APPENDIX DR1. DETAILS OF BEDLOAD SAMPLING METHODS

Methods

Bedload data were collected using two Helley-Smith hand-sampling devices, one with a narrow orifice (7.8 cm wide), and one with a larger area orifice (15.2 cm wide). The narrow orifice sampler was better suited to higher flow discharges, because it had more mass and tended not slide on the bed due to high-velocity drag. This effect reduced unnatural sediment mobilization under and near the sampler intake. The larger area orifice was more appropriate for use during low-flow times when velocity did not produce much drag on the device. The larger orifice also increased the sampling sensitivity by exposing more intake area to the oncoming flow. The difference in vertical aperture size in rejecting sediment was considered negligible, as no deflection of bedload material by the orifice was physically detected during sampling (e.g. impact vibrations).

In order to obtain the most accurate bedload sample possible, it was necessary first to explore the bed of the channel draining the vent to find the most topographically flat part available. The meltwater discharged from the vent was opaque with silt, and it was impossible to visually determine if there are any barriers to bedload movement blocking the orifice (i.e. large clasts not in traction). It was also imperative to ensure that the sampling device was not perched on any large clasts preventing the sampler from lying flat on the channel bottom, effectively missing the tracting flux. The device was carefully positioned onto the channel floor, minimizing disturbance to the sediment when sampler impact occurred. We consciously avoided any tilt of the sampler forward of the angle normal to the bottom of the channel, also know as “scooping”. Scooping can easily occur, and will significantly increase the amount of sediment collected as scouring turbulence becomes concentrated at the very front of the sampling orifice.

Each vent was sampled at the same location throughout the melt season to provide consistency. At both NV and LR, this location was at the transition point between the vent’s outlet and the start of the alluvial reaches (Fig. DR1). At both of these vents it was possible to sample the bedload coming from them with no contamination by inwash from the ice, moraine, or stream banks. Bedload captured came from, and only from, the subglacial meltwater discharging from the vents. Furthermore, both locations were at the middle of the sediment pathway, so theoretically we were sampling the maximum flux, because tractive and shear stress decrease towards the banks.

Samples of bedload were generally taken for three to five minutes of time, with less time allocated for high sediment transport and more time for low sediment transport. The samples were then dried and weighed in the field laboratory. The mass of the sediment was then divided by the product of the sample duration times the width of the sampler orifice. The latter computation normalizes the two different sampling orifices in terms of a unit width. The resulting value yields a transfer of sediment expressed as flux per unit [channel] width (g $m^{-1}s^{-1}$).

The dry bedload samples were then sieved through an automated Ro-Tap sieve device for ten minutes to determine the distribution of grain sizes in the sample. The results of the sieving are reported as percent by mass of the total sample mass. Clasts larger than –2.25 phi were not sorted by size and can represent a range of particle sizes, dominated by pebbles. Cobbles are only rarely present.

Suspended sediment load was obtained daily with an automated sampler at 2-hour intervals, in 500 mL increments. Samples were filtered, dried, weighed and reported as concentrations (g L^{-1}). These data were then converted to an average concentration value, and multiplied by the average discharge (m^3s^{-1}) during the sediment sampling interval, in order to derive a mass per time value suitable for comparison with the bedload data. Discharge data were obtained from a digital nitrogen-bubbler flow recorder for the period coincident with both bedload and suspended load sampling. The discharge data are reported in 10-minute intervals.

Figure DR1. Photos of North vent. Bottom photo shows the upstream view, during early-season flow conditions when vent-fringing clasts are subaerially exposed. Top photo shows the downstream view, during mid-season flow conditions when the stage is higher, submerging the clasts.

Figure DR2. Grain-size distributions for five samples from (A) North vent and (B) Little River vent through melt season, expressed as percent by mass not exceeding phi. Values shown at top of each sample column are discharge recorded at time of measurement. Both vents show a decrease in pebble and larger size clasts as discharge increases, indicative of an undercompetent, supply-limited subglacial drainage.

Table DR1. Details of bedload grain size, flux, and total sample mass for Little River vent and North vent through the 2000 melt season.

Data Repository Item
Figure DR1

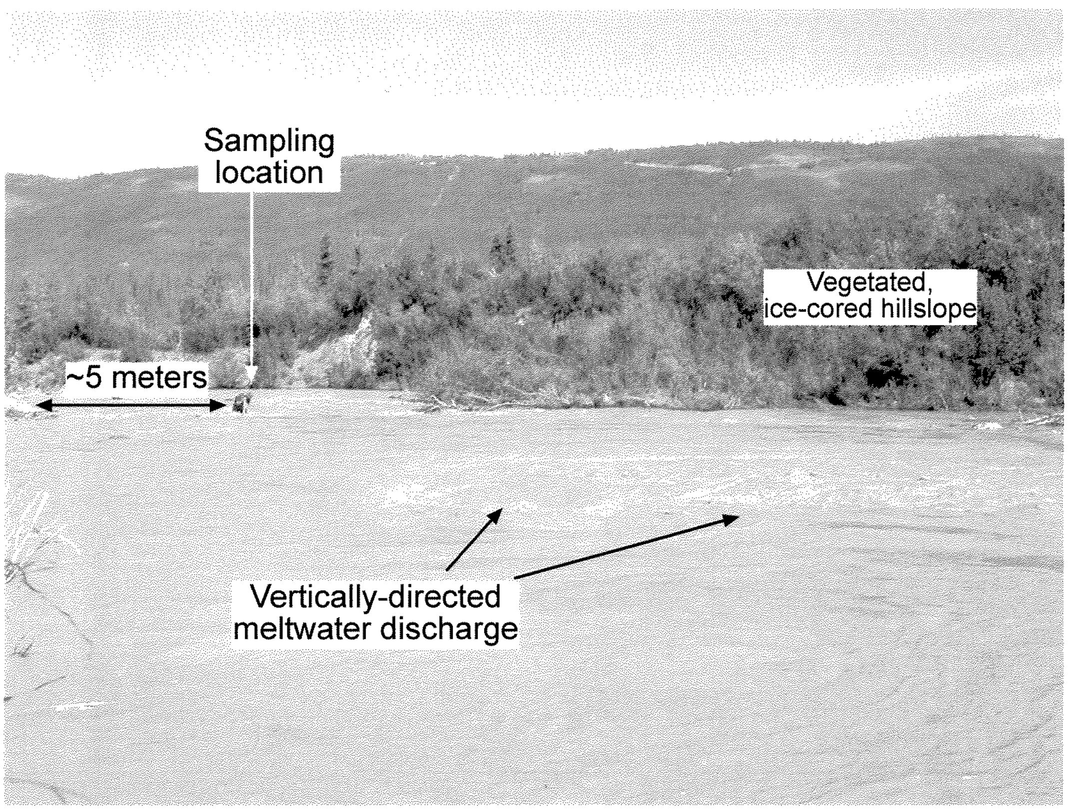
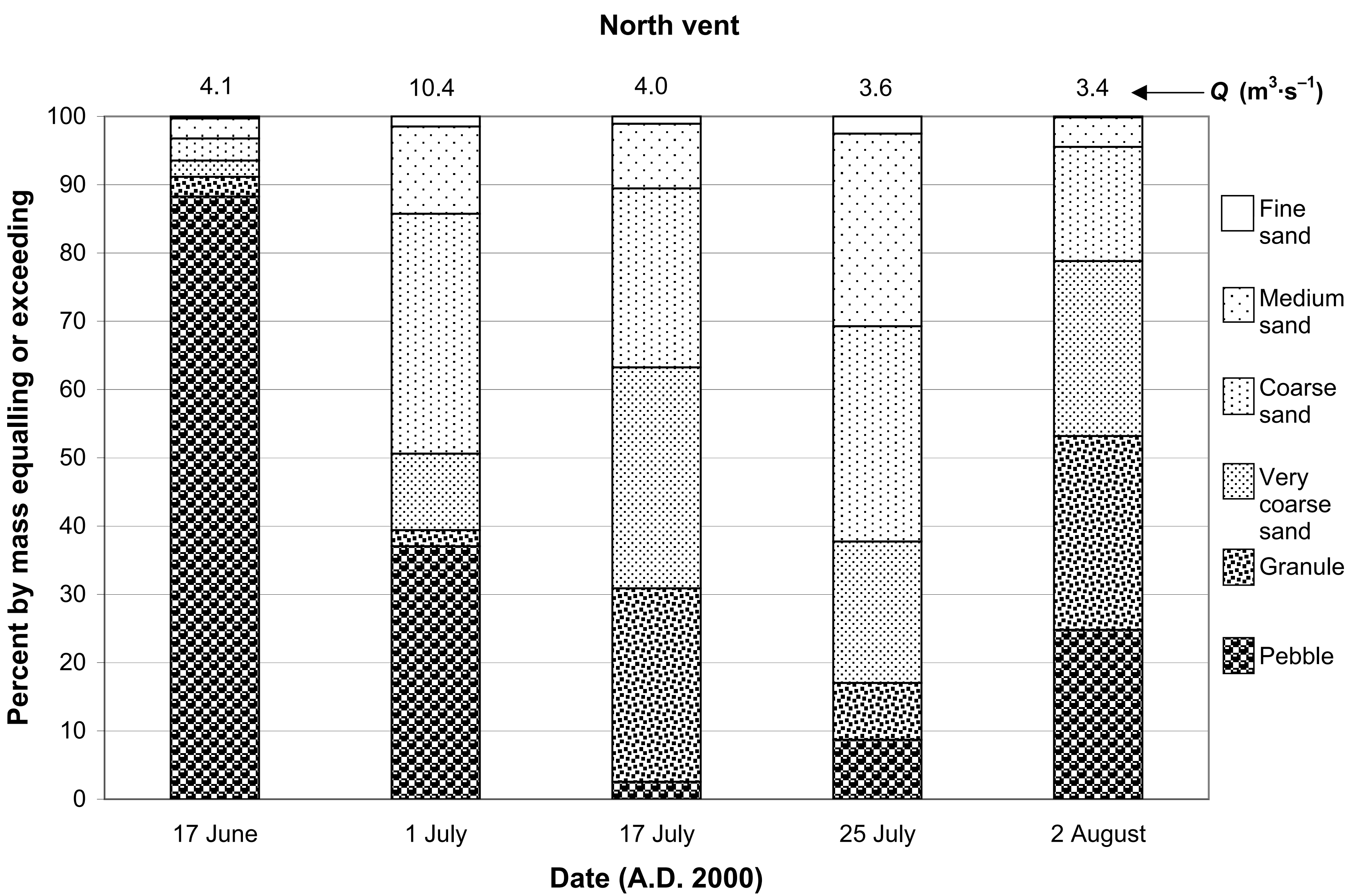


Figure DR2



Pearce et al.
2002 Geology submittal
Figure 3-NV

Table DR1. Summary of bedload grain size, flux, and total sample mass for North vent and Little River vent through the 2000 melt season

Sample number	Sample date	Sample time	Sample duration (min.)	Sample location	-2.25 Phi (% by mass)	-1 Phi (% by mass)	0 Phi (% by mass)	1 Phi (% by mass)	2 Phi (% by mass)	3 Phi (% by mass)	Total sample mass (grams)	Bedload Flux ($g \cdot m^{-1} \cdot s^{-1}$)	Percent by mass gravel	Percent by mass sand
3	28-May-00	2:00 PM	3	Little River Vent	0.00%	50.56%	28.33%	15.00%	6.11%	0.00%	0.180	0.01	50.56%	49.44%
6	30-May-00	5:30 PM	3	Little River Vent	0.00%	22.51%	25.65%	37.28%	14.14%	0.42%	0.955	0.07	22.51%	77.49%
7	31-May-00	12:30 PM	6	Little River Vent	0.00%	63.29%	20.55%	12.40%	3.55%	0.21%	2.847	0.10	63.29%	36.71%
8	3-Jun-00	12:30 PM	3	Little River Vent	0.00%	86.38%	10.50%	2.25%	0.87%	0.00%	0.800	0.06	86.38%	13.62%
11	6-Jun-00	2:00 PM	2	Little River Vent	2.56%	26.84%	35.01%	23.54%	11.69%	0.36%	34.677	1.90	29.40%	70.60%
13	10-Jun-00	11:30 AM	3	Little River Vent	15.62%	54.30%	23.47%	5.57%	1.03%	0.00%	1.453	0.11	69.92%	30.08%
16	13-Jun-00	11:30 AM	6	North Vent	94.99%*	0.66%	0.71%	1.73%	1.82%	0.09%	111.388	4.07	95.65%	4.35%
17	14-Jun-00	3:30 PM	3	Little River Vent	0.00%	60.68%	27.35%	8.55%	3.42%	0.00%	0.351	0.03	60.68%	39.32%
19	16-Jun-00	12:00 PM	5	Little River Vent	61.84%	24.02%	8.32%	4.22%	1.52%	0.08%	221.754	4.86	85.86%	14.14%
21	16-Jun-00	2:45 PM	5	Little River Vent	68.11%	16.50%	8.23%	4.75%	2.31%	0.09%	228.563	5.01	84.61%	15.39%
23	17-Jun-00	11:15 AM	5	North Vent	88.27%**	2.87%	2.40%	3.22%	2.94%	0.30%	670.349	14.70	91.13%	8.87%
25	19-Jun-00	11:00 AM	5	North Vent	30.03%	11.73%	15.35%	22.71%	19.03%	1.16%	46.476	1.02	41.75%	58.25%
26	19-Jun-00	12:35 PM	5	North Vent	30.93%	15.22%	14.70%	19.14%	18.32%	1.70%	86.896	1.91	46.15%	53.85%
27	21-Jun-00	11:45 AM	5	North Vent	62.13%	13.71%	10.00%	8.49%	5.33%	0.35%	343.580	7.53	75.84%	24.16%
33	23-Jun-00	11:00 AM	5	North Vent	43.55%***	6.93%	5.23%	7.72%	29.17%	7.40%	218.157	4.78	50.49%	49.51%
35	24-Jun-00	10:45 AM	5	Little River Vent	31.37%	19.22%	12.56%	14.14%	19.28%	3.43%	177.703	7.79	50.58%	49.42%
37	26-Jun-00	12:30 PM	5	North Vent	41.53%	19.62%	13.41%	12.02%	11.41%	2.01%	180.548	3.96	61.14%	38.86%
39	27-Jun-00	5:30 PM	4	North Vent	6.99%	6.37%	5.73%	10.11%	37.71%	33.09%	98.499	2.70	13.36%	86.64%
40	28-Jun-00	5:20 PM	6	North Vent	0.09%	1.28%	4.11%	15.78%	57.66%	21.08%	260.923	9.54	1.37%	98.63%
41	29-Jun-00	10:00 AM	3	Little River Vent	16.03%	27.34%	16.29%	18.40%	20.73%	1.20%	36.377	1.33	43.38%	56.62%
42	29-Jun-00	11:30 AM	3	North Vent	1.56%	2.44%	3.83%	10.84%	63.70%	17.62%	166.437	12.17	4.00%	96.00%
45	1-Jul-00	11:00 AM	5	North Vent	37.05%****	2.35%	11.20%	35.14%	12.78%	1.48%	1,167.921	51.22	39.40%	60.60%
50	5-Jul-00	10:50 AM	8	North Vent	39.57%	13.50%	12.80%	19.89%	13.38%	0.86%	138.212	3.79	53.07%	46.93%
52	7-Jul-00	11:30 AM	5	North Vent	4.31%	24.59%	24.05%	28.10%	17.42%	1.53%	19.627	0.86	28.90%	71.10%
55	9-Jul-00	11:00 AM	3	North Vent	27.01%	22.68%	28.45%	15.62%	5.34%	0.90%	16.339	1.19	49.69%	50.31%
57	15-Jul-00	12:00 PM	5	North Vent	6.04%	22.74%	29.02%	26.07%	14.90%	1.24%	27.489	1.21	28.78%	71.22%
60	17-Jul-00	11:30 AM	5	North Vent	2.55%	28.33%	32.35%	26.22%	9.48%	1.07%	13.318	0.58	30.88%	69.12%
61	19-Jul-00	1:40 PM	5	Little River Vent	64.34%	14.82%	7.34%	7.44%	5.48%	0.58%	13.037	0.57	79.16%	20.84%
63	21-Jul-00	11:50 AM	5	North Vent	43.34%	24.23%	15.03%	11.85%	5.12%	0.43%	28.980	1.27	67.57%	32.43%
64	23-Jul-00	2:20 PM	5	Little River Vent	15.63%	41.12%	17.13%	13.09%	11.31%	1.72%	3.147	0.14	56.75%	43.25%
66	25-Jul-00	10:40 AM	5	North Vent	8.69%	8.33%	20.72%	31.53%	28.20%	2.53%	5.015	0.22	17.03%	82.97%
81	27-Jul-00	10:00 AM	5	North Vent	45.06%	24.64%	15.93%	10.54%	3.65%	0.17%	109.445	4.80	69.70%	30.30%
82	29-Jul-00	4:20 PM	5	Little River Vent	37.53%	37.58%	15.62%	5.72%	3.27%	0.28%	6.506	0.29	75.12%	24.88%
84	2-Aug-00	1:00 PM	5	North Vent	24.80%	28.39%	25.62%	16.71%	4.34%	0.14%	121.538	5.33	53.19%	46.81%

* = One clast with mass of 104.87 grams

** = One clast with mass of 491.04 grams

*** = One clast with mass of 82.59 grams

**** = One clast with mass of 243.33 grams, one clast with 173.53 grams