaw, south central Saskatchewan (50°48'N, 105°50'W). This sample was submitted by E.A. Christiansen to gain information on the rate of sedimentation.

S-910 Arm River valley

Uncorrected age: 10 675 ± 170

The organic silt at a depth of 7.6 m (25 ft) was collected by E.A. Christiansen in 1973 from the Arm River valley, about 45 km north of Moose Jaw, Saskatchewan (50°50'N, 105°26'W). This sample was submitted by E.A. Christiansen to gain information on alluvial geomorphic processes.

Eyebrow Series

A series of organic silt samples from Eyebrow, about 60 km northwest of Moose Jaw, south central Saskatchewan (50°53'N, 106°05'W) (locality: NW5-22-22-1-W3; site record: Ref. file SRC Eyebrow NW5-22) was collected by E.A. Christiansen in 1970 and the samples were submitted to gain information on rates of sedimentation.

S-545 Eyebrow I

Uncorrected age: 16 720 ± 465

The sample was at a depth of 22.9-23 m (75-76 ft).

S-546 Eyebrow II

Uncorrected age: 16 780 ± 360

The sample was at a depth of 29-29.5 m (96-97 ft).

I-1393 South Saskatchewan River

Uncorrected age: 585 ± 205

The charred wood was collected by D.A. St-Onge in 1964 from halfway up an 8 m cutbank on the South Saskatchewan River, north of Lancer, about 95 km northwest of Swift Current, southwestern Saskatchewan (50°57'N, 108°41'W). This sample was submitted by J.T. Andrews to gain information on the recent history of the South Saskatchewan River.

Comment (**J.T. Andrews**): The purpose of the date was to determine the recent history of the South Saskatchewan River. The date implies that the river has, for the past 500 years, been in a state of dynamic equilibrium.

Bridgeford Series

A series of organic silt samples from Bridgeford in the Qu'Appelle Valley, about 85 km northeast of Moose Jaw, south central Saskatchewan (50°58'N, 106°22'W) (locality: SE7-21-23-3-W3; site record: Ref. file SRC Bridgeford SE7-21) was collected by E.A. Christiansen in 1970 and samples were submitted to gain information on rates of sedimentation.

S-543 Bridgeford I

Uncorrected age: 9345 ± 625

The sample was at a depth of 2.4-3 m (8-10 ft).

S-544 Bridgeford II

Uncorrected age: 15 700 ± 515

The sample was at a depth of 7.3 m (24 ft).

GSC-1356 Yorkton Channel

Uncorrected age: 10 300 ± 160

The organic detritus at a depth of 6.97 to 7.00 m was collected by L.D. Delorme in 1969 from Yorkton channel, at the eastern outskirts of Yorkton, southeastern Saskatchewan (51°12.6'N, 102°28.0'W), at an elevation of about 506 m. This sample was submitted by L.D. Delorme to gain information on alluvial geomorphic processes.

Comment (**L.D. Delorme**): The sediments were deposited as channel fill after the channel ceased to be used for collecting meltwater. They are overlain by clay and the glacial till was encountered at a depth of 9.8 m.

GSC-1431 Assiniboine River

Uncorrected age: 1920 ± 190

The wood (*Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 70-21)) was in alluvium at a depth of 490 cm. The sample was collected by R.W. Klassen on September 9, 1970 from a new diversion channel about 30 m from the Assiniboine River channel,

about 10.4 km west of Togo, about 55 km east of Yorkton, southeastern Saskatchewan (51°24'N, 101°45'W), at an elevation of about 427 m. This sample was submitted by R.W. Klassen to gain information on the rate of sediment deposition.

Comment (**R.W. Klassen**): The date is considerably younger than GSC-280 (6320 ± 140 years; Dyck et al., 1965) from same depth in the diversion channel about 86 km farther downstream in Manitoba. The age differences most likely reflect shifts of the channel across the flood plain although a greater rate of deposition in the upstream part may also be indicated.

S-3562 Outlook

Uncorrected age: 11 470 ± 170

Sample Outlook Bridge No. 107 (wood, enclosed in alluvium at 15.85 m depth) was collected by E.A. Christiansen on August 8, 1994, from 1.5 km southwest of Outlook in the South Saskatchewan River valley, south of Saskatoon, Saskatchewan (51°28'24"N, 107°04'21"W), at an elevation of 478.6 m. This sample was submitted by B.T. Schreiner to gain information on alluvial geomorphic processes.

Comment (**B.T. Schreiner**): This is the oldest date on the South Saskatchewan River alluvium.

Tuffnell Lake Series

A series of samples from Tuffnell Lake, near Tuffnell, about 160 km northeast of Regina, southeastern Saskatchewan (51°36'N, 103°20'W) (locality: SW7-22-30-10-W2; site record: Ref. SRC file Tuffnell Lake SW7-22) was collected by Shelby tube from a drill site on ice. The samples were collected by E.A. Christiansen in 1970 and submitted to gain information on the rate of sediment accumulation.

S-529 Tuffnell Lake I

Uncorrected age: 4180 ± 130

The organic silt sample was at a depth of 33.5 m (110 ft).

S-530 Tuffnell Lake II

Uncorrected age: 5465 ± 135

The organic silt sample was at a depth of 38.4 m (126 ft).

S-531 Tuffnell Lake III

Uncorrected age: 8405 ± 185

The organic silt sample was at a depth of 43 m (141 ft).

S-532 Tuffnell Lake IV

Uncorrected age: 10 210 ± 225

The wood sample was at a depth of 47 and 48 m (155 and 157 ft).

S-534 Tuffnell Lake V

Uncorrected age: 31 710 ± 1420

The organic silt sample was at a depth of 76-77.7 m (250-255 ft).

S-535 Tuffnell Lake VI

Uncorrected age: 33 830 ± 1630

The organic silt sample was at a depth of 89-90.5 m (292-297 ft).

S-536 Tuffnell Lake VII

Uncorrected age: 36 940 ± 3630

The organic silt sample was at a depth of 111-112.8 m (365-370 ft).

Frenchman's Flat A Series

A series of samples from the south end of the floodplain, "Frenchman's Flat", Saskatchewan (51°47'N, 106°45'W) was collected by L.E. Hodgins in 1964 and samples were submitted to gain information on fluvial degradation and aggradation.

S-261 "Frenchman's Flat" A-I

Uncorrected age: 1450 ± 70

The charcoal and soil sample (90 cm (3 ft) depth) was in alluvium and was from the same section as S-262, and -263.

S-262 "Frenchman's Flat" A-II

Uncorrected age: 1950 ± 85

The charcoal and soil sample (120 cm (4 ft) depth) was in alluvium and was from the same section as S-261, and -263.

S-263 "Frenchman's Flat A"-III

Uncorrected age: 2980 ± 75

The charcoal and soil sample (2.1 m (7'2") depth) was in alluvium and was from the same section as S-261, and -262.

S-1075 South Saskatchewan River

Uncorrected age: 4210 ± 75

The charcoal with red-brown silt was in a 1 cm-thick layer in silt and clay alluvium (flood plain deposit) at a depth of 1.2 m. The sample was collected by E.A. Christiansen in 1975 from the east bank of the South Saskatchewan River Valley Park, about 30 km south of Saskatoon, Saskatchewan (51°49'N, 106°43'W). This sample was submitted by E.A. Christiansen to gain information on alluvial geomorphic processes.

"Frenchman's Flat" B Series

A series of samples from the central part of the flood plain, "Frenchman's Flat", Saskatchewan (51E57NN, 106E47NW), was collected by L.E. Hodgins in 1964. These samples were submitted by L.E. Hodgins to gain information on geomorphic fluvial processes.

S-265 "Frenchman's Flat" B-I

Uncorrected age: 450 ± 60

The charcoal sample (1.35 m (4.5 ft) depth), about 100 m south of S-264 site, was enclosed in alluvium.

S-264 "Frenchman's Flat" B-II

Uncorrected age: 540 ± 75

The wood sample (a horizontal log at 2.4 m (8 ft) depth) enclosed in alluvium, was 100 m north of S-265 site.

S-266 "Frenchman's Flat" B-III

Uncorrected age: 1035 ± 60

The *Bison* bone sample (2.4 m (8 ft) depth) was enclosed in alluvium. The bone pre-treatment method used, charring, was probably inadequate to remove contaminants.

Comment (**L.E. Hodgins**): These samples date parts of local but morphologically significant flood plain and give rates of sedimentation of overbank flood deposits. Range of dates indicate main river channel has been relatively stable for at least 1000 years, and are minimum for earlier post-glacial degradation and aggradation. S-266 is maximum for Pike Lake (large ox-bow) which probably also post-dates S-264 and -265.

Goodale Farm Series

A series of organic silt samples from the Goodale Farm, about 8 km east-southeast of the junction of highway 16 and 11 in Saskatoon, Saskatchewan (52°03'N, 106°30'W) (locality: NE16-33-35-4-W3; site: 029; no Palynological Report (cf. GSC PL-77.027)) was collected by E.A. Christiansen in 1976 and samples were submitted to gain information on rates of accumulation.

S-1178 Goodale Farm I

Uncorrected age: 6705 ± 180

The sample (1.52 m depth) was in silt over till.

S-1179 Goodale Farm II

Uncorrected age: 9290 ± 155

The sample (2.13 m depth) was in silt over till.

S-1180 Goodale Farm III

Uncorrected age: 10 730 ± 280

The sample (2.74 m depth) was in silt over till.

S-424 South Saskatchewan River

Uncorrected age: 4100 ± 50

The basal organic clay was at a depth of 1.5 m (5 ft). The sample was collected by E.A. Christiansen in 1967 from a high-level channel of the South Saskatchewan River, Saskatoon, Saskatchewan (52°08'N, 106°41'W). This sample was submitted by E.A. Christiansen to gain information on fluvial geomorphic processes.

Comment (**E.A. Christiansen**): Samples of carbonaceous clay taken from a postglacial slough deposit in the Hudson Bay channel contained animal remains.

Tramping Lake Series

A series of samples from Tramping Lake, 80 km south-southwest of North Battleford, Saskatchewan (52°08'N, 108°50'W) (locality: NW15-32-36-20-W3) was collected by J. Labossiere and E.K. Sauer in 1983. These samples were submitted by B.T. Schreiner to gain information on alluvial geomorphic processes.

S-102 Tramping Lake I

Uncorrected age: 5775 ± 160

The paleosol sample (depth 7.8 m) was in alluvium.

S-2402 Tramping Lake II

Uncorrected age: 6285 ± 625

The wood sample (depth 7.8 m) was in alluvium.

S-2513 Tramping Lake III

Uncorrected age: >33 000

The wood sample (depth 7.8 m) was in alluvium.

Comment (**B.T. Schreiner**): S-2513 is a suspect date in relation to its stratigraphic setting.

Maymont Bridge Series

A series of wood samples in alluvial sand from Maymont Bridge, North Saskatchewan River, about 45 km southeast of North Battleford, western Saskatchewan (52°29'23"N, 107°42'43"W) (locality: SW16-31-40-12-W3) was collected by E. A. Christiansen in 1983 and samples were submitted to gain information on alluvial geomorphic processes.

GX-10074 Maymont Bridge I

Uncorrected age: modern

Sample "Eagle No. 46" was at a depth of 3-4 m (site record: U of S file Eagle 46 T.H.).

GX-10056 Maymont Bridge II

Uncorrected age: 1520 ± 160

Sample "Eagle No. 48" was at a depth of 9 m (site record: SRC file Eagle 48).

GX-10060 Maymont Bridge III

Uncorrected age: 2275 ± 170

Sample "Eagle No. 42" was at a depth of 11 m (site record: SRC file Eagle 42).

GX-10057 Maymont Bridge IV

Uncorrected age: 2815 ± 180

Sample "Eagle No. 48" was at a depth of 9 m (site record: SRC file Eagle 48).

GX-10068 Maymont Bridge V

Uncorrected age: 2830 ± 180

Sample "Eagle No. 49" was at a depth of 10-13 m (site record: SRC file Eagle 49).

GX-10058 Maymont Bridge VI

Uncorrected age: 3730 ± 200

Sample "Eagle No. 48" was at a depth of 14 m (site record: SRC file Eagle 48).

GX-10065 Maymont Bridge VII

Uncorrected age: 5195 ± 205

Sample "Eagle No. 43" was at a depth of 19 m (site record: SRC file Eagle 42).

GX-10061 Maymont Bridge VIII
Uncorrected age: 6730 ± 230

Sample "Eagle No. 42" was at a depth of 17 m (site record: SRC file Eagle 42).

GX-10062 Maymont Bridge IX
Uncorrected age: 6990 ± 245

Sample "Eagle No. 42" was at a depth of 19 m (site record: SRC file Eagle 42).

GX-10059 Maymont Bridge X
Uncorrected age: 4225 ± 195

Sample "Eagle No. 48" was at a depth of 20 m (site record: SRC file Eagle 48).

GX-10063 Maymont Bridge XI
Uncorrected age: 7530 ± 255

Sample "Eagle No. 42" was at a depth of 20 m (site record: SRC file Eagle 42).

GX-10070 Maymont Bridge XII
Uncorrected age: 7780 ± 265

Sample "Eagle No. 44" was at a depth of 20 m (site record: SRC file Eagle 42).

GX-10066 Maymont Bridge XIII
Uncorrected age: 10 460 ± 340

Sample "Eagle No. 43" was at a depth of 22 m (site record: SRC file Eagle 42).

GX-10072 Maymont Bridge XIV
Uncorrected age: 7405 ± 387

Sample "Eagle No. 30" was at a depth of 23 m (site record: SRC file Eagle 39 T.H.).

GX-10064 Maymont Bridge XV
Uncorrected age: 8200 ± 285

Sample "Eagle No. 42" was at a depth of 23 m (site record: SRC file Eagle 42).

GX-10067 Maymont Bridge XVI
Uncorrected age: 9925 ± 300

Sample "Eagle No. 43" was at a depth of 23 m (site record: SRC file Eagle 42).

GX-10075 Maymont Bridge XVII
Uncorrected age: 10 333 ± 380

Sample "Eagle No. 45" was at a depth of 23-25 m (site record: SRC file Eagle 45 T.H.).

GX-10069 Maymont Bridge XVIII
Uncorrected age: 7395 ± 830

Sample "Eagle No. 49" was at a depth of 25 m (site record: SRC file Eagle 49).

GX-10071 Maymont Bridge XIX
Uncorrected age: 8580 ± 315

Sample "Eagle No. 44" was at a depth of 25-27 m (site record: SRC file Eagle 42).

GX-10073 Maymont Bridge XX
Uncorrected age: 10 790 ± 790

Sample "Eagle No. 30" was at a depth of 29 m (site record: SRC file Eagle 39 T.H.).

GX-10076 North Saskatchewan River
Uncorrected age: 8345 ± 374

The wood (Eagle No. 41 (21 m depth)) in alluvial sand was collected by E.A. Christiansen in 1983 from Maymont Bridge, North Saskatchewan River, about 45 km southeast of North Battleford, western Saskatchewan (52°29'30"N, 107°42'41"W). This sample was submitted by E.A. Christiansen to gain information on alluvial geomorphic processes.

S-226 Hazel Lake
Uncorrected age: >31 500

The marl was in an 18.3 m-thick sand unit, 3 m above noncalcareous Upper Cretaceous bedrock. The sample was collected by W.A. Meneley in 1968, from Hazel Lake in Hatfield Valley, near Melfort, about 110 km northeast of Saskatoon, Saskatchewan (52°39'N, 105°17'W). This sample was submitted by W.A. Meneley to gain information on alluvial sedimentation.

McCloy Creek Series

A series of wood samples from rotary drill cuttings was enclosed in postglacial deposits. They were taken from the McCloy Creek valley, about 60 km southeast of Prince Albert, central Saskatchewan (52°46'N, 105°08'W) (locality: NE1-9-44-22-W2). The samples were collected by E.K. Sauer and L. Sinclair on March 16, 1987, and were submitted by B.T. Schreiner to gain information on the rates of sedimentation.

S-2905 McCloy Creek I
Uncorrected age: 5585 ± 295
The sample was at a depth of 13.4-13.7 m.

S-2894 McCloy Creek II
Uncorrected age: less than 100
The sample was at a depth of 26-26.5 m.

Foxes Flat Series

A series of wood samples from "Foxes Flat", west of Nipawin, Saskatchewan (53°18'N, 104°14'W) was collected by J.E. Campbell in 1984 and samples were submitted to gain

information on a point bar sequence and fluvial geomorphic processes. (locality: C-11-11-50-16-W2; site record: file for Foxes Flat-19; Campbell 1988: R-842-57-E-88.)

S-2516 Foxes Flat I

Uncorrected age: 260 ± 60

The wood sample ((29) depth 1.8 m) was in gravel below a sand unit.

S-2517 Foxes Flat II

Uncorrected age: 260 ± 60

The bone sample ((29) depth 1.8 m) was in gravel below a sand unit.

S-2626 Foxes Flat III

Uncorrected age: 6010 ± 235

The paleosol sample (depth 2.95 m) was in overbank alluvial deposits. Site record: SRC #2514; file for FF-19.

Comment (**J.E. Campbell**): The date appears to be unreliable, possibly because of coal contamination.

S-2515 Foxes Flat IV

Uncorrected age: 3595 ± 110

The bone sample ((21) depth 10.5 m) was in gravel below a sand unit.

S-2514 Foxes Flat V

Uncorrected age: 3875 ± 80

The wood, tree trunk sample (depth 10 m) was in gravel below a sand unit.

Nipawin Series

A series of samples enclosed in overbank alluvial silt and fine sand from Nipawin, Saskatchewan (53°19'00"N, 104°03'45"W) (site record: D. Meyer file for S-2624; S-2287; S-2286) was collected by D. Meyer in 1983 and samples were submitted by J.E. Campbell to gain information on alluvial geomorphic processes, and intercomparison of materials.

S-2624 Nipawin I

Uncorrected age: 2090 ± 195

The bone sample was at a depth of 1.33 m.

S-2625 Nipawin II

Uncorrected age: 2175 ± 205

A paleosol sample.

Bainbridge River Series

A series of samples from the west bank of a new course of Bainbridge River, about 255 km east of Prince Albert, east central Saskatchewan (53°34'N, 102°07'W) was collected by H. Kagis in 1961 and samples were submitted by E.A. Christiansen to gain information on alluvial geomorphic processes. The samples date two episodes of alluviation.

S-179 Bainbridge River I

Uncorrected age: 470 ± 50

The wood sample (90 cm (3 ft) above till) was a vertical log with roots in sand and silt 3.6 m (12 ft) thick overlying till.

S-178 Bainbridge River II

Uncorrected age: 770 ± 50

The wood sample (15 cm (6") above till) was a horizontal log in sand and silt 3.6 m (12 ft) thick overlying till.

S-287 North Saskatchewan River

Uncorrected age: 2270 ± 70

The wood was in alluvial silt at a depth of 3.4-3.6 m (11-12 ft). The sample was collected by E.A. Christiansen in 1965 adjacent to the North Saskatchewan River, "Meridian Ferry", west central Saskatchewan (53°36'00"N, 109°59'30"W). This sample was submitted by E.A. Christiansen to gain information on fluvial floodplain aggradation.

GSC-5950 Cross Bay

Normalized age: modern
δ¹³C = -26.8‰

The silty organic detritus was overlain by pebbly sands and underlain by a calcareous sandy-silty till. Sample 94-JEC-0080 (17-20 cm) was collected by J.E. Campbell on July 26, 1994, from 75 m west of the southwest shore of Cross Bay, Nanew Lake, 23.25 km northeast of Cumberland House, north-central Saskatchewan (54°06'33"N, 102°00'47"W), at an elevation of 267 m. This sample was submitted by I. McMartin to gain information on alluvial geomorphic processes.

Uncorrected age: 40 ± 60

Comment (**I. McMartin**): The sample is modern which makes this radiocarbon date is insignificant.

S-2234 Way Lake

Uncorrected age: less than 100

The wood was near the top of the lake bottom fluvial sand unit. The sample was collected by T. Donkes and E.A. Christiansen in 1982 from Way Lake, about 250 km northeast of La Ronge, central Saskatchewan (57°08'N, 104°52'W). This sample was submitted by B.T. Schreiner to gain information on fluvial geomorphic processes.

Dates providing chronologic control on peat development (Fig. II-10)²

S-2570

Tall Pines area

Uncorrected age: 3415 ± 165

The basal fen peat was north of Preeceville, near Tall Pines, southeastern Saskatchewan (52°22'N, 102°37'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

GSC-539

Yellow Creek

Uncorrected age: 7100 ± 150

The basal silty gyttja was overlying gray silt and underlying marly gyttja and fen peat. Sample "280-290 cm" was collected by R.J. Mott in 1965 from a fen 4.3 km (2.7 miles) south-southeast of Yellow Creek, about 60 km southeast of Prince Albert, central Saskatchewan (52°43'00"N, 105°13'15"W). This sample was submitted by R.J. Mott to gain information on the initiation of peat accumulation.

Comment (R.J. Mott): Because the deposit is above the maximum limit of Glacial Lake Agassiz, it was hoped it would provide a minimum date for deglaciation in the area. The date is much younger than expected and only indicates when organic accumulation started.

Nipawin Series

A series peat samples from Nipawin, Saskatchewan (53°16'N, 104°28'W), locality: NW16-30-49-17-W2, was collected by E.A. Christiansen in 1981 and samples were submitted to gain information on peat accumulation.

S-2169

Nipawin I

Uncorrected age: 2865 ± 115

The peat sample at a depth 2.4 m (8 ft) was in 1.4 m of peat, under 1.4 m of road fill, and was underlain by channel gravel.

S-2170

Nipawin II

Uncorrected age: 3870 ± 125

The peat sample at a depth of 2.7 m (9 ft) was in 1.4 m of peat under 1.4 m of road fill, and was underlain by channel gravel.

S-2171

Nipawin III

Uncorrected age: 3280 ± 125

The peat sample at a depth of 3.4 m (11 ft) was in 1.4 m of peat under 1.4 m of road fill, and was underlain by channel gravel.

S-2168

Nipawin

Uncorrected age: 4675 ± 130

The basal peat at a depth of 3.4-3.7 m (11-12 ft) was underlying 1.5 m of road fill, 2.1 m of peat, and over 0.8 m of postglacial silt and glacial sand. The sample (209) was collected by E.A. Christiansen in 1981 from Nipawin, Saskatchewan (53°20'N, 104°25'W) and was submitted to gain information on peat accumulation.

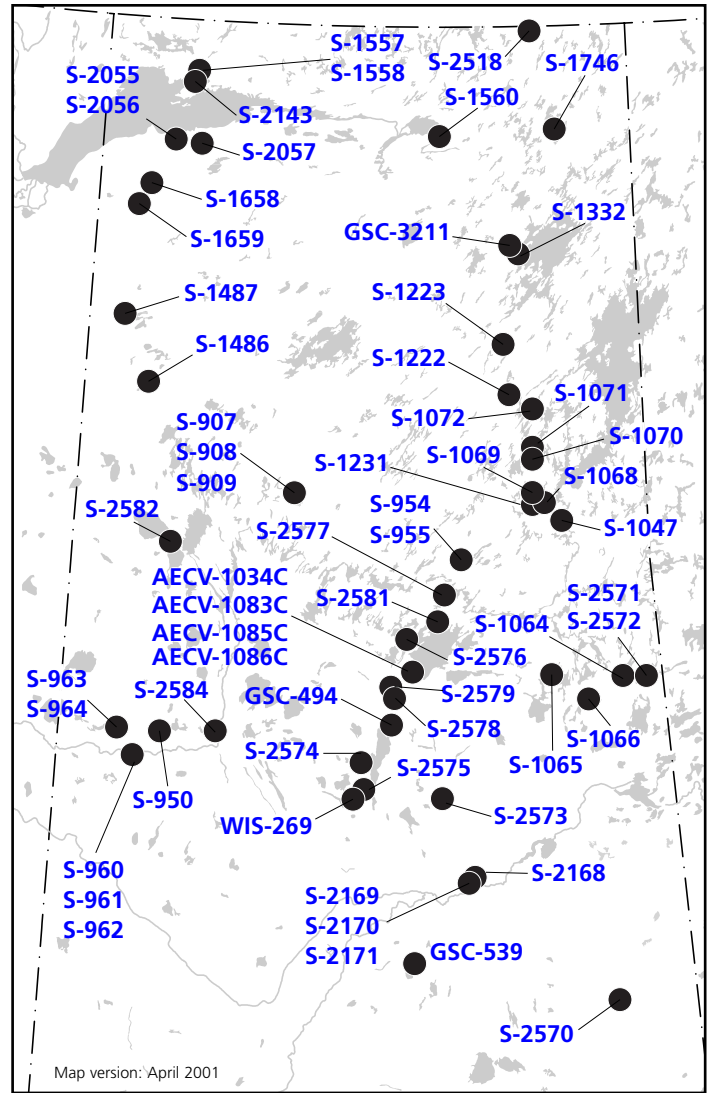


Fig. II-10. Dates providing chronologic control on peat development.

WIS-269

Waskesiu Lake

Uncorrected age: 2410 ± 60

The basal organic detrital mud at a depth of 150-160 cm, was enclosed in mud overlying clay. It was collected by R.A. Bryson and H. Nichols in 1967 from Waskesiu Lake, Prince Albert National Park, central Saskatchewan (53°55'N, 106°03'W). This sample was submitted by H. Nichols to gain information on the initiation of peat accumulation.

Comment (H. Nichols): The organic material immediately overlies glacial lake clay which begins at 158 cm with a rather sharp transition from organics to clay. The mud may not be conformable with the clay, but the date should indicate the initiation of bog conditions in the valley.

S-2573

Noyes Lake area

Uncorrected age: 3750 ± 120

²The locality descriptions for the samples of S. C. Zoltai were derived by McNeely from the coordinates provided by the submitter.

The basal fen peat was from the Noyes Lake area, near Nipawin Provincial Park, central Saskatchewan (53°58'N, 104°52'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2575 Nikik Lake
Uncorrected age: 3470 ± 230

The basal fen peat was near Nikik Lake, Montreal Lake area, central Saskatchewan (54°00'N, 105°52'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2574 Dunster Lake area
Uncorrected age: 5215 ± 140

The basal fen peat was near Dunster Lake, Montreal Lake area, central Saskatchewan (54°15'N, 105°57'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

Beaver River Series

A series of peat and wood samples from the Beaver River valley, west central Saskatchewan (54°15'N, 108°58'W) (locality: SW13-5-61-20-W2; site record: Ref. file SRC Beaver River SW13-5; EC 44) was collected by E.A. Christiansen in 1974 and were submitted to gain information on geomorphic processes and peat accumulation.

S-960 Beaver River I
Uncorrected age: 1600 ± 100

The sample (0.3 m below the top of a peat bed) was enclosed in alluvium under 2.7 m of road fill.

S-961 Beaver River II
Uncorrected age: 3205 ± 65

The sample (0.6 m below the top of a peat bed) was enclosed in alluvium under 2.7 m of road fill.

S-962 Beaver River III
Uncorrected age: 3140 ± 105

The sample (0.9 m below the top of a peat bed) was enclosed in alluvium under 2.7 m of road fill.

S-950 Waterhen River
Uncorrected age: 1855 ± 75

The basal peat was at a depth of 11.9 m and was collected by E.A. Christiansen in 1974 from Waterhen River, west central Saskatchewan (54°25'N, 108°38'W). This sample was submitted by E.A. Christiansen to gain information on the initiation of peat accumulation.

Waterhen River Series

A series of peat samples from a depression near Waterhen River, west central Saskatchewan (54°27'N, 109°12'W) was collected by E.A. Christiansen in 1974 and were submitted to gain information on geomorphic processes and the initiation of peat accumulation.

S-963 Waterhen River I

Uncorrected age: 490 ± 65

The peat was 0.3 m below the top of a peat bed at a depth of 6.4 m below the road fill surface.

S-964 Waterhen River II
Uncorrected age: 9935 ± 170

The basal peat was 3.0 m below the top of a peat bed, 9.5 m below the road fill surface, and was associated with freshwater gastropod and pelecypod shells.

S-2584 Cowan River area
Uncorrected age: 4215 ± 175

The basal fen peat was from the Cowan River area, near Green Lake, central Saskatchewan (54°28'N, 107°51'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

GSC-494 Molanosa
Uncorrected age: 4200 ± 130

The basal peat was overlying boulders and sand with 1.2 m of peat above. Sample MS-65-20 was collected by R.J. Mott in 1965 from a drainage ditch in a bog beside highway 2, about 5 km (3 miles) north of Molanosa, about 145 km north of Prince Albert, central Saskatchewan (54°33'N, 105°32'W), at an elevation of about 509 m. This sample was submitted by R.J. Mott to gain information on deglaciation and the initiation of peat accumulation.

Comment (**R.J. Mott**): The sample was dated to provide a minimum age for deglaciation. The young date gives the age for the beginning of peat accumulation at the site.

S-1066 Hanson Lake
Uncorrected age: 5570 ± 95

The basal peat (3 m (10 ft) depth) was overlain by peat, and underlain by silty clay. It was collected by E.A. Christiansen in 1975 from Hanson Lake, about 60 km west of Flin Flon, east central Saskatchewan (54°42'N, 102°53'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and the initiation of peat accumulation.

S-2578 near Casat Lake
Uncorrected age: 6240 ± 165

The basal fen peat was collected north of Casat Lake, central Saskatchewan (54°43'N, 105°28'W). It was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2579 near Casat Lake
Uncorrected age: 7400 ± 170

The basal fen peat was collected north of Casat Lake, central Saskatchewan (54°49'N, 105°33'W). It was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-1064 Maskunow Lake area
Uncorrected age: 3715 ± 75

The peat was collected by E.A. Christiansen in 1975 on highway 106, 2.9 km (1.8 miles) north of Maskunow Lake, 4.3 km (2.7 miles) south of Judique Lake, about 35 km west of Flin Flon, east central Saskatchewan (54°52'N, 102°25'W). This sample was submitted by E.A. Christiansen to gain information on peat accumulation.

S-2571 near Flin Flon

Uncorrected age: 5975 ± 210

The basal peat was in peat overlying organic lacustrine sediment at a depth of 308 cm. It was collected from about 20 km west of Flin Flon, east central Saskatchewan (54°53'N, 102°05'W). This sample was submitted by S.C. Zoltai to gain information on peat accumulation.

S-2572 near Tyrrell Lake

Uncorrected age: 7255 ± 250

The basal limnic peat was collected near Tyrrell Lake, Flin Flon area, northeastern Saskatchewan (54°53'N, 102°05'W). It was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-1065 Deschambault Lake

Uncorrected age: 5900 ± 80

The basal fen peat, at a depth of 3 m, was overlying recent and glaciolacustrine silt. It was collected by E.A. Christiansen, D.W. Alley and B.T. Schreiner in 1975 from the shore of Deschambault Lake, west of Carey Island, east of Robertson Island, east central Saskatchewan (54°54'00"N, 103°22'25"W). This sample was submitted by E.A. Christiansen to gain information on the initiation of peat accumulation.

La Ronge Bog Series

A series of peat samples was collected from La Ronge Bog, central Saskatchewan (54°56'N, 105°16'W). The samples were submitted by P. Kuhry to gain information on peat accumulation.

AECV-1086C La Ronge Bog I

Normalized age: 960 ± 90

AECV-1085C La Ronge Bog II

Normalized age: 3710 ± 90

AECV-1083C La Ronge Bog III

Normalized age: 4290 ± 100

AECV-1034C La Ronge Bog IV

Normalized age: 5020 ± 110

S-2576 English Creek area

Uncorrected age: 8010 ± 170

The basal fen peat was collected from the English Creek area, near La Ronge, central Saskatchewan (55°11'N, 105°20'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2581 Duck Lake area

Uncorrected age: 6405 ± 255

The basal fen peat was collected near Duck Lake, Lac la Ronge Provincial Park, Central Saskatchewan (55°20'N, 104°55'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-2577 Hine Lake area

Uncorrected age: 5270 ± 205

The basal fen peat was collected from north of Hine Lake, Lac la Ronge Provincial Park, central Saskatchewan (55°32'N, 104°48'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

Halistone Lake Series

A series of moss peat samples from a depth of about 23 m (75 ft), enclosed in sphagnum moss (2 m), under road fill (23 m), and overlying fine sand (15 cm) was collected by E.A. Christiansen in 1974 from highway 102, 1.6 km (1 mi.) west of Halistone Lake, central Saskatchewan (55°48'N, 104°34'W) (site record: Ref. SRC file EC 10: 2-1, 2-2). The samples were submitted by E.A. Christiansen to gain information on peat accumulation.

S-954 Halistone Lake I

Uncorrected age: 4260 ± 75

S-955 Halistone Lake II

Uncorrected age: 5060 ± 105

S-2582 Buffalo Narrows area

Uncorrected age: 6855 ± 160

The basal fen peat was collected near Buffalo Narrows, northwestern Saskatchewan (55°54'N, 108°35'W). This sample was submitted by S.C. Zoltai to gain information on deglaciation and the initiation of peat accumulation.

S-1047 Royal Lake

Uncorrected age: 5455 ± 80

The basal peat at a depth of 1 m (40") was overlying blue clay (81 cm) and under peat (20 cm), and 1.27 m of humus-clay, in permafrost. The sample was collected by W.G.Q. Johnston in 1974 from Royal Lake, about 30 km south of Southend Reindeer, northeastern Saskatchewan (56°07'N, 103°11'W). This sample was submitted by E.A. Christiansen to gain information on deglaciation and the initiation of peat accumulation.

S-1068 Southend Road

Uncorrected age: 4560 ± 80

The basal peat at 3 m (10 ft) was overlain by peat and underlain by silt and till. The sample was collected by D.W. Alley in 1975 from Southend (Reindeer) Road, northeastern Saskatchewan (56°15'N, 103°30'W) and was submitted to gain information on deglaciation and the initiation of peat accumulation.

S-1231 Reindeer Lake

Uncorrected age: 6420 ± 115

The basal peat was overlying silt at a depth of 1.8 m. It was collected by D.W. Alley in 1976 from a palsa on a topographic high,

at the junction of highways 102 and 105, Reindeer Lake, northeastern Saskatchewan (56°15'N, 103°35'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

Complex Lake Series

A series of samples that were overlain by moss and wood at 25 cm with a well decomposed dark organic layer at 37 cm was collected. The sample site was about 92 m from the southwest shore of Complex Lake, about 90 km north of Pinehouse Lake, north central Saskatchewan (56°19'30"N, 106°57'00"W) (site record: Ref. SRC file Complex Lake series; Nos. 1, 2, 3 excavation). They samples were collected by E.A. Christiansen and D. Acton in 1972 and were submitted by E.A. Christiansen to gain information on peat accumulation.

S-907 Complex Lake I

Uncorrected age: 165 ± 85

The moss (peat) sample was located at a depth of 17.8-25.4 cm (7-10").

S-908 Complex Lake II

Uncorrected age: 100 ± 90

The moss (peat) and wood sample was located at 25.4 cm (10") depth.

S-909 Complex Lake III

Uncorrected age: 495 ± 65

The dark organic moss (peat) sample was located at a depth of 36.8-38 cm (14.5-15").

S-1069 Wollaston Lake Road

Uncorrected age: 2090 ± 70

The peat (depth 3 m (10 ft)) was overlain by peat and underlain by silt and till. The sample was collected by D.W. Alley in 1975 from "Mile 8" on Wollaston Lake road, northeastern Saskatchewan (56°22'N, 103°32'W). This sample was submitted by D.W. Alley to gain information on deglaciation and peat accumulation.

S-1070 Wollaston Lake Road

Uncorrected age: 6910 ± 100

The basal peat was enclosed in peat overlying silt and silty sand in permafrost at a depth of 2.7 m (9 ft). The sample was collected by E.A. Christiansen, D.W. Alley and B.T. Schreiner in 1975 from "Mile 25" on highway 105, Wollaston Lake Road, northeastern Saskatchewan (56°36'N, 103°35'W). This sample was submitted by E.A. Christiansen to gain information on the initiation of peat accumulation.

S-1071 Wollaston Lake Road

Uncorrected age: 6910 ± 100

The basal peat (depth 2.7 m (9 ft)) was overlain by peat and underlain by silt and silty sand units in permafrost. The sample was collected by D.W. Alley in 1975 from Wollaston Lake Road, northeastern Saskatchewan (56°40'N, 103°35'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

S-1072 Wollaston Lake Road

Uncorrected age: 4285 ± 70

The peat, at a depth of 2.1 m (7 ft), was collected by D.W. Alley in 1975, from Wollaston Lake road, northeastern Saskatchewan (56°59'N, 103°36'W). It was submitted by D.W. Alley to gain information on deglaciation and peat accumulation.

S-1222 Wollaston Lake area

Uncorrected age: 2690 ± 70

The basal peat, at a depth of 2.4 m, was enclosed in 2 m of peat, overlying till, and underlying 0.4 m of fill. The sample was collected by B.T. Schreiner in 1976 from "Mile 70" on highway 105, Wollaston Lake area, northeastern Saskatchewan (57°06'00"N, 103°51'45"W). This sample was submitted by B.T. Schreiner to gain information on the initiation of peat accumulation.

S-1486 Mile 60

Uncorrected age: 1800 ± 70

The basal peat at a depth of 3 m (10 ft) was overlying gravels. It was collected by B.T. Schreiner in 1978 from "Mile 60" on the winter road to Cluff Lake, northeast of Descharme Lake, Saskatchewan (57°08'N, 109°05'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1223 Wollaston Lake area

Uncorrected age: 5660 ± 70

The basal peat containing charcoal and seeds (1.8 m depth (6 ft)) was enclosed in 1.4 m of peat, overlying sandy till laden with pebbles, and was overlain by 0.6 m of fill. The sample was collected by B.T. Schreiner in 1976 from "Mile 100" on highway 05, Wollaston Lake area, northeastern Saskatchewan (57°29'N, 103°58'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1487 Mile 106

Uncorrected age: 6980 ± 100

The basal peat, with a gyttja-like appearance, at a depth of 2.4 m was overlying sandy silt. It was collected by B.T. Schreiner in 1978 from "Mile 106" on the winter road to Cluff Lake, near Sholte Lake, Saskatchewan (57°40'N, 109°28'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1332 Rabbit Lake

Uncorrected age: 8340 ± 160

The basal peat in lacustrine peat overlying till was collected by B. Geddes in 1977 from the north end of Rabbit Lake, Wollaston Lake area, Saskatchewan (58°12'N, 103°42'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

Comment (**B.T. Schreiner**): This sample probably dates the time of the formation of the lake. The sediments were sampled from an open-cut through the basin of Rabbit Lake after it was drained.

GSC-3211 McClean Lake

Uncorrected age: 6960 ± 80

The basal peat sample 64L801328 (190-194 cm), was collected by R.N.W. DiLabio and W.B. Coker in 1980 from McClean Lake, west of Wollaston Lake, northeastern Saskatchewan (58°16'N, 103°52'W), at an elevation of 435 m. This sample was submitted by R.N.W. DiLabio to gain information on deglaciation and the initiation of peat accumulation.

Comment (**R.N.W. DiLabio**): The date is a minimum age for deglaciation and organic accumulation at the site. Unpublished GSC Plant Macrofossil Report 81-7 and unpublished GSC Fossil Arthropod Report 81-8 by J.V. Matthews, Jr. indicate that the assemblage is typical of a poorly drained site within the spruce treeline.

S-1659 Carswell Lake

Uncorrected age: 4690 ± 70

The basal black peat with wood chips was enclosed in fibrous peat overlying sand and till. Sample BS-2361 1-5 (2.4 m depth) was collected by B.T. Schreiner in 1979 from the south shore of Carswell Lake, about 110 km south of Lake Athabasca, Saskatchewan (58°31'N, 109°24'W). This sample was submitted by B.T. Schreiner to gain information on deglaciation and the initiation of peat accumulation.

S-1658 Carswell Lake

Uncorrected age: 320 ± 40

The fibrous peat and charred material between two tills, sample BS-2360 2-1, was collected by B.T. Schreiner in 1979 from a roadcut exposure on the north shore of Carswell Lake, about 110 km south of Lake Athabasca, Saskatchewan (58°41'N, 109°15'W). This sample was submitted by B.T. Schreiner to gain information on intertill peats.

S-2057 Archibald Lake

Uncorrected age: 5205 ± 130

The basal woody peat at a depth of 170-185 cm was enclosed in peat overlying sand. The sample was collected by J.S. Rowe in 1980 from Archibald Lake, 86 km southwest of Fond-du-lac, south of Lake Athabasca, Saskatchewan (59°02'N, 108°30'W). This sample was submitted by J.S. Rowe to gain information on the initiation of peat accumulation.

S-2056 Lake Athabasca area

Uncorrected age: 7755 ± 135

The basal woody peat overlying sand was collected by J.S. Rowe in 1980 from the west end of a small (unnamed) lake, south of Lake Athabasca, Saskatchewan (59°02'25"N, 108°52'10"W). This sample was submitted by J.S. Rowe to gain information on the initiation of peat accumulation.

S-2055 Pederson Lake

Uncorrected age: 5920 ± 135

The basal amorphous peat (3.3 m depth) was overlying sand. The sample was collected by J.S. Rowe in 1980 from the east end of Pederson Lake, south of Lake Athabasca, Saskatchewan (59°03'30"N, 108°53'30"W). This sample was submitted by J.S. Rowe to gain information on the initiation of peat accumulation.

S-1560 Black Lake

Uncorrected age: 6860 ± 110

The basal peat (0.9 m depth) was underlain by ground ice in a discontinuous permafrost zone. The sample was collected by D.W. Alley in 1978 from a palsa at Black Lake, about 35 km east of Stony Rapids, northern Saskatchewan (59°08'N, 104°53'W). This sample was submitted by D.W. Alley to gain information on deglaciation and the initiation of peat accumulation.

S-1746 Phelps Lake

Uncorrected age: 5850 ± 70

The peat sample, SM-153 (depth 3 m), was collected by S. McNamara in 1979 from Phelps Lake, northeastern Saskatchewan (59°10'36"N, 103°6'11"W). This sample was submitted by S. McNamara to gain information on deglaciation and peat accumulation.

S-2143 Lorado Site 104

Uncorrected age: 7190 ± 125

The organic matter (peat at a depth of 1 m) was overlain by 0.6 m of peat, and underlain by 0.2 m of silt and sand. The sample was collected by E.A. Christiansen in 1981 from Lorado Site 104, Saskatchewan (59°31'40"N, 108°39'10"W). This sample was submitted by E.A. Christiansen to gain information on peat accumulation.

Fredette Lake Series

A series of peat samples from peat that was frozen near the base and overlying rock from a road cut exposure near Fredette Lake, about 7 km from Uranium City, northern Saskatchewan (59°36'N, 108°35'W). The samples were collected by B.T. Schreiner in 1978 and were submitted to gain information on deglaciation and peat accumulation.

S-1557 Fredette Lake I

Uncorrected age: 3430 ± 100

The basal peat (sample 1-1) was at a depth of 2 m: site record: BS-1891: 1-1, 1-2.

S-1558 Fredette Lake II

Uncorrected age: 3220 ± 100

The peat (sample 1-2) was at a depth of 3 m: site record: BS-1891: 1-1, 1-2.

S-2518 Hatle Lake

Uncorrected age: 6560 ± 85

The peat at a depth of 6 m was overlying bedrock. The sample was collected by B.T. Schreiner in 1984 from Hatle Lake, 155 km northeast of Stony Rapids, Saskatchewan (59°57'N, 103°27'W).

DATES RELATED TO VERTEBRATE PALEONTOLOGY (Fig. II-11)

S-177 Canuck

Uncorrected age: 7600 ± 115

The bone was in pond clay overlying till at a depth of 2.7 m. The sample was collected by B. McCorguodale in 1961 from an excavation in Canuck, about 125 km south of Swift Current, southern Saskatchewan (49°15'N, 108°14'W). This sample was submitted by E.A. Christiansen to gain information on vertebrate paleontology.

A-619 Kyle

Uncorrected age: 8650 ± 400

The bone (*Mammuthus* vertebra) was collected by T.F. Kehoe in 1964 from Kyle, about 185 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°50'00"N, 108°06'30"W). It was submitted by T.F. Kehoe to gain information on vertebrate paleontology.

Comment (**T.F. Kehoe**): This date is significantly younger than that obtained from S-246 (below). This is not surprising considering that the acid-soluble organic fraction commonly gives erroneous results.

S-246 Kyle

Uncorrected age: 12 000 ± 200

The bone (*Mammuthus*) was in oxidized, clayey, fossiliferous sand at a depth of 2.9 m (9.5'). The sample was collected by H. Cronk, J.G. Fyles and T. Kehoe in 1964 from Kyle, about 185 km west-northwest of Moose Jaw, southwestern Saskatchewan (50°50'N, 108°07'W). This sample was submitted by E.A. Christiansen to gain information on vertebrate paleontology.

Comment (**E.A. Christiansen**): The scattered skeletal remains and contorted pond deposits in which the mammoth was buried indicate that the remains were disturbed during the melting of stagnant ice after the mammoth died 12.0 ka ago.

S-232 Wiseton

Uncorrected age: 10 600 ± 140

The bone (*Mammuthus*) was enclosed in lacustrine silt at a depth of 91.4 cm. The sample was collected by F.H. Edmunds near Wiseton, about 115 km south-southwest of Saskatoon, southern Saskatchewan (51°19'N, 107°39'W). The sample was submitted by W.O. Kupsch to gain information on vertebrate paleontology.

Comment (**W.O. Kupsch**): The sample consisted of bone cores from the left femur of museum specimens. These mammoth bones gave the youngest mammoth date in Saskatchewan, although the pre-treatment method may have contributed to this result.

Eagle Creek Series

A series of *Bison* bones was collected by T.S. Woolf in 1975 from Eagle Creek, northwest of Tessier, about 65 km southwest of Saskatoon, Saskatchewan (51°47'N, 107°30'W). These samples were submitted by T.S. Woolf to gain information on vertebrate paleontology.

S-1073 Eagle Creek I

Uncorrected age: 850 ± 60

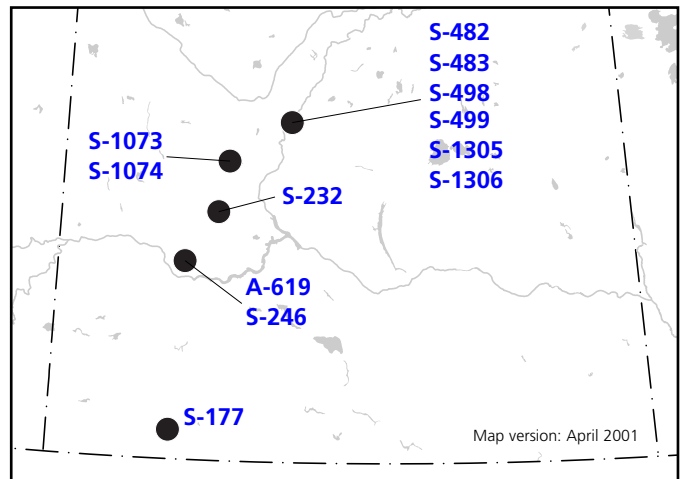


Fig. II-11. Dates related to vertebrate paleontology.

The sample was a surface collection on the creek bed.

S-1074 Eagle Creek II

Uncorrected age: 2365 ± 70

The sample was enclosed in clay at a depth of 2 m from a bluff slump on Eagle Creek.

Riddell Series

A series of bone samples was collected by T.S. Woolf in 1975 from the "Riddell site", Saskatoon, Saskatchewan (52°09'N, 106°36'W). The samples were submitted by T.S. Woolf to gain information on vertebrate paleontology.

S-1306 Riddell I

Uncorrected age: 4560 ± 115

The bone fragments (*Bison*) were enclosed in the Battleford Formation at a depth of 30 cm.

S-1305 Riddell II

Uncorrected age: 15 340 ± 500

The bone (*Equus* metapodial) was enclosed in sands 1.5 m below the Floral-Battleford Formation contact.

Saskatoon Series

A series of *Mammuthus* samples enclosed in sand within tills of the Floral Formation was collected by Z.S. Pohorecky in Saskatoon, Saskatchewan (52°10'N, 106°35'W) and the samples were submitted to gain information on interglacial vertebrate paleontology.

S-482 Saskatoon I

Uncorrected age: 12 000 ± 320

The tusk fragments were 2.4 m below S-483 and were collected in 1968.

S-498 Saskatoon II

Uncorrected age: 14 650 ± 360

The tusk fragments were collected in 1970.

S-499 Saskatoon III

Uncorrected age: 20 200 ± 500

The bone (skull) was collected in 1970.

S-483 Saskatoon IV

Uncorrected age: >34 200

The bone sample was 2.4 m above S-482 and was collected in 1968.

Comment (**Z.S. Pohorecky**): There were abundant faunal remains from seven taxa: gastropod, pelecypod, *Camelops*, *Mammuthus*, *Equus* cf. *niobrarensis*, *Bison*, and Cervid (Lammers, 1968). Bone fractures may indicate the presence of man (Pohorecky and Wilson, 1968).

Comment (**A.A. Rutherford**): The samples provided inconsistent dates for an apparent homogeneous unit. Samples S-482, and -498 are similar to other regional mammoth dates (S-232, and S-918) but appear to be too recent for their geologic position. Samples S-483 and -499 are more acceptable for the Floral Formation (E.A. Christiansen, personal communication).

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 GSC-XX Lowdon and Blake, 1980
 GSC-XXII Blake, 1982
 GSC-XXIV Blake, 1984
 GSC-XXVIII McNeely, 1989
 GSC-XXIX McNeely and McCuaig, 1991
 GSC-XXXI McNeely and Jorgensen, 1993
 I-V Trautman and Willis, 1966
 Q-III Barrette et al., 1981
 S-II McCallum and Dyck, 1960
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 S-IV McCallum and Wittenberg, 1965
 S-V McCallum and Wittenberg, 1968
 S-VI Rutherford et al., 1973
 S-VII Rutherford et al., 1975
 S-VIII Rutherford et al., 1979
 S-X Rutherford et al., 1984
 WIS-V Bender et al., 1968
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³ OP - "organic portion" of a sample, often a marl.
 IP - "inorganic portion" of a sample, usually the carbonate component
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Section III

Optical Dates in Saskatchewan

collated by
S.A. Wolfe

INTRODUCTION

All of the samples described in this section (Fig. III-1) were submitted by S.A. Wolfe to D.J. Huntley at Simon Fraser University for optical dating. The optical ages were obtained in order to gain information on the timing of past dune activity in southwestern Saskatchewan. Samples were collected for optical dating both from natural exposures (blowouts) and from shallow pits dug on the surface of stabilized dunes in order to determine the most recent period(s) of dune activity. Because of the palimpsest nature of eolian deposits (cf. David 1998), samples were only collected from dunes with recognized morphology and internal structure, so that the geological relevance of the optical ages was known. The stratigraphy and sedimentology of each site was described to establish the origin and geomorphic significance of the deposits and to avoid bioturbated sites. Modern samples were also collected from active sand surfaces to test the ability of the optical dating method to give "zero" ages.

Optical dating determines the time elapsed since mineral grains were last exposed to sunlight, and hence dune activity. The optical ages reported in this list were obtained from sand-sized K-feldspar grains with 1.4 eV (infrared) excitation and measurement of the 3.1

eV (violet) emission. The grain-sized selected for dating was 180-250 μm for all samples, except SFU-O-121, 122, 128, 150, 151, 152, and 153 for which it was 90-125 μm . Unless otherwise noted, all aliquots were heated prior to measurement for 16 h at 120°C. Uncontrolled systematic errors may cause the optical ages reported herein to be too high by at least 20 years due to "zero-age error" and/or too low by 5-25 % due to anomalous fading. The ages reported have not been corrected for either of these effects, except for three samples for which ages corrected for anomalous fading are also provided. For sample SFU-O-121, an optical age was obtained from quartz. Further details may be found in David et al. (1999) and Wolfe et al. (1995 and 2001).

All sand dunes investigated are of the parabolic type (David 1998). Figure III-2 shows the morphology of a typical parabolic dune in the areas studied. The slipface is convex downwind in plan view, and the wings, where developed, point upwind. Generally, the wing ridges rise evenly toward the head, whereas the low area between the wings is deflated. This deflation depression is commonly eroded to a more resistant substrate. A back ridge, where present, connects the wings around the deflation depression to form the upwind extension

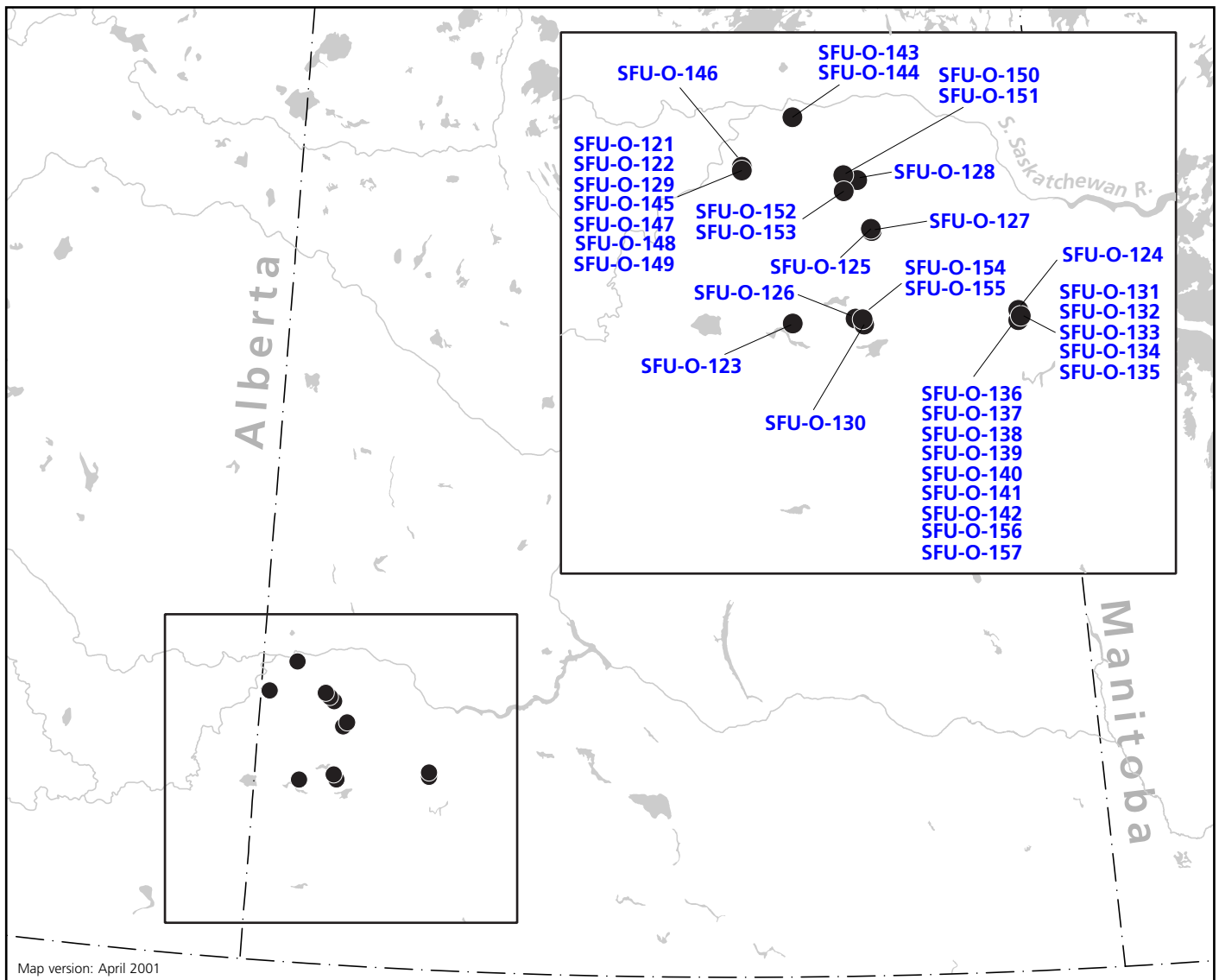


Fig. III-1. Location of Saskatchewan sites with optical dates.

of the dune. The back ridge is typically a low, arcuate sand accumulation, generally concave downwind and with an uneven crest line (Fig. III-2). Because it is produced by multidirectional winds removing sand from the deflation depression, it is absent from parabolic dunes that develop under unidirectional winds (David 1988). Accumulation of this sand begins with the initiation of dune activity and continues until the upwind portion of the deflation depression is stabilized by vegetation. Back ridges delineate the farthest upwind position of individual dunes and, where dune activity has been triggered by a climatic shift to more arid conditions, can be significant chronological and morphological markers (David et al. 1999).

Many dunes in areas of high local water tables in the Great Sand Hills region contain parallel, even-crested ridges between their wings (Fig. III-2). Termed "dune-track ridges" (David 1998), these are either arcuate, sometimes slightly sinuous or irregular ridges that connect the wings. Well-developed examples are found in the Seward sand hills, where the water table fluctuates close to the ground surface. Dune-track ridges develop when a period of dune migration is interrupted by more humid intervals that promote vegetation growth around the base of the dune, while the rest of the dune remains active (David 1998). With a return to more arid conditions, the dune migrates downwind and a low, vegetated ridge (lower than the corresponding back ridge) may remain at the former back base line of the dune. The even crest line of the ridge reflects the limit to which vegetation invaded the backslope of the dune. Dune-track ridges record only short-term climatic fluctuations, since any significant climate change would stabilize the entire dune, as is now widely observed throughout the region.

In light of this previous work, the ages of dune-track ridges within a particular dune should postdate the basal age of the back ridge, and should become successively younger downwind (David et al. 1999). Sand deposited on the backslope, head, or slipface of a dune should, in turn, postdate the age of the dune-track ridges, as these are typically the final portions of a dune to stabilize.

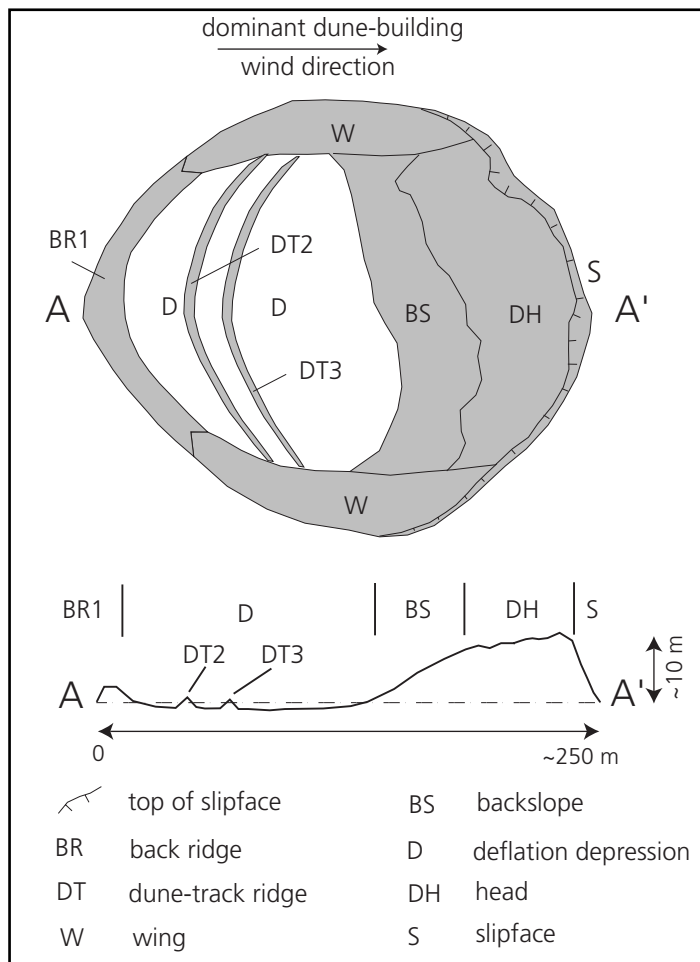


Fig. III-2. Schematic diagram of a stabilized parabolic dune with a back ridge and dune-track ridges (adapted from Wolfe and David 1997). Terminology for sand dunes in the Great Sand Hills region follows that of Wolfe and David (1997), David (1998), and David et al. (1999).

OPTICAL DATES (Fig. III-1)

Tunstall sand hills

The dune sample was collected from the northeastern portion of the Tunstall sand hills approximately 7.5 km south and 4.8 km east of Golden Prairie, Saskatchewan. The sample was obtained from a blowout in a stabilized parabolic dune (50°09'15"N; 109°33'20"W).

Lab # **SFU-O-123** Tunstall sand hills
Field # SW1-02

age (years before AD 1995): 68 ± 12

The eolian dune sand sample was collected from the southern arm of a stabilized parabolic dune at the northeast end of the Tunstall sand hills.

Stratigraphy: The sample was collected from a depth of 6 m below the top of the dune and 3 m above the base of the deflation depression of the active blowout. Sample from finely laminated sands with bedding 5 to 15 cm thick, dipping 10° E.

Comments: Sample was collected on October 19, 1993 by S.A. Wolfe and J. Ollerhead.

Seward sand hills A

The dune sample in this series was collected in the central portion of the Seward sand hills approximately 6 km north and 4 km west of Webb, Saskatchewan. The sample was obtained from a blowout in a stabilized parabolic dune (50°14'25"N; 108°15'20"W).

Lab # **SFU-O-124** Seward sand hills I
Field # SW2-02

age (years before AD 1995): 109 ± 8

The eolian dune sand sample was collected from the southern arm of a stabilized parabolic dune in the Seward sand hills.

Stratigraphy: The sample was collected from a depth of 8 m below the top of the dune and 7 m above the base of the deflation depression of the active blowout. Sample from cross-bedded sand beds to 1 m thick, dipping 17-21° E.

Comments: Sample was collected on October 19, 1993 by S.A. Wolfe and J. Ollerhead. The age obtained is consistent with geomorphic interpretation that the stabilized sand dunes are younger than the back ridges and dune track ridges in the same area (refer to Seward sand hills Series B and C).

Seward sand hills Series B

The five samples in this series were collected from a single stabilized parabolic dune (50°13'48"N; 108°15'10"W) in the central portion of the Seward sand hills approximately 4.8 km north and 3.8 km west of Webb, Saskatchewan. The ages obtained were from samples in shallow pits excavated into the back ridge and dune-track ridges of a stabilized dune, referred to as Dune 1 by David et al. (1999). The samples were collected to gain information on the timing of past dune activity in this portion of the Seward sand hills and to compare to an adjacent stabilized dune (Dune 2 as referred to by David et al., 1999 and Wolfe et al., 2001). Most of the ages obtained from this series do not match the expected pattern, and possibly signify re-working after initial ridge

formation. The ages of these reworked ridges are clustered at ca. 95 or 120 years before AD 1995 and may be associated with droughts occurring in about the mid AD 1870s and in AD 1900.

Lab # **SFU-O-131** Seward sand hills II
Field # SAW94-30

age (years before AD 1995): 123 ± 6

The eolian dune sand sample was collected from the stabilized back ridge (BR1) of Dune 1 (David et al., 1999) in the Seward sand hills. The ridge is asymmetric in profile, and is steeper on the east side, where the slope is concave. The ridge is 100 to 120 cm high, locally trends 310°-130°, and curves eastward. Vegetation cover includes moss, grass, *Rosa woodsii*, *Psoralea lanceolata*, and other herbaceous vegetation. Soil development is thin, surface is light-textured and sandy. Roots penetrating to >80 cm depth. Sand is fine, well-sorted with occasional coarse grains.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized back ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 1-5° SW.

Comments: Sample was collected on July 15, 1994 by S.A. Wolfe and P.P. David. The age obtained is younger than predicted by geomorphic interpretation of the stabilized back ridge. This probably signifies re-working after initial ridge formation.

Lab # **SFU-O-132** Seward sand hills III
Field # SAW94-31

age (years before AD 1995): 94 ± 6

The eolian dune sand sample was collected from the stabilized track-ridge (DT2) of Dune 1 (David et al., 1999) in the Seward sand hills. Dune track ridge is locally oriented 310°-130°, and curves eastward. The eastern slope dips at 11° and western slope dips at 8°. Vegetation cover includes moss, grass, *Artemisia* spp., *Elaeagnus commutata*, *Rosa woodsii*, *Psoralea lanceolata*. Soil development is thin, light-textured, sandy with A-horizon 3 to 7 cm thick. Roots are dense to a depth of 15 cm, and penetrate to a depth of about 80 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 11° and 9° and 0.5° SW and 3° NE.

Comments: Sample was collected on July 15, 1994 by S.A. Wolfe and P.P. David. The age is younger than predicted from this sequence of stabilized track-ridges, and probably signifies re-working after initial ridge formation.

Lab # **SFU-O-133** Seward sand hills IV
Field # SAW94-32

age (years before AD 1995): 116 ± 7

The eolian dune sand sample was collected from the stabilized track-ridge (DT3) of Dune 1 (David et al., 1999) in the Seward sand hills. Dune track ridge is locally oriented at 315°-135° and curves eastward. Sample site is on a level surface, but eastern slope of ridge dips at 14° and western slope dips at 9°. Vegetation cover includes grass, *Psoralea lanceolata*, *Elaeagnus commutata*, *Rosa*

woodsii and *Salix* spp. Soil is thin, light-textured with A-horizon about 5 cm thick.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 6° and 4.5° NE, 4° SW and 0°.

Comments: Sample was collected on July 15, 1994 by S.A. Wolfe and P.P. David. The age obtained is younger than predicted from this sequence of stabilized track-ridges, and probably signifies re-working after initial ridge formation.

Lab # **SFU-O-134** Seward sand hills V
Field # SAW94-33

age (years before AD 1995): 94 ± 6

The eolian dune sand sample was collected from the stabilized track-ridge (DT4) of Dune 1 (David et al., 1999) in the Seward sand hills. Dune track ridge is locally oriented at 310°-130° and is curves eastward. Surface of sample site is locally level, but eastern slope dips at about 9° and western slope dips at 19°. Vegetation cover includes abundant *Psoralea lanceolata*, grass, *Elaeagnus commutata*, *Betula occidentalis* and *Salix* spp. Soil is thin, light-textured, sands, with A-horizon about 7 cm thick.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 6°, 5° and 6.5° SW.

Comments: Sample was collected on July 15, 1994 by S.A. Wolfe and P.P. David. The age obtained does not match that predicted for this sequence of stabilized track-ridges, and possibly signifies re-working after initial ridge formation.

Lab # **SFU-O-135** Seward sand hills VI
Field # SAW94-34

age (years before AD 1995): 152 ± 8

The eolian dune sand sample was collected from the stabilized track-ridge (DT5) of Dune 1 (David et al., 1999) in the Seward sand hills. Dune track ridge is locally oriented 305°-125° and curves eastward. Surface of sample site is nearly level. Ridge slopes westward at about 10°, and eastward at about 20°. Shrub vegetation cover is dominated by *Elaeagnus commutata*, with some *Betula occidentalis* and *Salix* spp. on edges of ridge. Other vegetation includes moss, grass and *Psoralea lanceolata*. Soil is light-textured, sandy, with A-horizon about 8 cm thick. Roots are dense to about 10 cm depth, and penetrate more than 70 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 0.5° and 3° NE, and 6° and 1.5° SW.

Comments: Sample was collected on July 15, 1994 by S.A. Wolfe and P.P. David.

Seward sand hills Series C

The nine samples in this series were collected from a single stabilized parabolic dune (50°14'00"N; 108°15'10"W) in the central portion of the Seward sand hills, approximately 6 km north and 3.8 km west of Webb, Saskatchewan. The ages obtained were from samples in shallow pits excavated into the back ridge and

dune-track ridges of a stabilized dune, referred to as Dune 2 by David et al. (1999). One sample (SFU-O-142) was collected from the surface of the active portion of the dune as a reference "zero-age" sample. The remaining samples were collected to gain information on the timing of past dune activity in this portion of the Seward sand hills and to compare to an adjacent stabilized dune (Dune 1 as referred to by David et al., 1999 and Wolfe et al., 2001).

Lab # **SFU-O-136** Seward sand hills VII
Field # SAW94-35

age (years before AD 1995): 125 ± 5

The eolian dune sand sample was collected from the stabilized back ridge (BR1) of Dune 2 (David et al., 1999) in the Seward sand hills. Ridge is approximately 70 to 75 cm high, 10.5 m wide, is locally oriented 315°-135° and curves eastward. Eastern slope dips at 13° and western slope dips at 9°. Vegetation cover includes *Psoralea lanceolata*, moss, *Artemisia* spp., grass and *Rosa woodsii*. Soil is light-textured, sandy, with A-horizon 8 to 10 cm thick. Roots are dense to 15 cm depth, and penetrate to about 75 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized back ridge. Sample from light-brown to yellow-grey sand. Exposure contained a thin, bright grey (2.5 YR 7/1), sand layer dipping 3° NE.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age is younger than predicted, based on geomorphic interpretation of the stabilized back ridge. The age, however, is consistent with that of the back ridge (BR1) of Dune 1 (SFU-O-131). This probably signifies re-working of both ridges after initial formation. The age is also consistent with the ages of samples SFU-O-156 and 157 obtained from 1.0 and 1.5 m depth, respectively, within the same back ridge.

Lab # **SFU-O-156** Seward sand hills VIII
Field # SAW95-10

age (years before AD 1995): 180 ± 8

The eolian dune sand sample was collected from the stabilized back ridge (BR1) of Dune 2 (David et al., 1999) in the Seward sand. (See site description for sample SFU-O-136).

Stratigraphy: The sample was collected from a depth of 1.0 m below the surface of the stabilized back ridge, and 0.5 m below sample SFU-O-136. Sample from light-brown to yellow-grey sand.

Comments: Sample was collected on October 30, 1995 by D.S. Lemmen of the Geological Survey of Canada. The age obtained is consistent with geomorphic interpretation of the deposition of the back ridge, as it pre-dates the oldest track-ridge in this series. The age is also consistent with ages from samples SFU-O-136 and 157 obtained from 0.5 and 1.5 m, respectively, in the same back ridge.

Lab # **SFU-O-157** Seward sand hills IX
Field # SAW95-11

age (years before AD 1995): 185 ± 8

The eolian dune sand sample was collected from the stabilized back ridge (BR1) of Dune 2 (David et al., 1999) in the Seward sand hills. (See site description for sample 94-35).

Stratigraphy: The sample was collected from a depth of 1.5 m below the surface of the stabilized back ridge, and 1.0 m below sample SFU-O-136. Sample from light-brown to yellow-grey sand.

Comments: Sample was collected on October 30, 1995 by D.S. Lemmen of the Geological Survey of Canada. The age obtained is consistent with geomorphic interpretation of the deposition of the back ridge, as it pre-dates the oldest track-ridge in this series. The age is also consistent with ages from samples SFU-O-136 and 156 obtained from 0.5 and 1.0 m, respectively, in the same back ridge.

Lab # **SFU-O-137** Seward sand hills X
Field # SAW94-36

age (years before AD 1995): 174 ± 8

The eolian dune sand sample was collected from the stabilized track-ridge (DT2) of Dune 2 (David et al., 1999) in the Seward sand hills. The track-ridge varies from 0.55 to 1.0 m high and is about 16 m wide. The ridge is locally oriented at about 320°-140° and curves eastward. The eastern slope dips at about 6°, and the western slope dips at about 9°. Vegetation cover includes *Rosa woodsii*, grass, moss, *Artemisia* spp., and *Psoralea lanceolata*. Soil is light-textured, sandy, with A-horizon about 8 cm thick. Roots are dense to 15 cm depth, and penetrate to about 20 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 5° SW, 3° NE and 0°.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune track-ridges.

Lab # **SFU-O-138** Seward sand hills XI
Field # SAW94-37

age (years before AD 1995): 168 ± 7

The eolian dune sand sample was collected from the stabilized track-ridge (DT3) of Dune 2 (David et al., 1999) in the Seward sand hills. The track-ridge is about 45 to 50 cm high and 11.2 m wide. The ridge is locally oriented at 320°-140° and curves eastward. The eastern slope dips at about 5° and the western slope dips at about 4°. Vegetation cover is dominated by *Elaeagnus commutata* towards the south, and also includes *Salix* spp. *Rosa woodsii*, *Psoralea lanceolata*, grass and moss. Soil is light textured, sandy, with A-horizon about 15 to 18 cm thick. *Rosa woodsii* and *Elaeagnus commutata* roots are abundant to about 30 cm depth.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 8°, 6°, 7°, and 8° SW.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune track-ridges.

Lab # **SFU-O-139** Seward sand hills XII
Field # SAW94-38

age (years before AD 1995): 160 ± 10

The eolian dune sand sample was collected from the stabilized track-ridge (DT4) of Dune 2 (David et al., 1999) in the Seward sand hills. The track ridge is 80 to 90 cm high and 11 m wide. The ridge is locally oriented 320°-140° and is straight. The eastern slope dips at about 5° and the western slope dips at about 13°. Vegetation

cover includes abundant *Psoralea lanceolata*, with *Artemisia frigida*, *Artemisia cana*, grass, *Rosa woodsii*, *Elaeagnus commutata*, and *Salix* spp. along the ridge. Soil is light-textured and sandy. A-horizon is 5-10 cm thick, with dense roots to 10 cm depth and penetrating to 70 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 9°, 4°, and 6° SW.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune track-ridges.

Lab # **SFU-O-140** Seward sand hills XIII
Field # SAW94-39

age (years before AD 1995): 137 ± 9

The eolian dune sand sample was collected from the stabilized track-ridge (DT5) of Dune 2 (David et al., 1999) in the Seward sand hills. The track ridge is 30 to 60 cm high and 7.5 m wide. The ridge is locally oriented 320°-140° and is straight, but poorly defined due to dense vegetation. The eastern slope dips at about 5° and the western slope dips at about 12°. Vegetation cover includes dense *Elaeagnus commutata* and *Salix* spp., some *Symphoricarpos occidentalis*, *Shepherdia argentea*, *Rosa woodsii*, and grass. Soil is light-textured and sandy. A-horizon is 4-8 cm thick, with dense roots to 10 cm depth and penetrating to 70 cm, including large *Salix* spp. roots.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized track-ridge. Sample from light-brown to yellow-grey sand. Exposure contained thin, bright grey (2.5 YR 7/1), sand layers dipping 3° and 11° NE.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune track-ridges.

Lab # **SFU-O-141** Seward sand hills XIV
Field # SAW94-40

age (years before AD 1995): 117 ± 7

The eolian dune sand sample was collected from the stabilized back slope (BS6) of Dune 2 (David et al., 1999) in the Seward sand hills. The slope dips at about 22° west, and the base of the slope curves westward. Vegetation cover includes *Psoralea lanceolata*, grass, *Artemisia frigida*, and *Rosa woodsii* and *Salix* spp. near the base of the slope. Soil is light-textured and sandy. The soil is very poorly developed with an A-horizon about 7 cm thick, with an accumulation of deflated sand on top of this. A better developed buried A-horizon is present from 13 to 19 cm depth. Dense roots occur to 25 cm depth and penetrating to 80 cm.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized back slope. Sample from light-brown to yellow-grey sand.

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series.

Lab # **SFU-O-142** Seward sand hills XV
Field # SAW94-41

age (years before AD 1995): 17 ± 5

The eolian dune sand sample was collected from the top of the slipface of the active portion of Dune 2 (David et al., 1999) in the Seward sand hills.

Stratigraphy: The sample was collected from the surface of the active portion of Dune 2 (David et al., 1999).

Comments: Sample was collected on July 16, 1994 by S.A. Wolfe and P.P. David. The sample was submitted by S.A. Wolfe to use as a "zero-age" reference.

Bigstick sand hills A

The dune sample was collected in the central portion of the Bigstick sand hills approximately 18.6 km east of the intersection of Maple Creek (creek, not town) with highway 21. The sample was obtained from the southern arm of an active compound parabolic dune (50°11'07"N; 109°12'40"W)

Lab # **SFU-O-125** Bigstick sand hills I
Field # SW3-02

age (years before AD 1995): 91 ± 5

Stratigraphy: The sample was collected from a depth of 4 m below the top of the dune and 6 m above the base of the deflation depression of the active blowout. Sample from dune sand beds 10 to 15 cm thick with laminations 3 to 20 mm thick, dipping 17-28°E.

Comments: Sample was collected on October 20, 1993 by S.A. Wolfe and J. Ollerhead.

Bigstick sand hills Series B

The three samples in this series were collected from two stabilized parabolic dunes in the central portion of the Bigstick sand hills approximately 18.3 km east of the intersection of Maple Creek (creek, not town) with highway 21. The ages obtained were from samples obtained in shallow pits excavated into the dune heads and back ridge of stabilized parabolic dunes. The samples were collected to gain information on the timing of past dune activity in this portion of the Bigstick sand hills and to compare to other stabilized dunes in the region (refer to Wolfe et al., 2001). The ages obtained from this series were consistent with geomorphic interpretation, as the ages of the dune heads from both dunes post-dated that of the back ridge from one of the dunes.

Lab # **SFU-O-130** Bigstick sand hills II
Field # SAW94-23

age (years before AD 1995): 85 ± 5

The eolian dune sand sample was collected from the dune head of a stabilized parabolic dune in the Bigstick sand hills (50°10'50"N; 109°09'25"W).

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized dune head. Sample from light-brown sand.

Comments: Sample was collected on May 28, 1994 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge.

Lab # **SFU-O-154** Bigstick sand hills III
Field # SAW95-07

age (years before AD 1995): 117 ± 6

The eolian dune sand sample was collected from the dune head of a stabilized parabolic dune in the Bigstick sand hills (50°10'56"N; 109°09'35"W).

Stratigraphy: The sample was collected from a depth of 0.6 m below the surface of the stabilized dune head. Sample from light-brown sand.

Comments: Sample was collected on September 24, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, sample SFU-O-155 collected from the back ridge of this dune pre-dates the age of this sample from the dune head.

Lab # **SFU-O-155** Bigstick sand hills IV
Field # SAW95-08

age (years before AD 1995): 151 ± 6

The eolian dune sand sample was collected from the back ridge of a stabilized parabolic dune in the Bigstick sand hills (50°10'56"N; 109°09'35"W).

Stratigraphy: The sample was collected from a depth of 0.7 m below the surface of the stabilized back ridge. Sample from light-brown sand containing several thin, bright grey, sand layers to a depth of 1.1 m.

Comments: Sample was collected on September 24, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, sample SFU-O-154 collected from the dune head of this dune post-dates the age of this sample from the back ridge.

Central Great Sand Hills Series

A series of two samples for optical dating were collected in the central portion of the Great Sand Hills approximately 7.2 km north and 23 km east of Fox Valley, Saskatchewan. These samples were collected to gain information on the time of dune activity in this portion of the Great Sand Hills.

Lab # **SFU-O-126** Central Great Sand Hills I
Field # SW4-01

age (years before AD 1995): 640 ± 60
age corrected for anomalous fading: 790 ± 70

The eolian dune sand sample was collected from the southern arm of an active parabolic dune in the Central Great Sand Hills (50°31'05"N; 109°08'40"W).

Stratigraphy: The sample was collected from a depth of 3 m below the top of the dune and 2.5 m above the base of the

deflation depression of the active blowout. Sample from sub-parallel sand beds with laminations 3 to 5 mm thick, dipping 12-17° E. Occasional convex structures in beds. Lithic archaeological artefacts and pot shards found on blowout surface.

Comments: Sample was collected on October 21, 1993 by S.A. Wolfe and J. Ollerhead.

Lab # **SFU-O-127** Central Great Sand Hills II
Field # SW4-02

age (years before AD 1995): 930 ± 50
age corrected for anomalous fading: 1150 ± 90

The eolian dune sand sample was collected from the southern arm of an active compound parabolic dune within a larger stabilized parabolic dune ridge in the Central Great Sand Hills (50°31'45"N; 109°08'05"W).

Stratigraphy: The sample was collected from a depth of 6 m below the top of the dune and 3 m above the base of the deflation depression of the active blowout. Sample from sub-parallel sand beds with laminations 20 mm thick, dipping 3° W. Occasional convex structures 20 mm thick and 15 cm wide.

Comments: Sample was collected on October 21, 1993 by S.A. Wolfe and J. Ollerhead.

Northwestern Great Sand Hills A

The dune sample was collected in the northwestern portion of the Great Sand Hills approximately 18.5 km south and 1.5 km west of Sceptre, Saskatchewan. The sample was obtained from a blowout in a dune (50°41'35"N; 109°17'00"W) referred to as "Big Dune" by P.P. David and illustrated in David (1972, p. 40).

Lab # **SFU-O-128** Northwestern Great Sand Hills I
Field # SW5-01

age (years before AD 1995): 216 ± 11

The eolian dune sand sample was collected 0.5 m above the base of a blowout surface, upwind of an active parabolic dune (referred to as "Big Dune" by P.P. David) in the Central Great Sand Hills.

Stratigraphy: The sample was collected from a depth of 4 m below the top of the dune and 0.5 m above the base of the deflation depression of the active blowout. Sample from sub-parallel sand beds with discontinuous convex bedding with laminations 20 mm thick, dipping 3-7° NW.

Comments: Sample was collected on October 21, 1993 by S.A. Wolfe and J. Ollerhead.

Northwestern Great Sand Hills Series B

The four samples in this series were collected from two stabilized parabolic dunes in the northwestern portion of the Great Sand Hills approximately 16 km south and 3.2 km west of Sceptre, Saskatchewan. The ages obtained were from samples in shallow pits excavated into the dune heads and back ridges of stabilized parabolic dunes. The samples were collected to gain information on the timing of past dune activity in this portion of the Great Sand Hills and to compare to other stabilized dunes in the region (refer to Wolfe et al., 2001). The ages obtained from this series were consistent with geomorphic interpretation, as the ages of the dune heads from both dunes post-dated that of the back ridges from the same dunes.

Lab # **SFU-O-150** Northwestern Great Sand Hills II
Field # SAW95-01

age (years before AD 1995): 115 ± 5

The eolian dune sand sample was collected from the dune head of a stabilized parabolic dune in the northwestern Great Sand Hills (50°42'10"N; 109°18'12"W). The dune is oriented 105-285° and was migrating towards the northeast before it stabilized. Vegetation cover includes *Artemisia frigida*, grass to 20 cm height and moss. Bare sand occurs on 10 to 15% of the surface, and there is some evidence of burrowing. A-horizon to a depth of 10 cm. Sand is slightly moist from 10 to 55 cm depth, and is more firm and drier at 55 to 95 cm depth.

Stratigraphy: The sample was collected from a depth of 0.75 m below the surface of the stabilized dune head. Sample from light-brown sand. Massive.

Comments: Sample was collected on May 6, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, sample SFU-O-153 collected from an adjacent dune has a similar age, whereas the ages of the back ridges of both dunes (SFU-O-151 and 152) pre-date the ages from the dune heads.

Lab # **SFU-O-151** Northwestern Great Sand Hills III
Field # SAW95-02

age (years before AD 1995): 143 ± 9

The eolian dune sand sample was collected from the back ridge of a stabilized parabolic dune in the northwestern Great Sand Hills (50°42'10"N; 109°18'12"W). Vegetation cover includes *Juniperus horizontalis*, *Artemisia frigida*, patchy grass and *Rosa woodsii*. Sample site selected in a bare patch on a road track to avoid woody vegetation. A-horizon development to a depth of 10 cm.

Stratigraphy: The sample was collected from a depth of 0.9 m below the surface of the stabilized back ridge. Sample from light-brown sand with light grey sand layers approximately 3 mm thick and dipping 7°, 11°, 11°, and 7° E. Between 110 and 125 cm depth, sand is mottled grey and brown with oxidized root casts and calcareous casts.

Comments: Sample was collected on May 6, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, the age of sample SFU-O-150 from the head of this dune post-dates this sample from the back ridge.

Lab # **SFU-O-152** Northwestern Great Sand Hills IV
Field # SAW95-03

age (years before AD 1995): 129 ± 6

The eolian dune sand sample was collected from the back ridge of a stabilized parabolic dune in the northwestern Great Sand Hills (50°41'47"N; 109°18'10"W). Surface vegetation includes *Juniperus horizontalis*, *Artemisia frigida* and patchy grass. Sample area is only 40 to 50% covered by vegetation.

Stratigraphy: The sample was collected from a depth of 0.75 m below the surface of the stabilized back ridge. Sample from light-brown sand in section with one grey sand layer dipping 2.5° W. Below 90 cm depth, sand is mottled grey and contains calcareous root casts.

Comments: Sample was collected on May 6, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, the age of sample SFU-O-153 from the head of this dune post-dates this sample from the back ridge.

Lab # **SFU-O-153** Northwestern Great Sand Hills V
Field # SAW95-04

age (years before AD 1995): 116 ± 5

The eolian dune sand sample was collected from the dune head of a stabilized parabolic dune in the northwestern Great Sand Hills (50°41'47"N;109°18'10"W). Surface vegetation includes *Artemisia frigida* and patchy grass in the sample area with *Rosa woodsii* and *Juniperus horizontalis* in the surrounding area. Sample area is from a small, recent blowout depression approximately 30 cm deep just south of the centre-line of the head of the dune. Sample site was selected in order to avoid re-deposited sand and to avoid existing animal burrows.

Stratigraphy: The sample was collected from a depth of 0.9 m below the surface of the stabilized dune head. Sample from light-brown sand. Sand had been recently deposited to a depth of 25 cm. Between a depth of 25 to 125 cm, the sand was massive, varying between stiffly and loosely packed.

Comments: Sample was collected on May 6, 1995 by S.A. Wolfe. The age obtained is consistent with geomorphic interpretation of the depositional sequence for this series of dune heads and back ridge. In particular, sample SFU-O-150 collected from an adjacent dune has a similar age, whereas the ages of the back ridges of both dunes (SFU-O-151 and 152) pre-date the ages from the dune heads.

Burstall sand hills Series A

A series of six samples for optical dating was collected from the southern portion of the Burstall sand hills approximately 4.8 km north of Burstall, Saskatchewan. Sample SFU-O-145 was collected from the active surface of a blowout. The remaining samples in this series were collected from the southern side of the active blowout in a stabilized parabolic dune (50°42'10"N; 109°54'40"W).

Lab # **SFU-O-145** Burstall sand hills I
Field # SAW94-70

age (years before AD 1995): 4 ± 7

Stratigraphy: The sample was collected from the surface of the active portion of the blowout, at the easternmost end of the deposit.

Comments: Sample was collected on July 22, 1994 by S.A. Wolfe. The sample was submitted by S.A. Wolfe to use as a "zero-age" reference.

Lab # **SFU-O-129** Burstall sand hills II
Field # SW6-02

age (years before AD 1995): 168 ± 9

Stratigraphy: The dune sample was collected from a depth of 3 m below the top of the dune and 5 m above the base of the deflation depression of the active blowout. Sample from cross-bedded sands up to 40 cm thick and laminations 10 to 50 mm

thick representing slipface (foreset) deposits. Cross-beds dipping 15-24° E.

Comments: Sample was collected on October 22, 1993 by S.A. Wolfe and J. Ollerhead.

Lab # **SFU-O-149** Burstall sand hills III
Field # SAW94-83

age (years before AD 1995): 163 ± 7

Stratigraphy: The dune sample was collected from a depth of 3.2 m below the top of the dune and 4.8 m above the base of the deflation depression of the active blowout. Horizontally bedded light brown sand with occasional light grey layers to 10 mm thick representing toeset deposits that occur at the base of in downwind from slipface deposits. Unit has sharp contact with underlying sheet sand deposits which are horizontally stratified eolian sands deposits lacking any slipfaces.

Comments: Sample was collected on September 28, 1994 by S.A. Wolfe and D.S. Lemmen.

Lab # **SFU-O-148** Burstall sand hills IV
Field # SAW94-82

age (years before AD 1995): 252 ± 17

Stratigraphy: The sample was collected from a depth of 3.7 m below the top of the dune and 4.3 m above the base of the deflation depression of the active blowout. Sample from horizontally stratified sheet sands, 1.5 to 2.0 m thick. Top of unit contains oxidized root casts.

Comments: Sample was collected on September 28, 1994 by S.A. Wolfe and D.S. Lemmen.

Lab # **SFU-O-147** Burstall sand hills V
Field # SAW94-81

age (years before AD 1995): 307 ± 21

Stratigraphy: The sample was collected from a depth of 5.5 m below the top of the dune and 2.5 m above the base of the deflation depression of the active blowout. Sample from horizontally stratified sheet sands, 1.5 to 2.0 m thick. Top of unit contains oxidized root casts.

Comments: Sample was collected on September 28, 1994 by S.A. Wolfe and D.S. Lemmen.

Lab # **SFU-O-121** Burstall sand hills VI
Field # SW6-01

age (years before AD 1995);(quartz grains) 5400 ± 600

Lab # **SFU-O-122**
Field # SW6-01

age (years before AD 1995): 4120 ± 350
(5-day preheat at 140°C): 4190 ± 200
age corrected for anomalous fading: 5300 ± 300

Stratigraphy: The interdune sample was collected from a depth of 6.5 m below the top of the dune and 1.5 m above the base of the deflation depression of the active blowout. Sample of

interdune deposits from mottled sand with oxidized staining, root casts, bison bone and lithic archeological artefacts.

Comments: Sample was collected on October 22, 1993 by S.A. Wolfe and J. Ollerhead.

Burstall sand hills B

The dune sample was collected from the southern portion of the Burstall sand hills approximately 5.3 km north of Burstall, Saskatchewan (50°42'25"N; 109°54'25"W). The sample was collected to gain information on the time of dune activity in this portion of the Burstall sand hills and, in particular, to the section in the nearby stabilized dune (refer to Burstall sand hills series A).

Lab # **SFU-O-146** Burstall sand hills VII
Field # SAW94-71

age (years before AD 1995): 92 ± 7

The eolian dune sand sample was collected from the dune head of a stabilized dune, north of the blowout section containing the Burstall sand hills series A samples.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized dune head. Sample from light-brown sand.

Comments: Sample was collected on July 22, 1994 by S.A. Wolfe. The age obtained from the stabilized dune head is consistent with geomorphic interpretation, as it is younger than the ages obtained from the dune sand deposits in the nearby section.

Westerham sand hills Series

The two samples in this series were collected from a stabilized parabolic dune (termed shield dune as per David, 1999) in the Westerham sand hills approximately 6.5 km west and 2.8 km north of the western limit of Leader, Saskatchewan. The ages obtained were from samples in shallow pits excavated into the dune head and back ridge of the stabilized dune (50°55'05"N; 109°39'10"W). The samples were collected to gain information on the timing of past dune activity in the Westerham sand hills, and to compare to other stabilized dunes in the region (refer to Wolfe et al., 2001). The ages obtained from this series were consistent with geomorphic interpretation, as the age of the dune head post-dated that of the back ridge from the same dune.

Lab # **SFU-O-143** Westerham sand hills I
Field # SAW94-50

age (years before AD 1995): 129 ± 9

The eolian dune sand sample was collected from the back ridge of a stabilized parabolic dune in the Westerham sand hills. Sample collected from the lower portion of the ~2 m high back ridge, with a gently sloping surface of <5° to the west. Vegetation cover is dominated by *Psoralea lanceolata* and *Artemisia frigida* and grass, with about 70% vegetation cover. West slope dominated by *Rosa woodsii*, east slope dominated by *Rosa woodsii* and *Symphoricarpos occidentalis*. Poorly developed soil, base of A-horizon varying from 7 to 20 cm, with roots penetrating to 80 cm. Medium to coarse sand, moderately-sorted. Moderately to well-packed.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized back ridge. Sample from light-

brown sand in section with two light grey sand layers 1 to 3 mm thick at 15 cm and 40 cm depth, the lower dipping 2° W. Section also contained coarser, less well-sorted discontinuous sand layers, 5 to 10 mm thick, at 35, 41, 42, 46 and 55 cm depth.

Comments: Sample was collected on July 21, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation, as the age of the sample from the dune head (SFU-O-144) post-dates this sample from the back ridge.

Lab # **SFU-O-144** Westerham sand hills II
Field # SAW94-51

age (years before AD 1995): 105 ± 8

The eolian dune sand sample was collected from the dune head of a stabilized parabolic dune in the northwestern Great Sand Hills. Sample collected from the top of the south side of the dune head, located in a depression to determine the last time of transport towards the southeast. Surface dominated by grass, *Psoralea lanceolata*, *Artemisia frigida* in about equal proportions and some moss cover, with about 80% total vegetation coverage. A-horizon approximately 5 to 10 cm thick and varying, with dense roots to 80 cm. Medium sand with some coarser sand, loosely packed and moderately-sorted.

Stratigraphy: The sample was collected from a depth of 0.5 m below the surface of the stabilized dune head. Sample from light-brown sand. Section contained undulating, light grey sand layers about 10 mm thick, at a depth of 15 and 20 cm. Lower layer dipping 4° SE.

Comments: Sample was collected on July 21, 1994 by S.A. Wolfe and P.P. David. The age obtained is consistent with geomorphic interpretation as the age of the sample from the back ridge (SFU-O-143) predates this sample from the dune head.

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