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Preliminary Release of Kimberlite Indicator Mineral Data from National Geochemical Reconnaissance Stream Sediment Samples in the Jackpine Lake Area (NTS 84C/15, 84C/16, 84F/01, 84F/02), Southwest Buffalo Head Hills, Alberta

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Prior, G.J., McCurdy, M.W., Friske, P.W.B., Pawlowicz, J.G., Day, S.J.A. and McNeil, R.J. (2006)

Introduction

The Geological Survey of Canada (GSC) and Alberta Geological Survey (AGS) carried out a regional stream sediment and water geochemical survey in the southwest Buffalo Head Hills, north-central Alberta, in 2005 (Figure 1). Samples were collected in the Peace River map area (84C/15, 84C/16) and the Bison Lake map area (84F/01, 84F/02).

The 2005 data are part of an ongoing survey of the Buffalo Head Hills area initiated in 2001 (Friske et al., 2003; McCurdy et al., 2004; McCurdy et al., 2006). Selected results from the 2004 National Geochemical Reconnaissance (NGR) survey were released in Prior et al. (2005a; 2005b).

The Buffalo Head Hills Upland forms a northerly-trending region lying between the Peace River Lowland (Cadotte Plain) to the west and the Wabasca Lowland (Loon Lake Plain) to the east (Pettapiece, 1986). Samples were collected by helicopter based at Peace River, Alberta, a community located 390 km northwest of Edmonton. A wide range of services is available in Peace River, including lodging, gas stations, grocery and hardware stores, and restaurants. The airport is located 10 km west of town and several companies provide helicopter and charter services.

Partial, preliminary kimberlite indicator mineral data from bulk sediment samples (10-15 kg) are released in this report. Bulk samples are composed mainly of sand-sized material collected from second or third-order streams. The reader is cautioned that:

- (i) data from other NGR samples collected in the area (2004 and pre-2004) are not contained within this report;
- (ii) grains from the 2005 survey have not undergone microprobe analyses and the mineralogy of these grains is based upon visual identification;
- (iii) not all of the sample data are provided, and;
- (iv) the data that are reported have not been subjected to all of the usual NGR quality control checks.

However, the preliminary results from this survey are believed to have mineral exploration significance and an early release of information was deemed appropriate.

This National Geochemical Reconnaissance (NGR) project contributes to Alberta's plan for a multi-year, multi-disciplinary study in the northern part of the province. The Geological Survey of Canada, under the Targeted Geoscience Initiative II (TGI II) and Northern Resources Development Program, and the Alberta Energy and Utilities Board/Alberta Geological Survey (EUB/AGS), funded the 2005 survey.

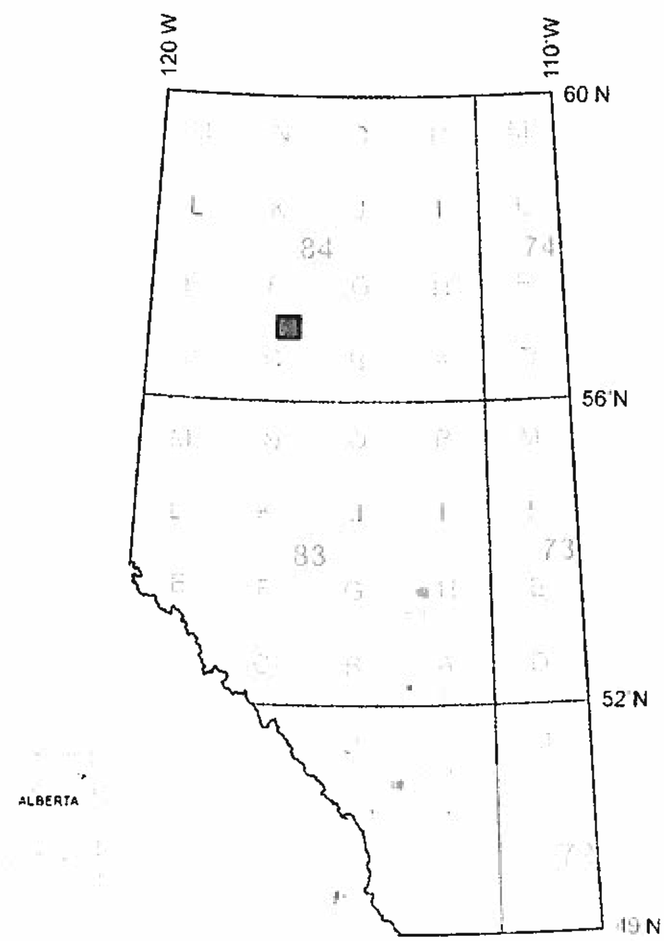

Figure 1. Alberta map showing location of the Jackpine Lake survey area (parts of NTS map areas 84C/15, 84C/16, 84F/01 and 84F/02).

Geological Setting

Sedimentary Rocks

The Jackpine Lake survey area, in the southwest Buffalo Head Hills, is underlain by Cretaceous strata of the Western Canada Sedimentary Basin (Figure 2). Moving upwards through the stratigraphic succession these strata are divided into the Shaftesbury Formation (marine shale and silty shale), the Dunvegan Formation (deltaic to marine sandstone, siltstone and silty shale) and the Smoky Group (marine shale and silty shale; Green et al., 1970; Hamilton et al., 1999). Stratigraphic markers in the lower part of the Upper Cretaceous succession indicate nearly horizontal dips in the south-central Buffalo Head Hills (Chen and Olson, 2005).

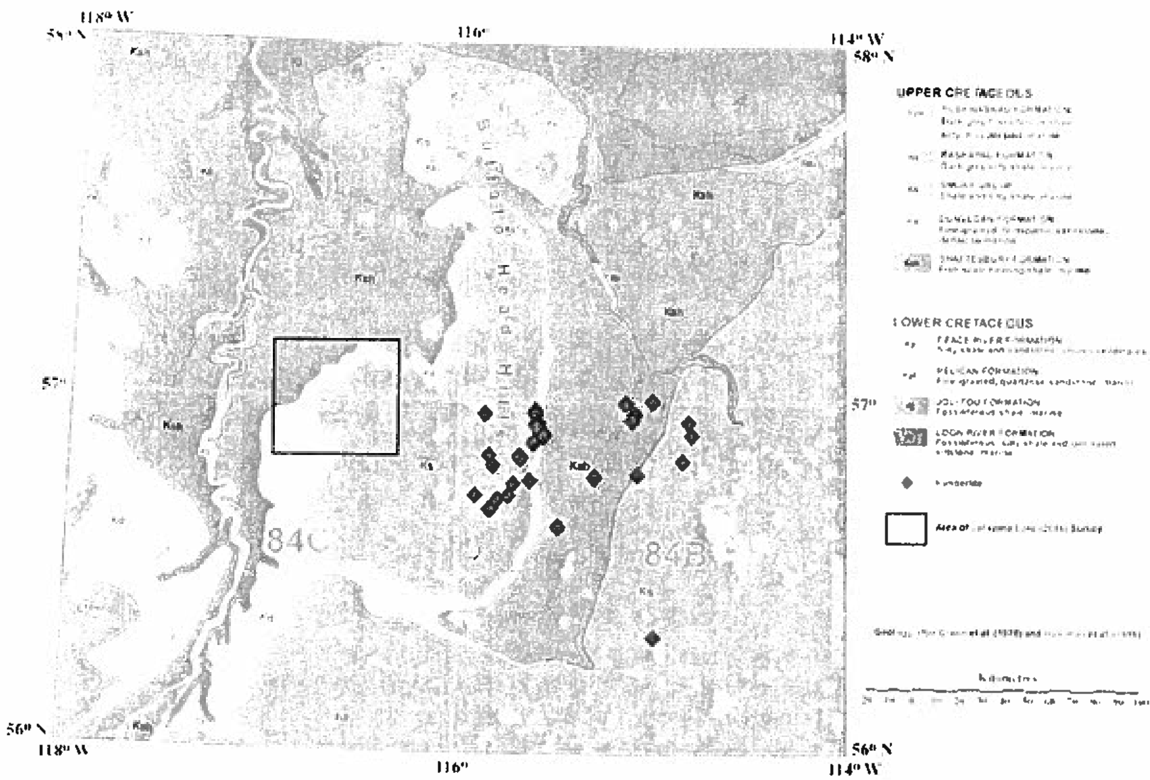

Figure 2. Bedrock geology of the Buffalo Head Hills area (84B, C, F and G)

Kimberlites

The Buffalo Head Hills kimberlite field, which occurs within the southern Buffalo Head Hills and the adjacent Loon Lake Plain (Loon River lowland) to the east, contains a minimum of 38 kimberlite bodies (Hood and McCandless, 2004). Some kimberlite pipes of the Buffalo Head Hills field are quite large with diameters of up to 600 metres, based upon drillhole information and ground magnetic signatures. Several of the kimberlites form bedrock highs, which may be accompanied by topographic highs, due to their greater resistance to weathering and glacial erosion relative to the soft Cretaceous sedimentary rocks. In general, kimberlites of the Buffalo Head Hills field consist primarily of crater facies, juvenile lapilli-rich olivine (crystal)-tuffs (Boyer et al., 2003; Eccles, 2004). Perovskite (U-Pb) dates obtained on three Buffalo Head Hills kimberlites indicate emplacement ages of 86±3, 87±3 and 88±5 Ma for kimberlites K7A, K5 and K14 respectively (Carlson et al., 1999).

The mineralogy of kimberlites within the Buffalo Head Hills field has been reported on by Hood and McCandless (2003; 2004):

> "Indicator mineral assemblages have been assessed for twenty-nine of the Buffalo Hills kimberlites, with forsteritic olivine forming the dominant xenocryst or cryptogenic mineral species. Chromian pyrope garnet and chromite are also important constituents, although some pipes (e.g. K8, K7B, K7C, and BM3) are devoid of these minerals. Eclogitic pyrope-almandine, titanian pyrope, chromian augite/diopside, and picroilmenite are also present in lesser amounts, and some bodies contain chromian corundum, zircon, edenitic amphibole, and Mg-Cr-Al spinel" (Hood and McCandless, 2003, p.1). "Xenocryst occurrence varies widely between bodies and appears uncorrelated with geographic location, pipe morphology or diamond content." (Hood and McCandless, 2004, p. 735).

Of the 38 kimberlites within the Buffalo Head Hills field, 26 are known to contain diamonds. Kimberlites in the northern part of this field tend to have higher diamond content. The northern group of kimberlites includes K252, which has the highest known diamond content with an estimated grade of 55 carats per hundred tonnes (Hood and McCandless, 2004).

Surficial Geology

The surficial geology of the northeast quadrant of the Peace River map area (NTS 84C/NE), which includes the southern part of the Jackpine Lake survey area, has been mapped at 1:100 000 scale by the Alberta Geological Survey (Paulen et al., 2004). Surficial units in the southern Jackpine Lake survey area consist mainly of stagnant ice moraine, glaciofluvial deposits, organic deposits and lesser amounts of eolian and glaciolacustrine deposits. The surfical geology of the region is largely the result of the advance and retreat of Late Wisconsin ice (Fenton, 1984).

Sample Methodology and Results

Sample Collection

Ideal sites for the collection of sediments for the heavy mineral concentrate fraction are located at the upstream points of mid-channel bars. Material was collected from a single location where possible, or within close proximity otherwise. A 5-gallon (22.7 litre) plastic pail was lined with a heavy-duty polyethylene bag (18x24 inches, 4 Mil). Material was wet-sieved through a 12-mesh (1.68 mm) stainless steel sieve placed on top of the pail, until a sample weight of 10-15 kg was attained. The bag lining the pail was taped shut with black plastic (electrical) tape and placed into a second bag with a sample number and taped. Samples were shipped directly to a commercial lab for preparation and analysis. Figure 3 illustrates all the samples types collected at a typical bulk sediment site.

The locations of sample sites within the Jackpine Lake area are shown in Figure 4. Sample site descriptions are listed in Appendix 1 and are also contained in a digital file that accompanies this report.

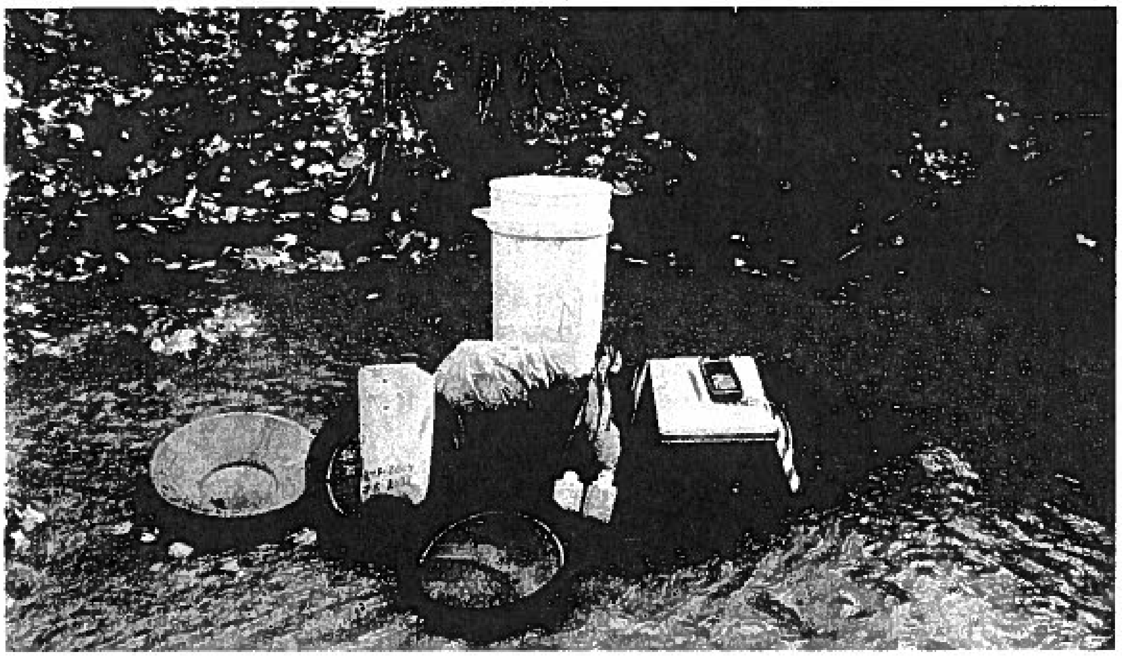

Figure 3. Pre-labelled Kraft paper bags and plastic bottles are used to collect samples of stream silts and stream waters. A bulk sample, for heavy mineral processing, is collected by wet-sieving coarse-grained stream sediment using a US Sieve Series 12-mesh (1.68 mm) sieve and collecting <12 mesh grains in a plastic pail lined with a polyethylene sample bag. The gold pan is used for adding water for wet sieving, not for heavy mineral concentrate panning. A sample composed of granules and pebbles, for archive, is collected at bulk sample sites by sieving >12 mesh material through a US Sieve Series 2-mesh (10 mm) sieve and collecting the <10 mm material in a labelled Kraft paper bag. Flagging tape with a sample site number is used to mark sample sites. Field observations are noted on pre-printed water-resistant paper.

Sample Preparation

Bulk sediment samples were progressively reduced by different laboratory procedures to concentrate heavy minerals. Initially a 500-g character sample was taken and stored before a low-grade table concentrate was prepared from the remainder. Gold grains were observed at this stage and counted, measured and classified as to degree of wear (reflecting distance of transport). The table reject was re-tabled to scavenge possible unrecovered kimberlite indicator minerals and magmatic massive sulphide indicator minerals. The concentrate from both tabling runs was separated in methylene iodide diluted with acetone to S.G. 3.20 to recover heavy minerals including pyrope, Cr-diopside, forsterite and chromite. Magnetite was removed after the heavy liquid separation and the remaining concentrate cleaned with oxalic acid to remove limonite stains. The dried concentrate was sieved to separate it into several size fractions, (<0.25 mm, 0.25 to <0.5 mm, 0.5 mm to <1.0 mm, ≥ 1.0 mm to 2.0 mm). The <0.25 mm fraction was kept for chemical analysis and the 0.25 to 0.50 mm fraction was sorted with a Carpco® drum magnetic separator into strongly, moderately, weakly and non-paramagnetic fractions.

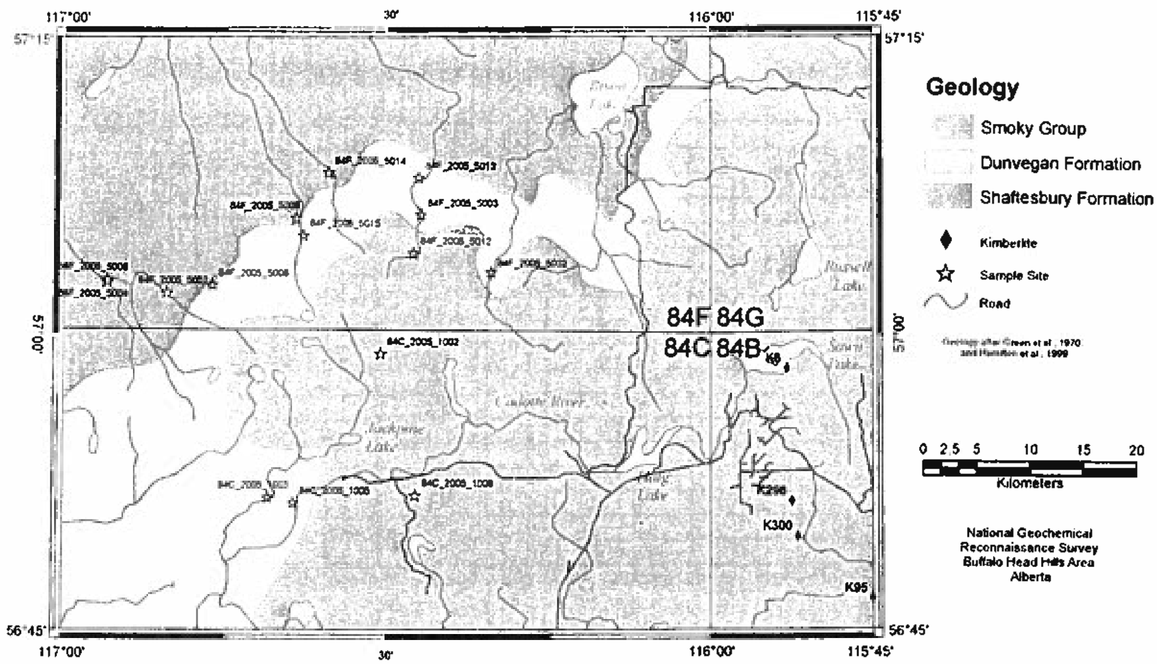

Figure 4. Map of the Jackpine Lake area showing sample sites.

Analysis

Kimberlite indicator minerals (KIMs) were picked and identified from each of three size fractions (0.25-0.5 mm, 0.5 mm-1.0 mm, 1.0-2.0 mm). Fractions exceeding a 100 g threshold were characterized by a 100 g split and normalized to represent the total sample weight. Following removal of the kimberlite indicator minerals, 100 grains were randomly selected from each 0.25-0.5 mm fraction and identified. After identification these 100 grains were recombined with the source sample fraction. The 0.25-0.5 mm, 0.5-1.0 mm and 1.0-2.0 mm fractions (minus KIMs) were archived. The <0.25 mm fraction of the heavy mineral concentrate will be sent to a commercial lab where it is ground in a ceramic mill and analyzed by a combination of ICP-MS, INAA and specific methods. Kimberlite indicator mineral grains undergo electron microprobe analysis for chemical characterization. A mineralogical consultant evaluates results of electron microprobe data.

Results

A digital file of selected picked grain results, including pyrope, chromite and forsterite grain counts, from the 2005 Jackpine Lake survey area accompanies this report and a summary is presented in Table 1. Selected picked grain results are also listed in Appendix 2 following this report. A map showing the distribution of pyrope, chromite and forsterite grains recovered from stream sediment heavy mineral concentrate samples in the Buffalo Head Hills collected from 2001 to 2005 is presented in Figure 5. Data sources for Figure 5 are listed in Table 2.

Table 1. Summary of picked pyrope (GP), chromite (CR) and forsterite (FO) results.

Sample Number	Number of Grains*									
	1.0 to 2.0 mm			0.5 to 1.0 mm			0.25 to 0.5 mm			
	GP	CR	FO	GP	CR	FO	GP	CR	FO	Sum
84C-2005-BS-1002	0	0	4	5	45	39	20	25(40)	20(30)	183
84C-2005-BS-1003	0	0	0	4	9	4	13	14	5	49
84C-2005-BS-1005	0	0	10	12	36	20(100)	9	25(70)	20(50)	287
84C-2005-BS-1006	0	0	1	9	20(40)	4	3	30(60)	1	118
84F-2005-BS-5002	0	0	0	0	0	0	0	1	2	3
84F-2005-BS-5003	0	0	0	1	0	0	0	1	0	2
84F-2005-BS-5004	0	0	0	0	1	0	1	1	2	5
84F-2005-BS-5006	0	0	0	0	0	0	0	0	0	0
84F-2005-BS-5007	0	0	0	0	0	0	1	0	1	2
84F-2005-BS-5008	0	0	0	0	0	0	0	1	0	1
84F-2005-BS-5009	0	0	0	0	0	0	0	3	0	3
84F-2005-BS-5012	0	0	2	2	2	25(60)	36	11(25)	20(60)	187
84F-2005-BS-5013	0	0	0	0	0	0	1	3	0	4
84F-2005-BS-5014	0	0	0	0	0	1	0	4	0	5
84F-2005-BS-5015	0	0	0	0	0	0	1	0	0	1

* Numbers in brackets are estimated total indicator grains present in samples where not all of the grains were picked.

Table 2. Sources of Buffalo Head Hills stream sediment and water data.

Survey Year(s)	Reference
2001-2002	Friske et al., 2003
2003	McCurdy et al., 2004
2004	McCurdy et al., 2006
2005	This report

Microprobe analyses, used to confirm and refine mineralogy, have not yet been performed on grains from the 2005 Jackpine Lake survey. In order to obtain some measure of the accuracy of the visual identification of the grains made during the picking process 41 grains from sample 84F-2005-BS-5012 were selected for scanning electron microscope (SEM) identification. The results, presented in Table 3, indicate that the visual grain identifications have a high degree of accuracy.

Table 3. Scanning electron microscope (SEM) checks of visual grain identifications.

Sample	Size Range (mm)	Visual Grain Identification	SEM Grain Identification	Comment
84F-2005-BS-5012	0.25-0.50	10 pyropes	10 pyropes	All G9
84F-2005-BS-5012	0.25-0.50	11 chromites	8 chromites	3 crustal ilmenites
84F-2005-BS-5012	0.25-0.50	20 forsterites	20 forsterites	

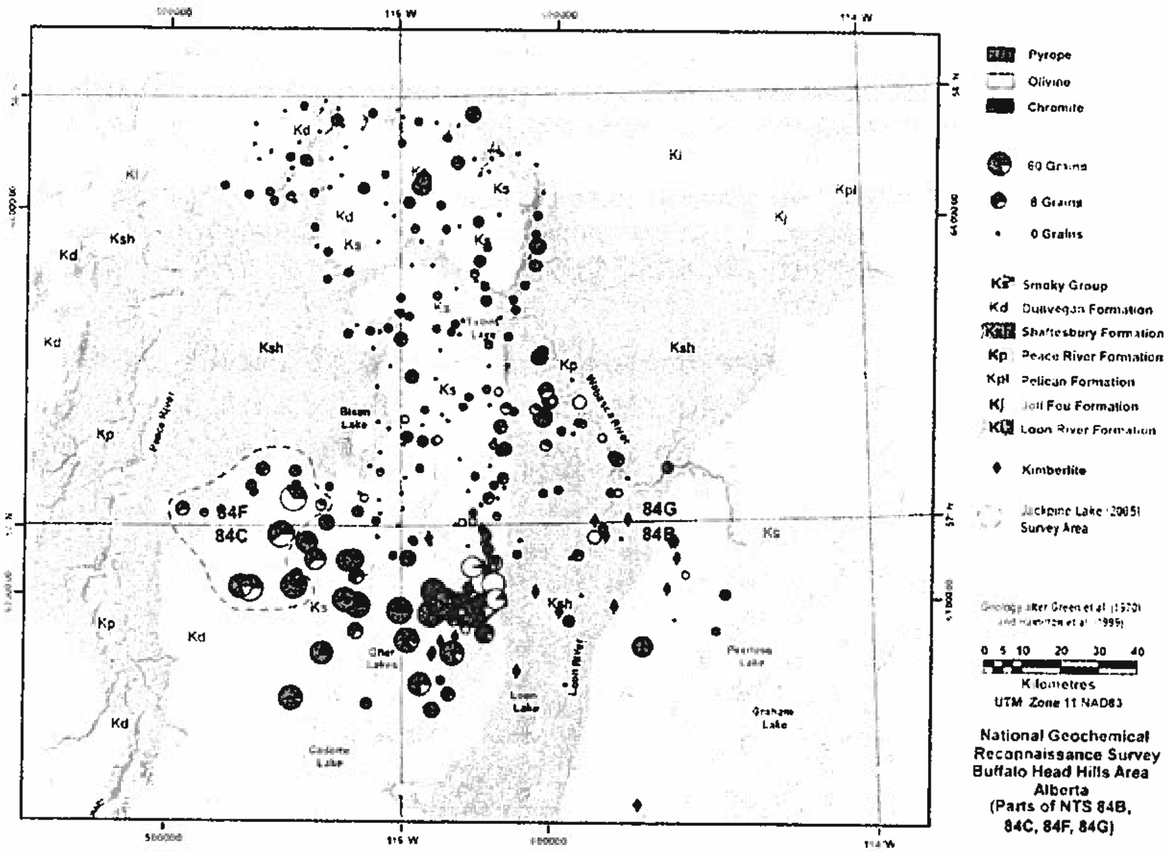

Figure 5. Pyrope, olivine and chromite grains in Buffalo Head Hills stream sediment heavy mineral concentrates. Grains from the 2005 survey have not undergone microprobe analyses and the mineralogy of these grains is based upon visual identification.

Discussion

Glacial Ice Flow History in the Southern Buffalo Head Hills

A reconstruction of Late Wisconsin ice flow in northern Alberta is shown in Figure 6. Glacial advances in northern Alberta originated from the Laurentide Ice Sheet, which generally flowed across central Alberta in a southwesterly direction (Fulton, 1989). According to regional studies, ice advanced to its maximum Late Wisconsin limit approximately 23 to 24 thousand years ago before the present (Ka) and retreated from the Buffalo Head Hills by 11 Ka (Dyke et al., 2002; 2003). Local evidence for the southwesterly flow of the Late Wisconsin Laurentide Ice Sheet across the Sawn Lake area during glacial maximum includes

- a sculpted crag and tail feature at the K5 kimberlite outcrop (Paulen et al., 2003; Trommelen, 2004),
- poorly developed flutings, trending west-southwest, formed in the upper part of the Buffalo Head Hills in a local area where the drift forms only a thin (<2 m) veneer over the Cretaceous mudstone (Paulen et al.. 2003),

- striae on a polished surface of the K6 kimberlite outcrop indicating south-southwest (212°) glacial flow (R. Paulen, pers comm, 2005),
- a west-southwest trending kimberlite indicator mineral grain dispersal pattern in the Sawn Lake (84B/13) map area (Prior et al., 2003; Prior et al., 2005c).

Sometime after glacial maximum, ice advanced out of the Peace River Valley and flowed in a southeasterly direction over the southwest flank of the Buffalo Head Hills (Mathews, 1980; R. Paulen, pers comm, 2005).

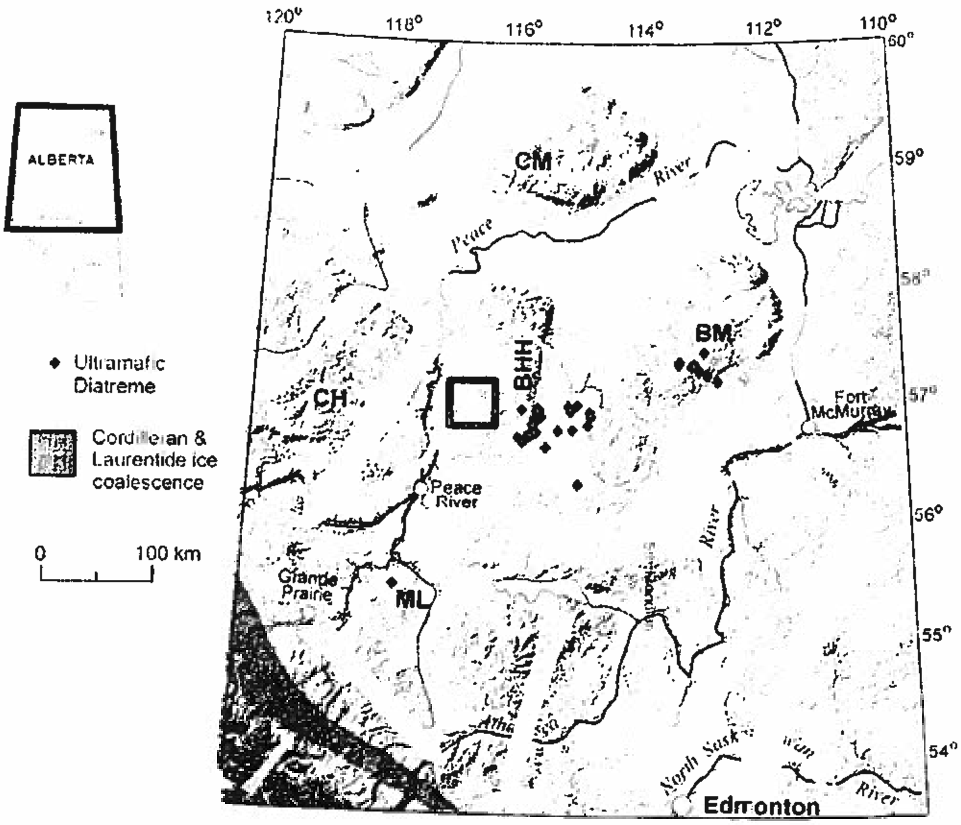

Figure 6. Flow of the Laurentide Ice Sheet during the Late Wisconsin. The large arrows indicate ice flow at glacial maximum (derived from Prest et al., 1968 and Fulton, 1989). The smaller arrows indicate general flow directions of latest Late Wisconsin ice (Mathews, 1980; Klassen 1989; Campbell et al., 2001; M. Fenton, pers comm, 2002; Paulen, 2002). CH = Clear Hills, CM = Caribou Mountains, BHH = Buffalo Head Hills, BM = Birch Mountains, ML = Mountain Lake. The rectangle northeast of Peace River (town) represents the 2005 Jackpine Lake survey area.

Source of Kimberlite Indicator Grains in the Jackpine Lake Area

The most northerly sample with strongly elevated kimberlite indicator mineral grain counts from the 2005 Jackpine Lake survey area is 84F-2005-BS-5012, located 20 km southwest of Bison Lake (Figures 4 and 5). The estimated yield from this 12.1 kg sample is 38 pyrope, 27 chromite and 122 forsterite grains. There are no known kimberlites in an up-ice direction from this sample site, based upon the ice flow information presented above. Transport of the grains to the area by glaciofluvial or eolian processes is unlikely.

The nearest known kimberlite to the Jackpine Lake survey area, kimberlite K8, is located near the southeastern shore of Sawn Lake within map area 84B/13 (Figures 4 and 5; Skelton et al., 2003; Hood and McCandless, 2004). The site from which sample 84F-2005-BS-5012 was collected lies 36 km west-northwest of kimberlite K8. In addition to being inconsistent with the glacial history of the area, kimberlite K8 is unlikely to be the source of the grains in Jackpine Lake survey area as it is reported to have negligible pyrope and chromite contents (Hood and McCandless, 2004).

There appears to be a significant probability that many, or perhaps all, of the kimberlite indicator mineral grains recovered from the Jackpine Lake survey area were transported from a kimberlite, or kimberlites, that remain to be discovered. It is evident from the grain distribution pattern shown in Figure 5 that the boundary between high and relatively low grain counts in the Jackpine Lake survey area occurs near the Dunvegan Formation–Smoky Group contact on the western flank of the Buffalo Head Hills. It is noteworthy that the highest concentration of known kimberlites in the Buffalo Head Hills kimberlite field, including kimberlite K252 with an estimated diamond grade of 55 carats per hundred tonnes (Hood and McCandless, 2004), lies along the Dunvegan Formation-Smoky Group contact on the eastern flank of the Buffalo Head Hills, approximately 60 km to the east-southeast. It is also noteworthy that high forsterite grain counts tend to occur in these two areas (near the Dunvegan Formation-Smoky Group contact) whereas samples from the south-central Buffalo Head Hills tend to be dominated by chromite and pyrope. These observations suggest a geological model in which the kimberlite distribution in the southeastern Buffalo Head Hills may be "mirrored" along the western flank of the upland, within or near the 2005 Jackpine Lake survey area.

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Ottawa, Ontario

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Appendix 1. Stream Site Field Data

Appendix 2. Heavy Mineral Concentrate Mineralogy (Preliminary)

Site ID	NTS Sheet	Year	Longitude (NAD 83)	Latitude (NAD 83)	Easting (NAD 83)	Northing (NAD 83)	Zone	Stream Width (m)	Stream Depth (m)	General Physiography	Surface Expression
84C_2005_1002	84C	2005	-116.50980	56.98355	529711	6315657	11	1.0	0.3	hilly	level
84C_2005_1003	84C	2005	-116.68322	56.86205	519315	6302075	11	4.5	0.3	plain	level
84C_2005_1005	84C	2005	-116.64368	56.85741	521744	6301582	11	10.0	0.4	plain	level
84C_2005_1006	84C	2005	-116.45641	56.86367	533143	6302341	11	3.0	0.3	hilly, plain	inclined, level
84F_2005_5002	84F	2005	-116.34111	57.05168	539971	6323336	11	1.5	0.1	plain	hummocky
84F_2005_5003	84F	2005	-116.44875	57.10033	533406	6328700	11	4.0		plain	hummocky
84F_2005_5004	84F	2005	-116.93234	57.04360	504103	6322243	11	4.5	0.3	plain	level
84F_2005_5006	84F	2005	-116.93242	57.04587	504096	6322500	11	4.0	0.3	plain	level
84F_2005_5007	84F	2005	-116.84098	57.03473	509652	6321265	11	1.0	0.2	plain	level
84F_2005_5008	84F	2005	-116.76976	57.04139	513977	6322024	11	1.5	0.2	plain	level
84F_2005_5009	84F	2005	-116.64007	57.09763	521809	6328299	11	3.0	0.3	plain	level
84F_2005_5012	84F	2005	-116.45988	57.06800	532750	6325086	11	1.5	0.2	hilly	inclined
84F_2005_5013	84F	2005	-116.45274	57.13168	533124	6332183	11	2.0	0.2	hilly	inclined
84F_2005_5014	84F	2005	-116.59097	57.13592	524759	6332586	11	3.5	0.3	hilly	inclined
84F_2005_5015	84F	2005	-116.62929	57.08285	522471	6326663	11	1.5	0.2	hilly	inclined

Site ID	Drainage Pattern	Site Drainage	Stream Source(s)	Stream Class	Stream Type	Stream Flow	Water Colour	Water Clarity	Vegetation
84C_2005_1002	poor	moderate	ground, recent rain	secondary	permanent	slow	light brown	transparent	coniferous
84C_2005_1003	poor	moderate	ground	secondary	permanent	slow	light yellow	transparent	coniferous
84C_2005_1005	poor	well	ground	tertiary	permanent	slow	light brown	partly cloudy	coniferous
84C_2005_1006	dendritic	well	ground	secondary	permanent	slow	light yellow	transparent	mixed, grass
84F_2005_5002	dendritic	well	ground, recent rain	primary	permanent	slow	yellow	partly cloudy	mixed, grass
84F_2005_5003	dendritic	well	ground, recent rain	primary	permanent	slow	yellow	partly cloudy	mixed, grass
84F_2005_5004	dendritic	moderate	ground	secondary	permanent	slow	yellow	partly cloudy	mixed, grass
84F_2005_5006	dendritic	moderate	ground	secondary	permanent	slow	yellow	transparent	mixed
84F_2005_5007	dendritic, poor	poor	ground	primary	permanent	slow	light brown	transparent	deciduous, grass
84F_2005_5008	dendritic	well	ground	secondary	permanent	slow	light brown	partly cloudy	mixed
84F_2005_5009	dendritic	moderate	ground	secondary	permanent	slow	pale yellow	transparent	mixed
84F_2005_5012	dendritic	moderate	ground, recent rain	primary	permanent	slow	yellow	partly cloudy	mixed, grass
84F_2005_5013	dendritic	moderate	ground, recent rain	secondary	permanent	slow	yellow	partly cloudy	coniferous, grass
84F_2005_5014	dendritic	moderate	ground, recent rain	secondary	permanent	slow, moderate	yellow	partly cloudy	mixed, grass
84F_2005_5015	dendritic	moderate	ground, recent rain	secondary	permanent	slow, moderate	light brown	partly cloudy	mixed, grass

Site ID	Bank Types	Contamination	Bank Precipitate	Bottom Precipitate	HMC Site	Site Rating	Clast Shape (%)
							Rounded, Sub-Angular, Angular, Platy/Flat
84C_2005_1002	alluvium	none	no	no	log trap, gravel veneer	moderate	70,25,3,2
84C_2005_1003	alluvium	none	no	red	transverse bar	moderate	70,25,3,2
84C_2005_1005	alluvium	possible - oil/gas industry, forestry	no	black	transverse bar, gravel veneer	moderate	70,25,3,2
84C_2005_1006	alluvium, organic	possible	no	no	transverse bar, gravel veneer	moderate	70,25,0,5
84F_2005_5002	alluvium, organic	possible - seismic lines	no	no	longitudinal bar, gravel veneer	moderate to poor	70,20,5,5
84F_2005_5003	alluvium	possible - seismic lines	no	no	longitudinal bar, gravel veneer	moderate to poor	75,20,0,5
84F_2005_5004	alluvium, organic	none	no	no	transverse bar	good to moderate	75,20,0,5
84F_2005_5006	alluvium, till	none	no	no	transverse bar	good to moderate	70,23,2,5
84F_2005_5007	organic	none	no	no	gravel veneer, beaver dam	poor	65,25,5,5
84F_2005_5008	alluvium, organic	none	no	no	longitudinal bar, gravel veneer, beaver dam	moderate	65,25,5,5,
84F_2005_5009	alluvium, organic	possible - oil/gas industry	no	red	longitudinal bar, beaver dam	moderate to poor	60,30,5,5,
84F_2005_5012	alluvium, organic	none	no	no	boulder trap, gravel veneer	moderate	65,25,5,5
84F_2005_5013	alluvium, organic	possible - forestry	no	minor black	transverse bar, log trap, gravel veneer	moderate	70,20,5,5
84F_2005_5014	alluvium	possible - oil/gas industry, forestry	no	minor black	transverse bar	moderate	65,25,5,5
84F_2005_5015	alluvium	possible - oil/gas industry, forestry	no	minor red	beaver dam	moderate	65,25,5,5

Site ID	HMC Site Composition (%)	Clast Lithologies (%)	Bedrock Exposed	Boulders Present
	Cobbles, Pebbles, Sand, Silt, Clay, Organics			
84C_2005_1002	5,35,50,5,0,5	shield igneous/metamorphic(73), sandstone(25), limestone(10), chert(2)	no	shield igneous/metamorphic
84C_2005_1003	10,50,30,5,0,5	shield igneous/metamorphic(54), sandstone(30), limestone(10), chert(5), shale(1)	no	no
84C_2005_1005	15,60,25,5,0,0	shield igneous/metamorphic(52), red sandstone(10), brown sandstone(25), limestone(10), chert(2), quartzite(1)	no	shield igneous/metamorphic
84C_2005_1006	15,50,30,5,0,0	shield igneous/metamorphic(65), sandstone(25), limestone(7), chert(2), quartzite(1)	no	shield igneous/metamorphic
84F_2005_5002	0,40,40,5,5,10	shield igneous/metamorphic(55), sandstone(30), limestone(11), chert(2), shale & ironstone(2)	no	no
84F_2005_5003	10,40,30,5,5,10	shield igneous/metamorphic(63), sandstone(25), limestone(8), chert(2), quartzite(1), shale(1)	no	shield igneous/metamorphic
84F_2005_5004	30,40,20,4,3,3	shield igneous/metamorphic(60), brown sandstone(20), carbonate(15), red sandstone(4), shale(1)	no	shield igneous/metamorphic
84F_2005_5006	20,60,20,0,0,0	shield igneous/metamorphic(58), sandstone(30), carbonate(10), chert(2)	no	shield igneous/metamorphic
84F_2005_5007	10,15,10,10,5,50	shield igneous/metamorphic(70), brown sandstone(20), red sandstone(1), carbonate(7), quartzite(2)	no	no
84F_2005_5008	50,25,10,5,5,5	shield igneous/metamorphic(62), brown sandstone(30), red sandstone(1), carbonate(5), chert(2)	no	shield igneous/metamorphic
84F_2005_5009	30,45,25,0,0,0	shield igneous/metamorphic(66), brown sandstone(25), red sandstone(2), carbonate(5), chert(2)	no	shield igneous/metamorphic
84F_2005_5012	10,20,60,5,0,5	shield igneous/metamorphic(70), brown sandstone(20), red sandstone(5), quartzite(2), chert(3)	no	shield igneous/metamorphic
84F_2005_5013	10,30,50,5,0,5	shield igneous/metamorphic(65), brown sandstone(22), red sandstone(3), limestone(5), quartzite(3), chert(2)	no	shield igneous/metamorphic
84F_2005_5014	25,35,30,5,0,5	shield igneous/metamorphic(55), brown sandstone(20), limestone(15), red sandstone(3), quartzite(3), chert(2), siltstone(2)	no	shield igneous/metamorphic
84F_2005_5015	20,40,40,0,0,0	shield igneous/metamorphic(65), brown sandstone(15), limestone(10), red sandstone(5), quartzite(3), chert(2)	no	shield igneous/metamorphic, brown sandstone

							Weight (kg)			
Sample ID	Site ID	Longitude (NAD 83)	Latitude (NAD 83)	Easting (NAD 83)	Northing (NAD 83)	Zone	Bulk Rec'd	Table Split	+2 mm Clasts	Table Feed
84C_2005_BS_1002	84C_2005_1002	-116.50980	56.98355	529711	6315657	11	13.5	13	0	13
84C_2005_BS_1003	84C_2005_1003	-116.68322	56.86205	519315	6302075	11	12.1	11.6	0	11.6
84C_2005_BS_1005	84C_2005_1005	-116.64368	56.85741	521744	6301582	11	12.1	11.6	0	11.6
84C_2005_BS_1006	84C_2005_1006	-116.45641	56.86367	533143	6302341	11	12.5	12	0	12
84F_2005_BS_5002	84F_2005_5002	-116.34111	57.05168	539971	6323336	11	12.5	12	0	12
84F_2005_BS_5003	84F_2005_5003	-116.44875	57.10033	533406	6328700	11	13.8	13.3	0	13.3
84F_2005_BS_5004	84F_2005_5004	-116.93234	57.04360	504103	6322243	11	12.5	12	0	12
84F_2005_BS_5006	84F_2005_5006	-116.93242	57.04587	504096	6322500	11	11.4	10.9	0	10.9
84F_2005_BS_5007	84F_2005_5007	-116.84098	57.03473	509652	6321265	11	10.7	10.2	0	10.2
84F_2005_BS_5008	84F_2005_5008	-116.76976	57.04139	513977	6322024	11	9.6	9.1	0	9.1
84F_2005_BS_5009	84F_2005_5009	-116.64007	57.09763	521809	6328299	11	11.9	11.4	0	11.4
84F_2005_BS_5012	84F_2005_5012	-116.45988	57.06800	532750	6325086	11	12.1	11.6	0	11.6
84F_2005_BS_5013	84F_2005_5013	-116.45274	57.13168	533124	6332183	11	16.5	16	0	16
84F_2005_BS_5014	84F_2005_5014	-116.59097	57.13592	524759	6332586	11	10.8	10.3	0	10.3
84F_2005_BS_5015	84F_2005_5015	-116.62929	57.08285	522471	6326663	11	10.7	10.2	0	10.2
Comment:										
Comment:										

	<2.0 mm Table Concentrate (g)								
		Heavy Liquid Separation S.G 3.20							
				Nonferromagnetic HMC					
Sample ID	Total	Heavy Liquid Lights	Mag HMC	Total	<0.25 mm (wash)	<0.25 mm	0.25 to 0.5 mm	0.5 to 1.0 mm	1.0 to 2.0 mm
84C_2005_BS_1002	1411.7	1285.9	6.4	119.4	3.4	50.1	44.1	16.3	5.5
84C_2005_BS_1003	1479.8	1346.1	7.2	126.5	9.1	39.1	37.4	24.3	16.6
84C_2005_BS_1005	1188.3	976.9	18.4	193.0	3.5	26.8	36.9	20.9	8.4
84C_2005_BS_1006	1475.9	1175.9	20.0	280.0	4.4	6.3	25.1	26.4	7.8
84F_2005_BS_5002	1283.7	1199.8	4.8	79.1	5.7	21.8	28.0	16.8	6.8
84F_2005_BS_5003	1292.1	1153.5	9	129.6	4.8	28.3	26.2	31.8	38.5
84F_2005_BS_5004	1363.6	1218.4	9.3	135.9	9.9	32.4	41.8	28.3	23.5
84F_2005_BS_5006	1263	1136.7	5.2	121.1	11.9	28.8	38.7	26.9	14.8
84F_2005_BS_5007	586.9	547.6	2.2	37.1	1.4	15.1	6.8	8.7	5.1
84F_2005_BS_5008	620.7	579.8	3	37.9	2.2	12.6	12.2	7.9	3.0
84F_2005_BS_5009	1254.8	1117.2	8.8	128.8	5.2	36.1	34.1	30.1	23.3
84F_2005_BS_5012	1229.6	1138.7	6.6	84.3	16.7	24.4	38.7	1.8	2.7
84F_2005_BS_5013	1538.6	1333.2	15.6	189.8	10.7	32.2	36.1	11.6	4.3
84F_2005_BS_5014	1073.8	943.9	7.4	122.5	8.0	29.0	38.0	28.3	19.2
84F_2005_BS_5015	1270.5	1201.6	4.5	64.4	5.9	25.1	18.1	8.3	7.0
Comment:									
Comment:									

Sample ID	Kimberlite Indicator Mineral Count*									
	1.0 to 2.0 mm			0.5 to 1.0 mm			0.25 to 0.5 mm			Total
	GP	CR	FO	GP	CR	FO	GP	CR	FO	GP+CR+FO
84C_2005_BS_1002	0	0	4	5	45	39	20	25(40)	20(30)	183
84C_2005_BS_1003	0	0	0	4	9	4	13	14	5	49
84C_2005_BS_1005	0	0	10	12	36	20(100)	9	25(70)	20(50)	287
84C_2005_BS_1006	0	0	1	9	20(40)	4	3	30(60)	1	118
84F_2005_BS_5002	0	0	0	0	0	0	0	1	2	3
84F_2005_BS_5003	0	0	0	1	0	0	0	1	0	2
84F_2005_BS_5004	0	0	0	0	1	0	1	1	2	5
84F_2005_BS_5006	0	0	0	0	0	0	0	0	0	0
84F_2005_BS_5007	0	0	0	0	0	0	1	0	1	2
84F_2005_BS_5008	0	0	0	0	0	0	0	1	0	1
84F_2005_BS_5009	0	0	0	0	0	0	0	3	0	3
84F_2005_BS_5012	0	0	2	2	2	25(60)	36	11(25)	20(60)	187
84F_2005_BS_5013	0	0	0	0	0	0	1	3	0	4
84F_2005_BS_5014	0	0	0	0	0	1	0	4	0	5
84F_2005_BS_5015	0	0	0	0	0	0	1	0	0	1
Comment:	GP: pyrope; CR: chromite; FO: forsterite									
Comment:	* Numbers in brackets are estimated total indicator grains present in samples where not all of the grains were picked.									

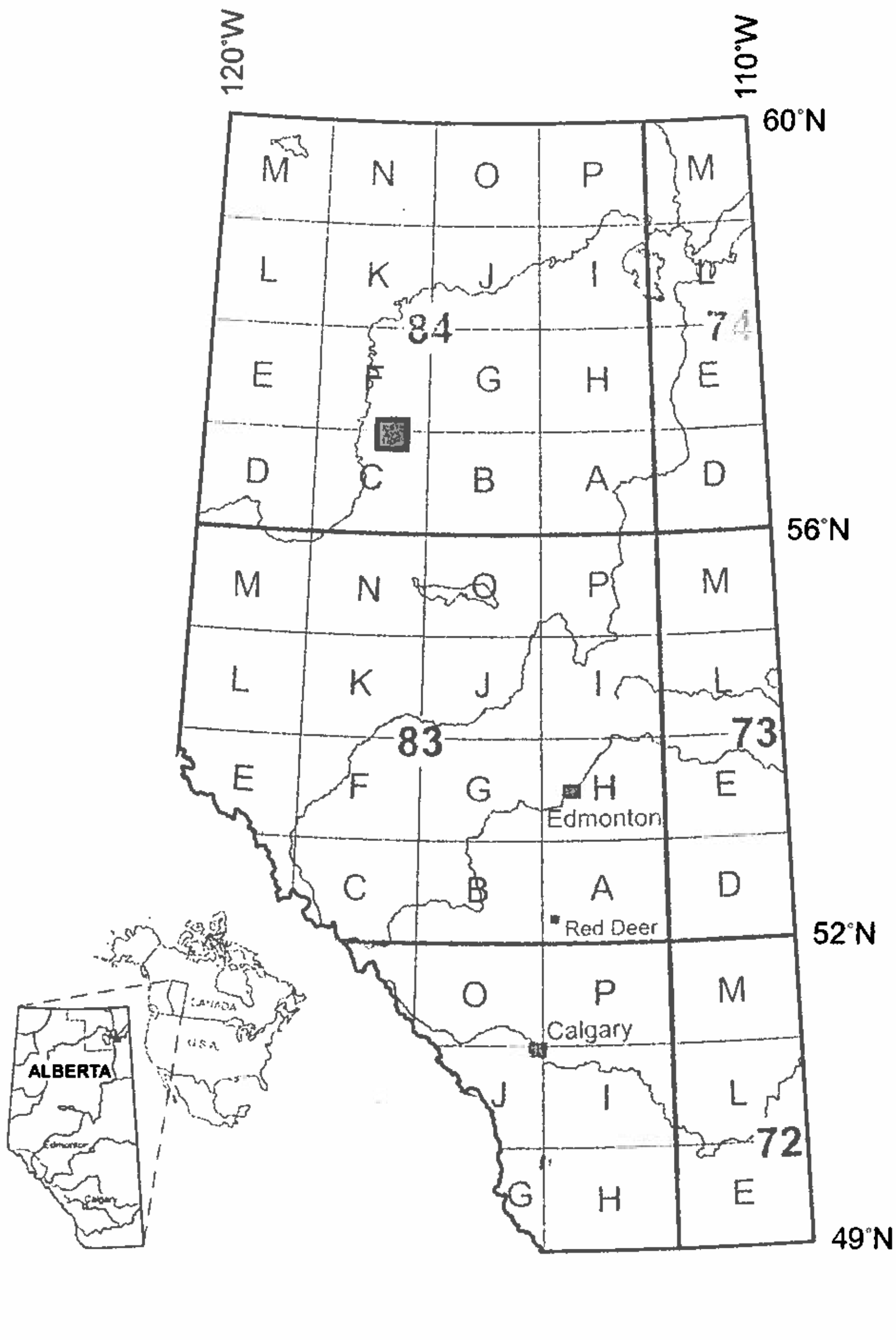
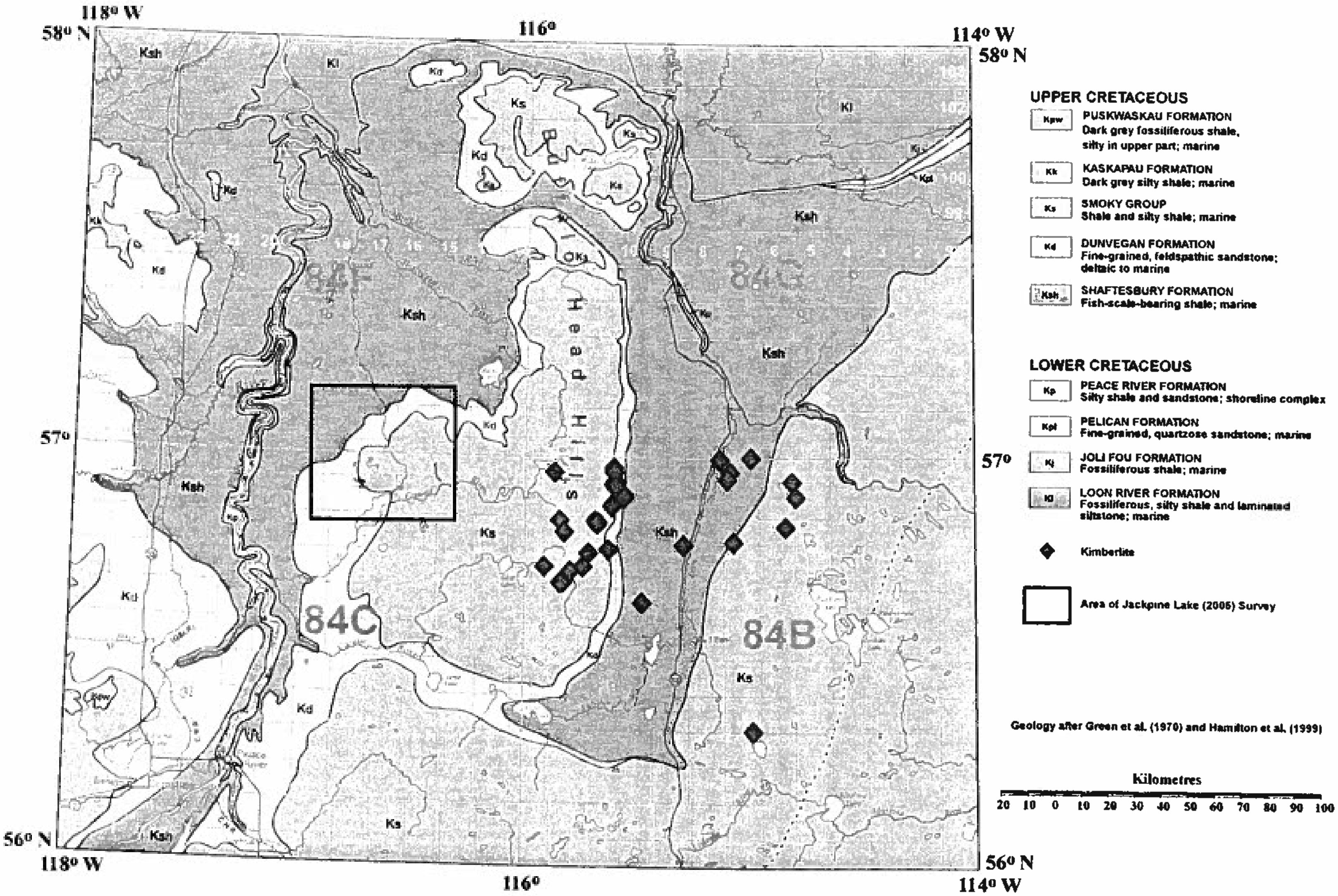


Figure 1. Alberta map showing location of the Jackpine Lake survey area (parts of NTS map areas 84C/15, 84C/16, 84F/01 and 84F/02).



118° W
58° N
116°
114° W
58° N
57°
57°
56° N
118° W
116°
56° N
114° W
Ksh
Kl
Ks
Kd
Kp
Head Hills
84F
84G
84C
84B
UPPER CRETACEOUS
PUSKWASKAU FORMATION
Dark grey fossiliferous shale, silty in upper part; marine
KASKAPAU FORMATION
Dark grey silty shale; marine
SMOKY GROUP
Shale and silty shale; marine
DUNVEGAN FORMATION
Fine-grained, feldspathic sandstone; deltaic to marine
SHAFTESBURY FORMATION
Fish-scale-bearing shale; marine
LOWER CRETACEOUS
PEACE RIVER FORMATION
Silty shale and sandstone; shoreline complex
PELICAN FORMATION
Fine-grained, quartzose sandstone; marine
JOLI FOU FORMATION
Fossiliferous shale; marine
LOON RIVER FORMATION
Fossiliferous, silty shale and laminated siltstone; marine
Kimberlite
Area of Jackpine Lake (2005) Survey
Geology after Green et al. (1970) and Hamilton et al. (1999)
Kilometres
20 10 0 10 20 30 40 50 60 70 80 90 100

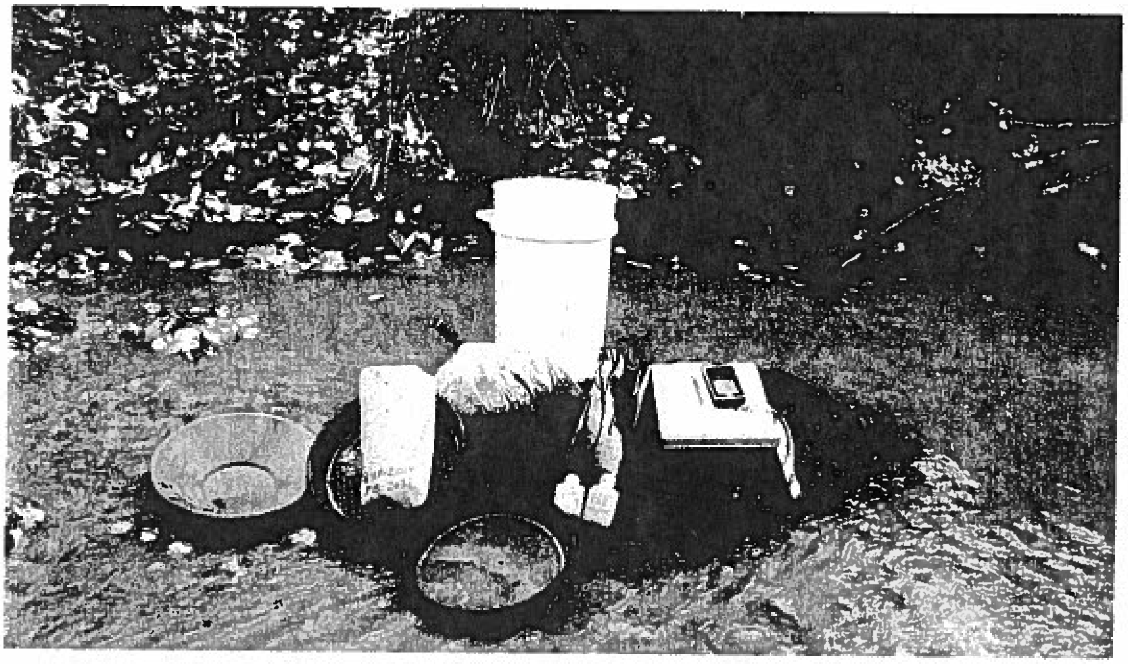


Figure 3. Pre-labelled Kraft paper bags and plastic bottles are used to collect samples of stream silts and stream waters. A bulk sample, for heavy mineral processing, is collected by wet-sieving coarse-grained stream sediment using a US Sieve Series 12-mesh (1.68 mm) sieve and collecting <12 mesh grains in a plastic pail lined with a polyethylene sample bag. The gold pan is used for adding water for wet sieving, not for heavy mineral concentrate panning. A sample composed of granules and pebbles, for archive, is collected at bulk sample sites by sieving >12 mesh material through a US Sieve Series 2-mesh (10 mm) sieve and collecting the <10 mm material in a labelled Kraft paper bag. Flagging tape with a sample site number is used to mark sample sites. Field observations are noted on pre-printed water-resistant paper.

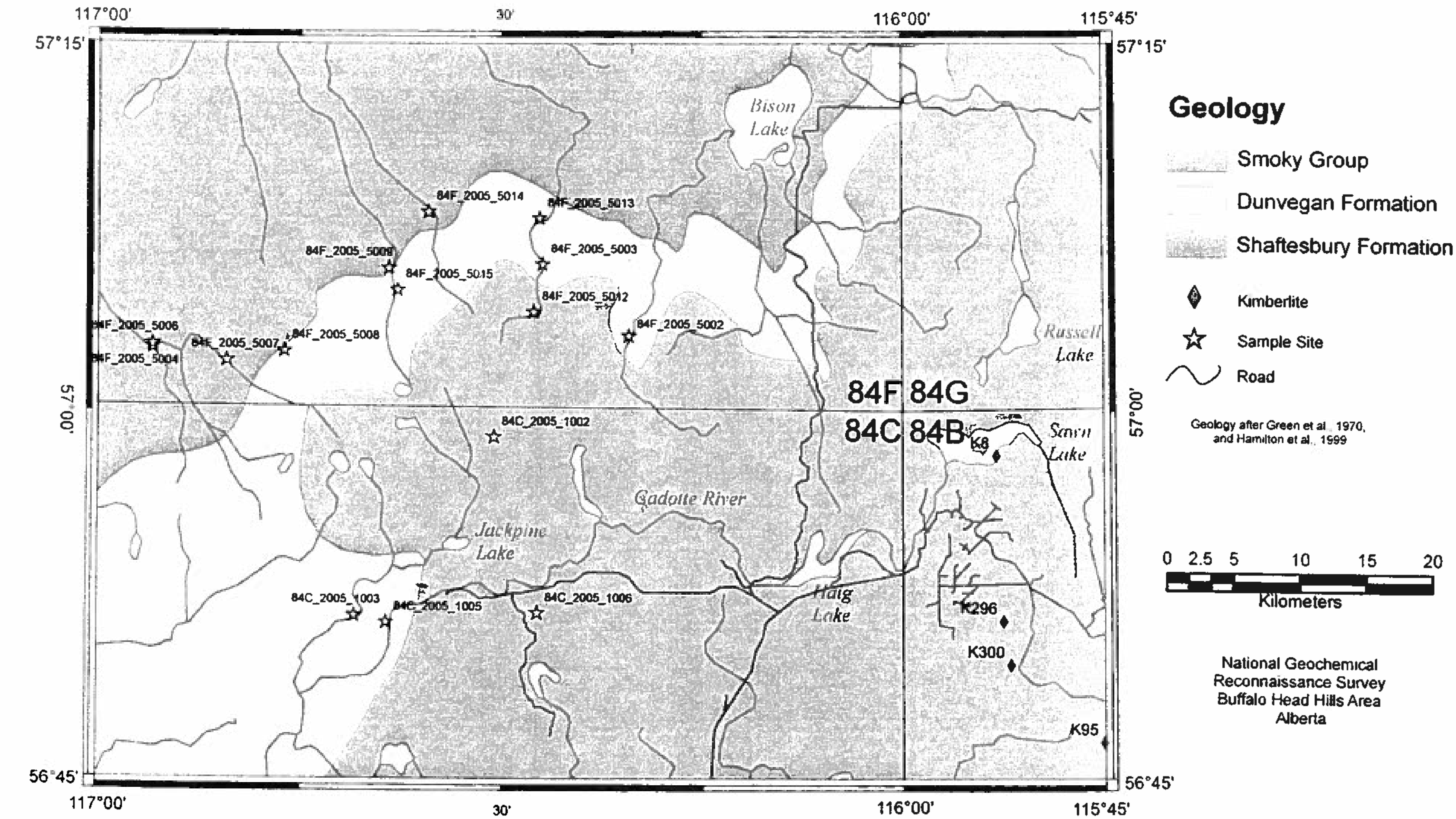
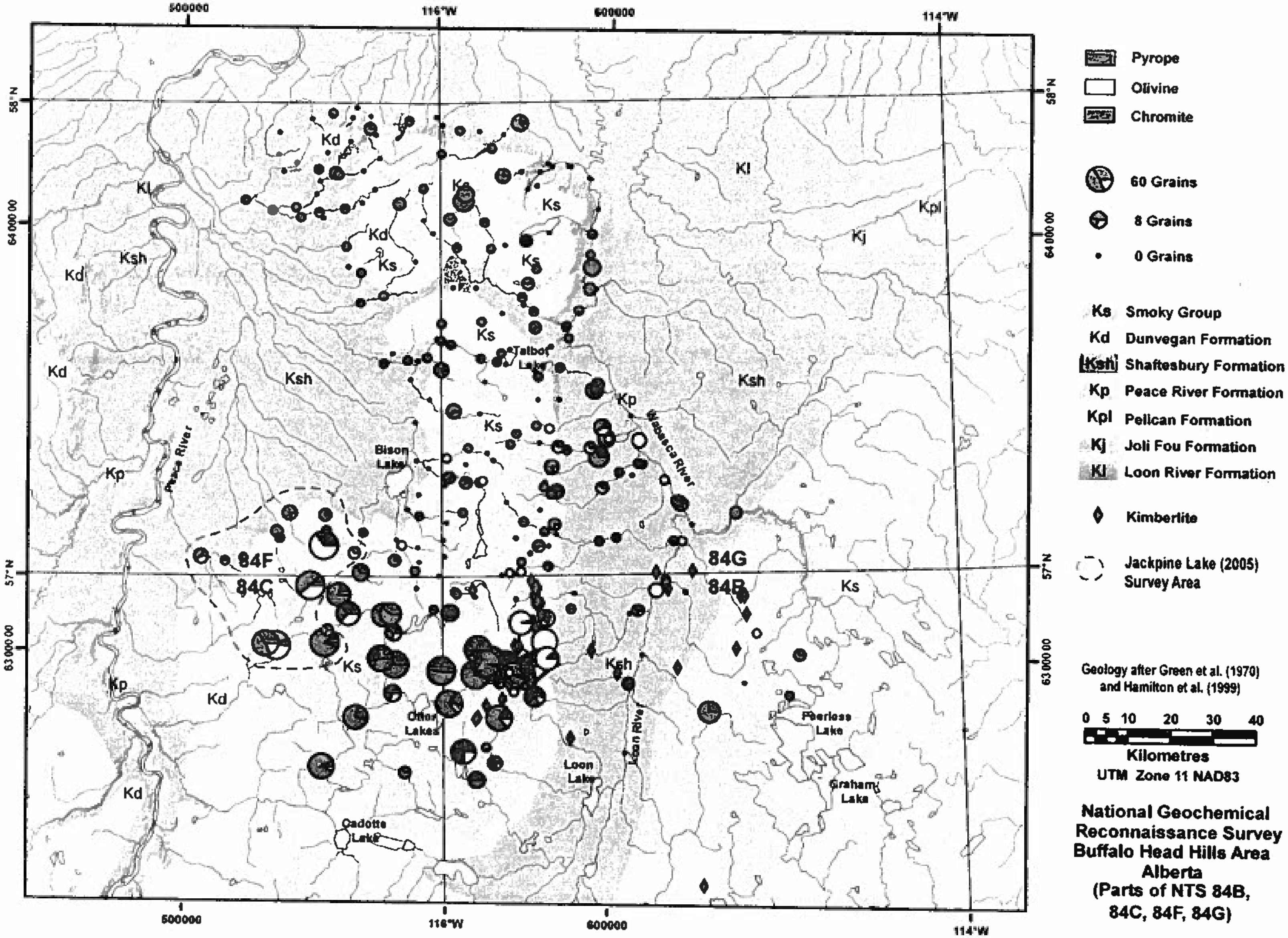


Figure 4. Map of the Jackpine Lake area showing sample sites.



Pyrope
Olivine
Chromite
60 Grains
8 Grains
0 Grains
Ks Smoky Group
Kd Dunvegan Formation
Ksh Shaftesbury Formation
Kp Peace River Formation
Kpl Pelican Formation
Kj Joli Fou Formation
Kl Loon River Formation
Kimberlite
Jackpine Lake (2005) Survey Area
Geology after Green et al. (1970) and Hamilton et al. (1999)
0 5 10 20 30 40
Kilometres
UTM Zone 11 NAD83
National Geochemical Reconnaissance Survey Buffalo Head Hills Area Alberta (Parts of NTS 84B, 84C, 84F, 84G)
500000
116°W
600000
114°W
58°N
57°N
64 000 00
63 000 00
84F
84C
84G
84B
Peace River
Wabasca River
Loon River
Bison Lake
Talbot Lake
Otter Lakes
Loon Lake
Cadotte Lake
Peerless Lake
Graham Lake

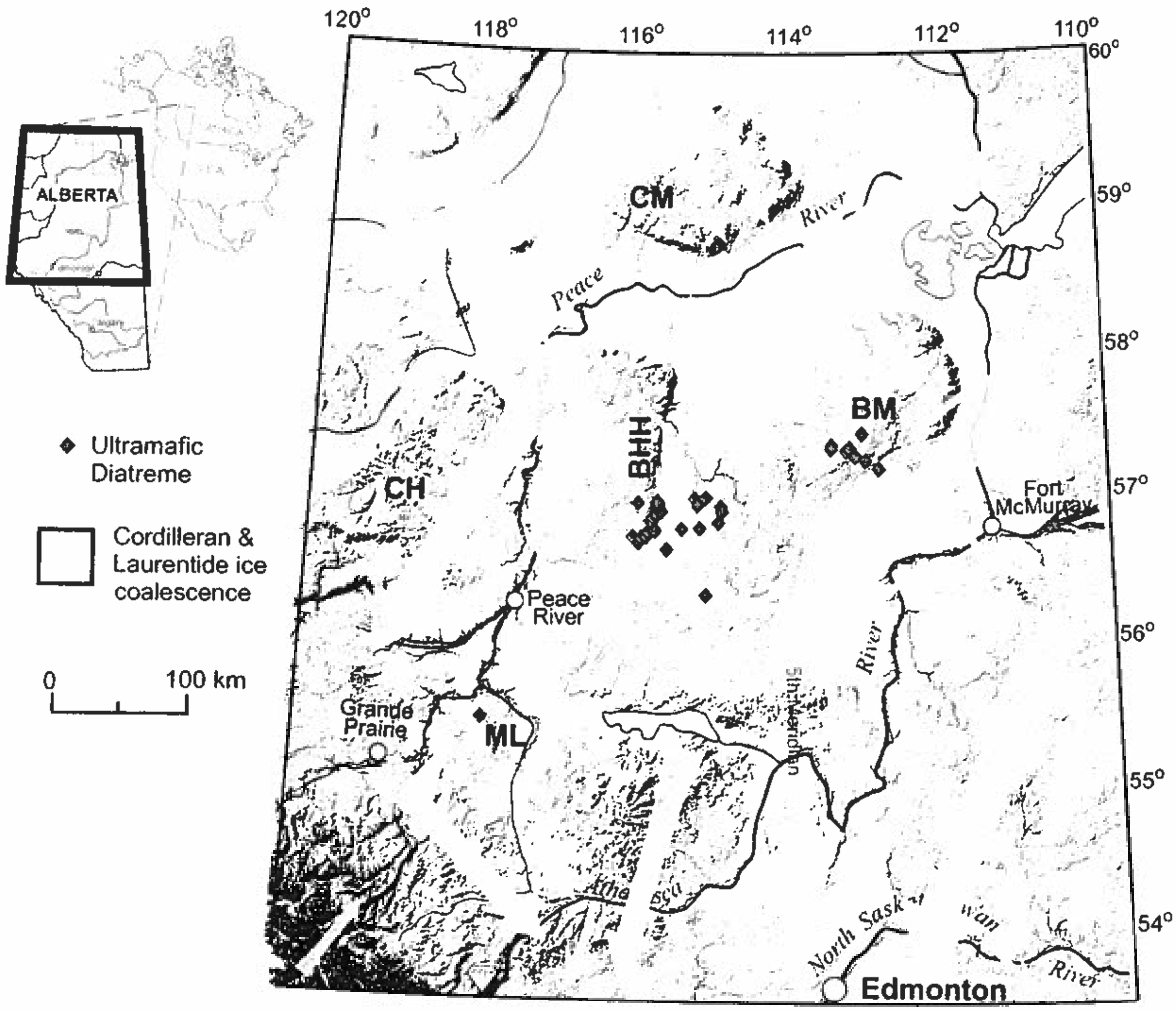


Figure 6. Flow of the Laurentide Ice Sheet during the Late Wisconsin. The large arrows indicate ice flow at glacial maximum (derived from Prest et al., 1968 and Fulton, 1989). The smaller arrows indicate general flow directions of latest Late Wisconsin ice (Mathews, 1980; Klassen 1989; Campbell et al., 2001; Fenton pers. comm., 2002; Paulen, 2002). CH = Clear Hills, CM = Caribou Mountains, BHH = Buffalo Head Hills, BM = Birch Mountains, ML = Mountain Lake.