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ELEMENT CONCENTRATIONS AND BASELINES FOR MOSS, LICHEN, SPRUCE, AND SURFACE SOILS, IN AND NEAR WRANGELL-SAINT ELIAS NATIONAL PARK AND PRESERVE, ALASKA

by

J.G. Crock*, K.A. Beck**, D.L. Fey*, P.L. Hageman*,

C.S. Papp*, and T.R. Peacock*

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*U.S. Geological Survey, DFC, Box 25046, MS 973, Denver, CO 80225
**Wrangell-Saint Elias National Park and Preserve, P.O. Box 29, Glennallen, AK 99588

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SUMMARY

The main purpose of the studies in and near the Wrangell-Saint Elias National Park and Preserve (WSEP), Alaska, was to establish predevelopment baseline elemental information on selected native vegetation and the organic-rich O2 soil horizon before a proposed coal-fired power plant was to be built near the northwest boundary of WSEP. This objective was accomplished by establishing three traverses, one generally north-to-south into WSEP, one generally south-to-north along the Copper River near the western boundary of WSEP, and one generally west-to-east, also into WSEP. Traverse sampling sites were positioned at intervals beginning near the proposed power plant site northeast of Gakona, Alaska on Alaska Highway One. At each site, samples were collected of Hylocomium splendens (Hedw.) BSG (feather moss, whole plant, including rhizoids), Peltigera aphthosa (L.) Willd. (ground lichen, whole plant), Picea glauca (Moench) Voss. (white spruce, twigs and needles), and the O2 horizon soil. All materials were analyzed for their major and trace total element concentrations. Observed baseline ranges are reported for each of these media and are in good agreement with those reported in the literature. Sample sites are also described to assist in returning to the exact location if resampling is required in the future to monitor impact of the proposed power plant on the biological resources of WSEP.

This report is to serve as a compilation of the analytical data collected by the U.S. Geological Survey (USGS) and to present listings of observed elemental baseline ranges for the sampled media and is not meant to be an interpretive summary of the WSEP studies. This report is the result of a cooperative study between the U.S. National Park Service (NPS) and the USGS. The NPS and the USGS have an existing Interagency Agreement to conduct research related to air quality impacts on biological resources.

INTRODUCTION

BACKGROUND

The studies described in this report provide predevelopment baseline information to help evaluate the potential impact of the proposed 10 MW coal-fired power plant on the biological resources of the Wrangell-Saint Elias National Park and Preserve (WSEP). The power generated by this proposed power plant is for a proposed U.S. Air Force Over-The-Horizon Backscatter Alaskan Radar System for south-central Alaska. The transmitting site was to be located near Gulkana, Alaska, and the receiver site was to be located in Tok, Alaska. Construction of the power plant is complete, but will not be put on-line.

Native vegetation, including feather moss, Sphagnum moss, and various soil lichens, and organic-rich soils have been used with success to assess the areal extent of industrial emissions [for example, Folkeson (1981), Godbeer and others (1981), Gough and Erdman (1977), LeBlanc and de Sloover (1970), Markert and Weckert (1989), Onianwa (1988), Pilegaard (1987), Severson and others (1992), and Thomas and others (1984)]. Details of these examples have been discussed elsewhere (Crock and others, 1992).

GEOLOGY AND PHYSIOGRAPHY

The WSEP study area is located in southcentral Alaska in the Copper River basin, an intermountain lowland flanked on all sides by mountainous uplands (fig. 1). The lowlands tend to be generally flat with numerous small thaw-lakes which are the result of permafrost and associated subsidence. The northwest WSEP boundary is located approximately 2.5 km south of the proposed transmitting site and less than 2 km from the proposed power plant site. The area has been affected by an extensive glacial and volcanic geologic history. Most of the WSEP study area is underlain by Pleistocene glacial deposits resulting from the damming of the Copper River that formed the former Lake Atna. The skyline to the south and east of Gulkana is dominated by the Wrangell volcanic field, including Mount Sanford (4,950 m), Mount Drum (3,662 m), and Mount Blackburn (4,997 m). There has been no major volcanic activity in this area in recent history, but Mount Wrangell is listed as active. The geology of the WSEP study area is summarized by Richter and others (1979, 1989). Details of the extensive volcanic history of the WSEP area are given by Richter and others (1990).

The WSEP study area is located within a continental climate zone which is characterized by cold, dry winters and comparatively warm, humid summers. Prevailing winds in the area are relatively gentle, with the highest frequency of occurrence during the summer from a southerly direction. During the winter, winds are also gentle and prevail from the north. During the spring and fall, the winds are gentle and usually prevail from the southeast. Temperature inversions with calm conditions are common in the winter.

SOILS

Soils in the study area range from very shallow residual materials to very deep glacial and eolian deposits. Gough and others (1988) discuss Alaskan surficial material types, weathering characteristics, and soil geochemistry. In this study, we were only interested in the organic-rich O2 horizon: the soil layer between the surface vegetation mat above and the A0 mineralized layer below.

METHODS

STUDY DESIGN

These studies focus on the use of moss, lichen, and spruce as biomonitors of the emissions from the proposed power plant. Hylocomium splendens (feather moss), Peltigera aphthosa (ground lichen), and Picea glauca (white spruce), species found throughout WSEP, have been used as bioindicators of metal accumulation in previous studies (Crock and others, 1992). By determining the metal concentrations in these species, it is possible to map the spatial distribution of the zone of influence of airborne sulfur or metals from a point source. These measurements give necessary data for the generation of the predevelopment baseline ranges, a snapshot in time, of these sensitive bioindicators. The organic-rich surface soil (O2 horizon) was also collected and analyzed as an integrator of possible areal deposition of sulfur and metals.

BASELINE CALCULATION

Baseline information for the vegetation species and the O2 soils was calculated as the observed range, dry-weight basis, for all samples collected, since it is believed that the area has not been impacted by anthropogenic sources.

FIELD SAMPLING AND SAMPLE PREPARATION

Site Selection

The field sampling was conducted with one field crew composed of NPS personnel in early September 1990.

The study area is shown in fig. 1 and the actual position of the sampling traverses in fig. 2, with detailed information for each of three traverse sampling sites given in fig. 3-5. Sampling sites for this study were selected to be as similar to one another as possible with regard to soil, vegetation, geology, slope, and aspect. Plant and soil samples were collected within 3 m of each other.

The general design consisted of three traverses that were delineated on topographic maps of the WSEP area before visiting the actual site. These traverses were: (1) the North Traverse, which originated at the proposed power plant site and progressed northward near the Copper River; (2) the East Traverse, which originated near the power plant site and progressed southeast into WSEP towards Mount Drum; and, (3) the Southern Traverse, which also originated near the power plant site and progressed into WSEP, along the west flank of Mount Drum. The closer sample spacing near the power plant site broke the pattern of standard geometric sampling to provide a greater spatial resolution near this site (fig. 2).

Sites consisted of conifer stands dominated by white spruce with a canopy cover of between 30-60 percent (moderately dense). Sites were further stratified according to the vegetation classification system of Viereck and others (1986) as determined by field crews. Sites were characterized by a moderate understory of mixed shrubs and a dense ground cover of mosses (Hylocomium/Pleurozium/Polytrichum) with scattered clumps of miscellaneous lichens (Cladina and Peltigera). Often this type of ground cover (moss/lichen) was best found under spruce tree canopies.

All sites were marked (numbered site locator tree), mapped, and geographical coordinates recorded. Sites were identified on 15-minute topographical maps (1:63,000). Photographs were taken of each site. This information is given in fig. 3-5.

Sampling Locations At Each Site

At each sampling site along each of the traverses, permanent elemental monitoring plots were established by marking one dominant white spruce (numbered site locator tree) with a steel tag, flagging, and an aluminum tag. This site locator tree was usually a predominant feature of the site and will help facilitate resampling in the future. It became the focal point for each of the three sampling locations within that site, with each of the three sampling locations per site having its own dominant white spruce tree. The three locations were within 200 m of each other (with a minimum of 50 m between locations); distance and direction between trees were randomly selected within reasonable constraints of movement within the spruce stands. Each of the three spruce trees were also tagged and mapped and serve as focal points for each location. Diameter-at-breast-height, bole characteristics (beetles, lightning scars, overall health, etc.) and canopy condition (percent live crown; foliage discoloration) were recorded for each locator tree.

Any additional location characteristics such as slope, elevation, aspect, and canopy closure thought to influence the structure of the lichen or vascular plant communities were recorded for all sites. The presence of vascular species was evaluated to aid in the Viereck vegetation classification of each plot.

Plant Collection

At each sampling location within a site, sufficient material to yield approximately 200 g dry weight of feather moss and lichen were collected. Distance and azimuth were recorded from the first plot indicator tree to the second and third plot indicator trees. Samples were taken within a 10 m radius of the location tree: Distance and azimuth were not recorded for every sample since it was necessary to collect over an entire area to acquire sufficient sample mass. The moss samples consisted of usually thick, uniform mats and included the stratified old material as well as young material. Lichen samples were collected also from the forest floor where it was usually found in small clumps intermingled with various mosses, low-lying shrubs, such as blueberries, or other lichens. Samples of the feather moss and lichen were composites of several clumps or mats within 10 m of the dominant white spruce tree.

Other lichens were also collected at some of the sample locations when present in sufficient quantity. These were included in the study for possible later use as bioindicators of areal contamination.

Needles and twigs (terminal 15 cm) were collected from the location indicator white spruce and several adjacent trees. A composite sample of several low branches was made by clipping with stainless steel sheers from around the dominant tree. All samples were labeled as to location, placed in Hubco cloth bags, and allowed to air dry at camp. All samples were cleaned of soil and debris and then sorted at the WSEP headquarters. All samples were then mailed to the USGS Denver laboratories for analyses.

O2-Horizon Soil Collection

At one of the three sampling locations per site, living vegetation was removed from the soil surface and a 50 cm-diameter circle was cut into the top 10-15 cm of soil with a tiling shovel. The organic-rich O2-horizon was then separated from the mineral soil using a knife or trowel and a subsample placed in a Hubco sample bag. This procedure was repeated at two additional points within the location. The three soil subsamples were dried and sent to the Denver USGS laboratories where a single composite sample was prepared.

LABORATORY METHODS

At the Denver laboratories, the samples of moss and lichen were washed by suspending the entire sample in plastic buckets filled with tap water. Foreign material was removed after careful visual inspection, and excess water was removed by hand squeezing. The material was then transferred to aluminum colanders and rinsed at least twice with demineralized water. The washed samples were then dried in a forced air oven at ambient room temperature. The white spruce samples were not washed, but were dried as received from the field in the same fashion as the mosses and lichens.

Once dry, the plant samples were ground to pass a 10 mesh (2 mm) screen with a standard Wiley mill. A laboratory-made split of each plant sample was ashed at 450°C over an 18-hr period, and the other split was left unashed. Analytical procedures followed established quality assurance and quality control policies used in the USGS laboratories (Arbogast, 1990) and included the analyses of laboratory-made duplicate samples.

Soil samples were dried under forced air at ambient temperature in the original paper bag. All of the dry samples were disaggregated using a mechanical ceramic mortar

and pestle and then sieved to minus 10-mesh (2 mm). Sample splits of the O2-horizon were ground to minus 100-mesh with an agate shatter box and a split of the minus 100-mesh material was ashed in a muffle furnace at 450°C over an 18-hr period and ash yield was calculated. Both the dry, as-received, and ashed material were used for analyses, depending on the method of analysis.

Splits of the ashed vegetation and soil samples were analyzed simultaneously for 38 elements using inductively coupled plasma-atomic emission spectroscopy. Each soil ash sample (0.200 g) and plant ash sample (0.100 g) was dissolved using a low-temperature digestion with concentrated hydrochloric, hydrofluoric, nitric, and perchloric acids (Crock and others, 1983). The acidic sample solution was taken to dryness and the residue was dissolved with 1 mL of aqua regia and then diluted to 10 g with demineralized water. Reagent blanks, reference materials, and sample replicates were all digested by the same procedure and analyzed at the same time as the samples. The elements determined and their limits of determination are shown in table 1. The relative standard deviation (RSD) for replicate determinations of most elements is five percent or less.

Mercury in soil and plants was determined using an automated continuous-flow, cold-vapor atomic absorption spectroscopic method (Kennedy and Crock, 1987). An unashed 0.100 g soil or 0.200 g plant sample was digested with nitric acid and sodium dichromate in an open flint glass test tube and then diluted to 12 mL with deionized water. The solution was reacted with a sulfuric acid-hydroxylamine hydrochloride solution and stannous chloride solution in a continuous-flow system. The gaseous mercury was separated in a phase separator and swept into a quartz cell of an atomic absorption spectrometer. Mercury was determined using an aqueous standard calibration curve.

Total sulfur in both soils and plants was determined using a Leco SC-132 automated analyzer. The sample and a vanadium pentoxide flux were combusted in an oxygen-rich atmosphere at 1370°C and the evolved sulfur dioxide measured by an IR (infra-red) detector (Jackson and others, 1985; 1987). Limits of determination are given in table 1 for both Hg and total sulfur.

Total fluorine in the soils was determined by an ion selective electrode (ISE) method described in Jackson and others (1987). A 0.25 g sample was fused with sodium hydroxide after being ashed with magnesium oxide, and the fusion cake dissolved in demineralized water. The resulting alkaline solution was buffered with ammonium citrate and the fluoride content determined using an ISE with an appropriate calibration curve. Limit of determination is given in table 1.

RESULTS AND CONCLUSIONS

All the analytical data on an ash-weight basis for the feather moss samples are given in Appendix table A1. The analytical results converted to a dry-weight basis for these same samples are given in table A2. For all the samples, concentrations of Ag, As, Au, Be, Bi, Cd, Eu, Ho, Nb, Sn, Ta, Th, and U in the ash were below their respective limits of determination as given in table 1.

All analytical data on an ash-weight basis for the ground lichen samples are given in Appendix table A3. The analytical results converted to a dry-weight basis for these same samples are given in table A4. For all the samples, concentrations of Ag, As, Au, Be, Bi, Cd, Eu. Ho, Nb, Sn, Ta, Th, and U in the ash were below their respective limits of determination as given in table 1.

All analytical data on an ash-weight basis for the white spruce samples are given in Appendix table A5. The analytical results converted to a dry-weight basis for these same samples are given in table A6. For all the samples, concentrations of Ag, As, Au, Be, Bi, Cd, Eu. Ho, Nb, Pb, Sc, Sn, Ta, U, and Yb in the ash were below their respective limits of determination as given in table 1. Only four samples showed detectable Mo, five showed detectable Nd, seven showed detectable Th, and eight showed detectable Y.

All analytical data on an ash-weight basis for the lichen samples other than Peltigera aphthosa are given in Appendix table A7 and were converted to dry-weight basis as given in Appendix table A8.

All analytical data on an ash-weight basis for the O2-horizon soil samples are given in Appendix table A9. All analytical results converted to a dry-weight basis for these soils are given in Appendix table A10. For all the samples concentrations of Ag, Au, Be, Bi, Cd, Eu, Ho, Nb, Sn, Ta, Th, and U in the ash were below their respective limits of determination as given in table 1. Only one soil sample showed detectable Mo.

An observed baseline for the elemental content and ash yield of feather moss is given in table 2. Also listed is the calculated baseline range for feather moss from the Kenai National Wildlife Range (KNWR), Alaska (Crock and others, 1992). By comparison, most trace elements and percent ash yield from the WSEP study are higher; they are similar, however, for total S, Hg, Pb, Y, and Zn. Also listed are results for a baseline study for the Denali National Park and Preserve (DENA), Alaska. This study was completed with similar field and laboratory methods. The DENA study area is more geographically and geomorphologically similar to the WSEP study, both being heavily influenced by a major river valley with its intermittent dust storms and lower precipitation as compared to the Kenai Peninsula.

An observed baseline for the elemental content and ash yield of Peltigera aphthosa lichen for the WSEP study area is given in table 3. Also listed is the observed baseline values for this lichen from the DENA. For most elements there is good agreement between the two studies.

An observed baseline for the elemental content and ash yield for white spruce for the WSEP study area is given in table 4. Also listed are the baseline ranges for KNWR and DENA. There is good agreement among all three studies.

An observed baseline for the elemental content and ash yield for the O2-horizon soils for the WSEP is given in table 5. Also listed are the baseline ranges for KNWR and DENA. In general there is good agreement among the three studies with several exceptions. These exceptions include Ce, Nd, and La, indicating a possible REE (rare earth elements) enriched source for the DENA soils. There is good agreement for the WSEP surface soils when compared to the reported baseline range of Alaskan surficial materials given by Gough and others (1988) in table 6.

ACKNOWLEDGEMENTS

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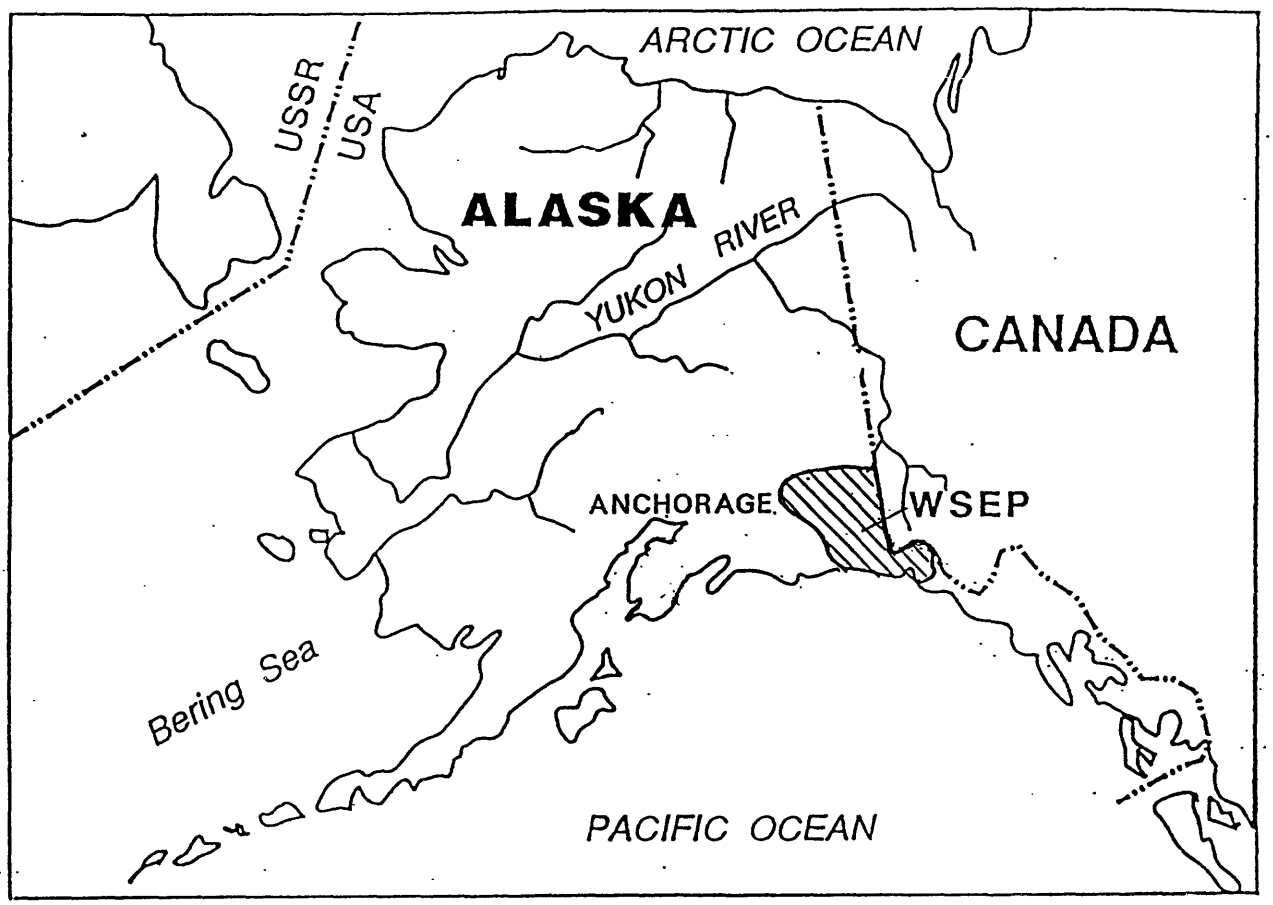


Figure 1.--Index map showing location of Wrangell-Saint Elias National Park and Preserve, Alaska (WSEP).

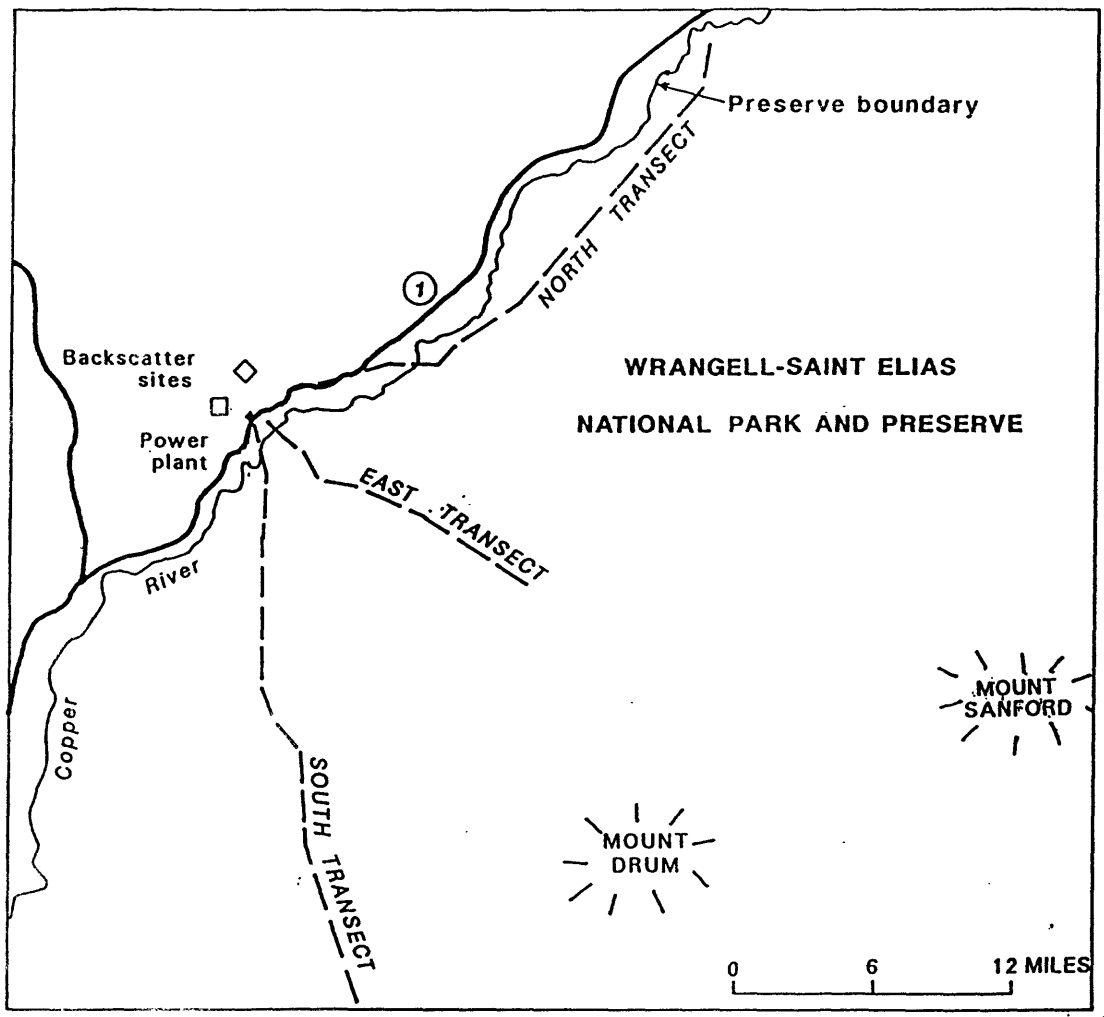
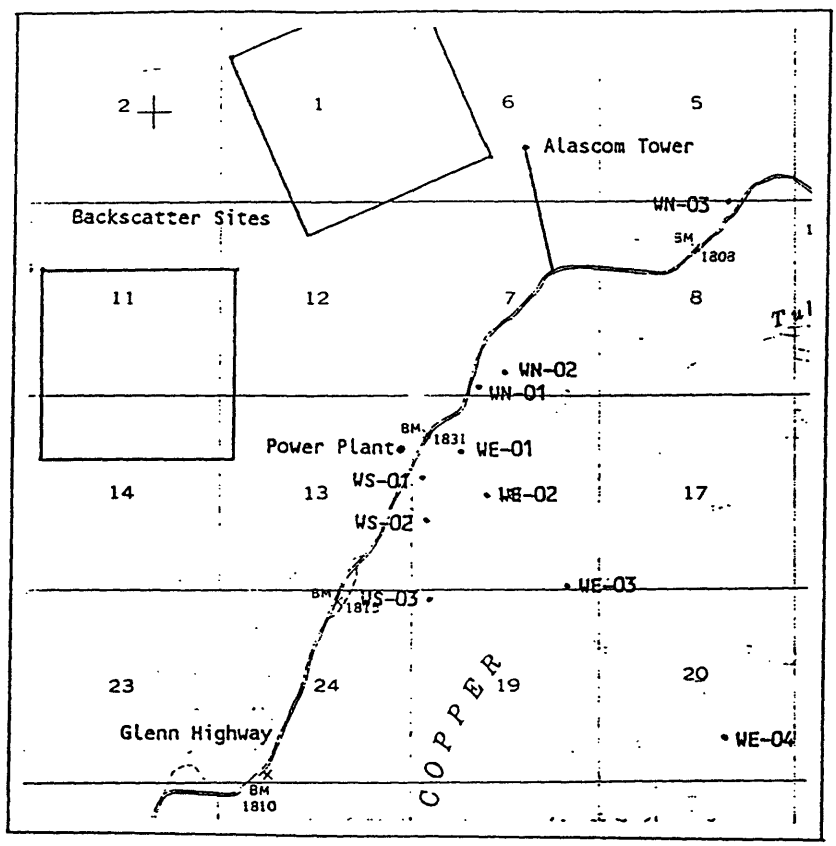
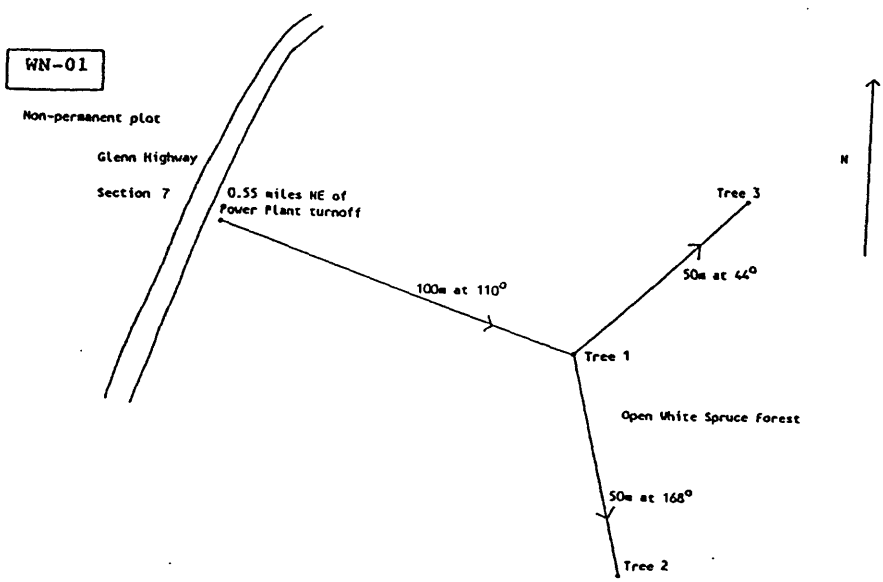


Figure 2.--Location of transects for the Wrangell-Saint Elias National Park and Preserve study area, Alaska.

Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska.





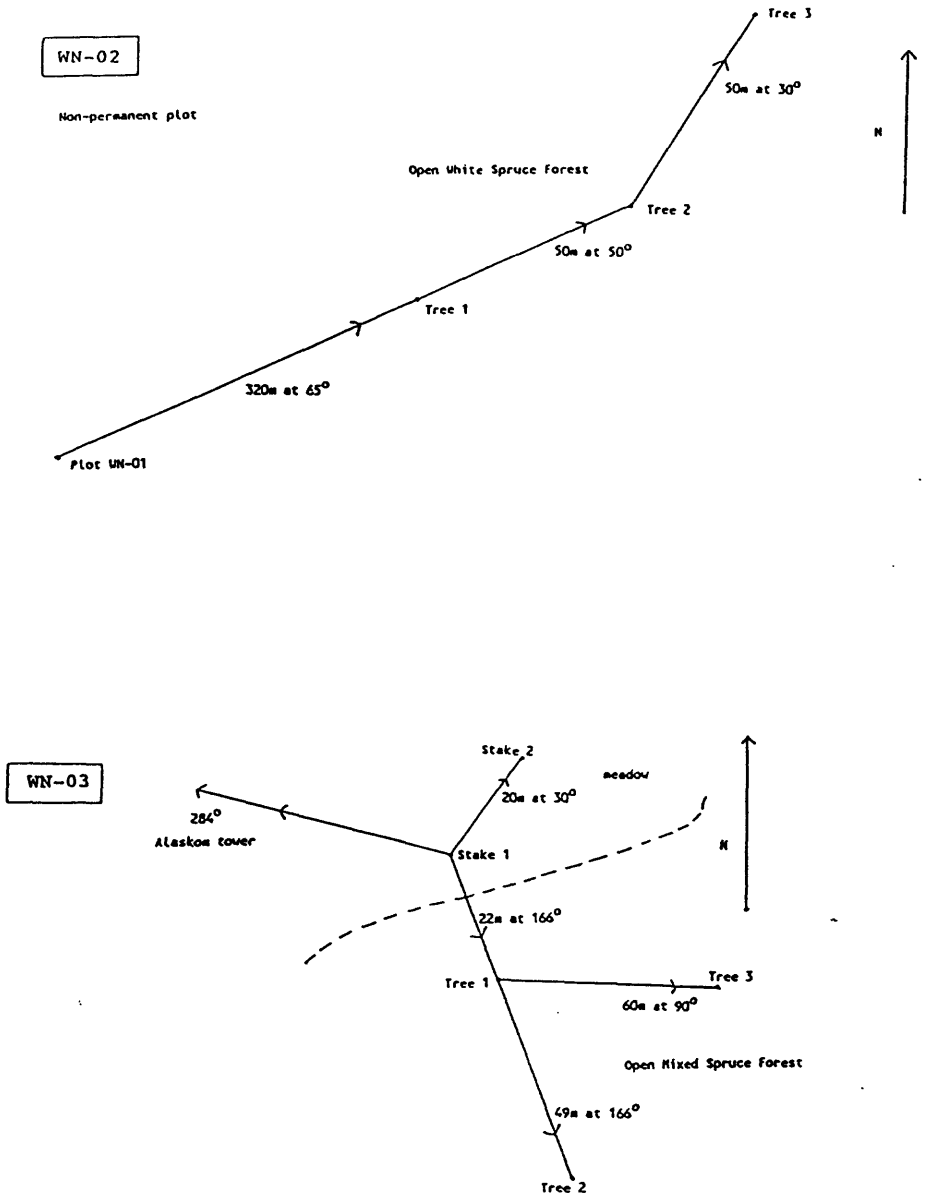


Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

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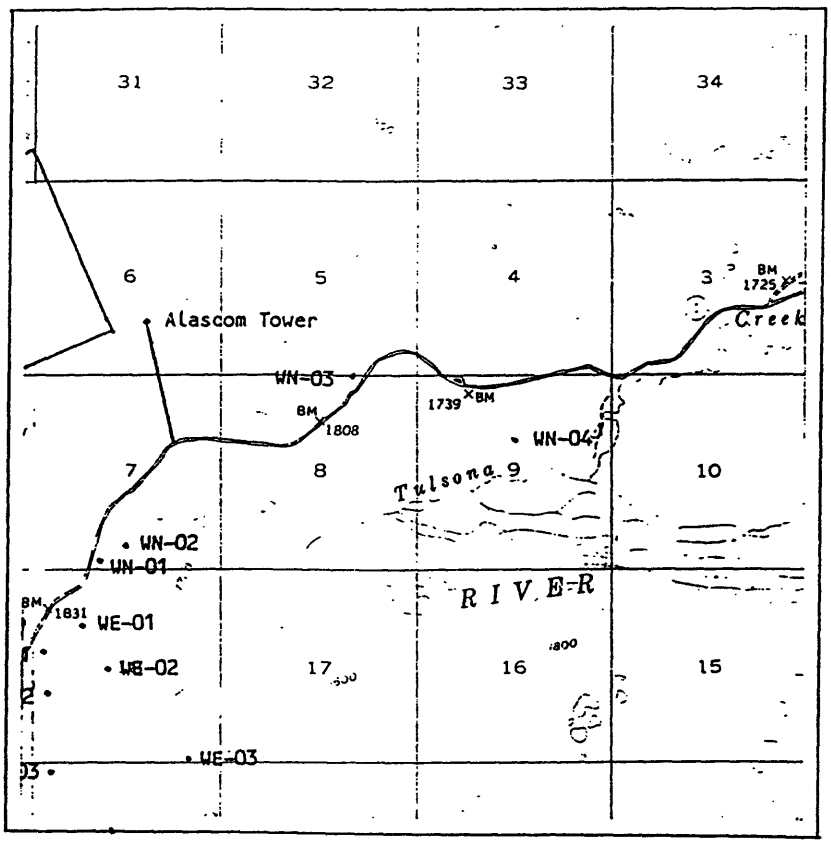
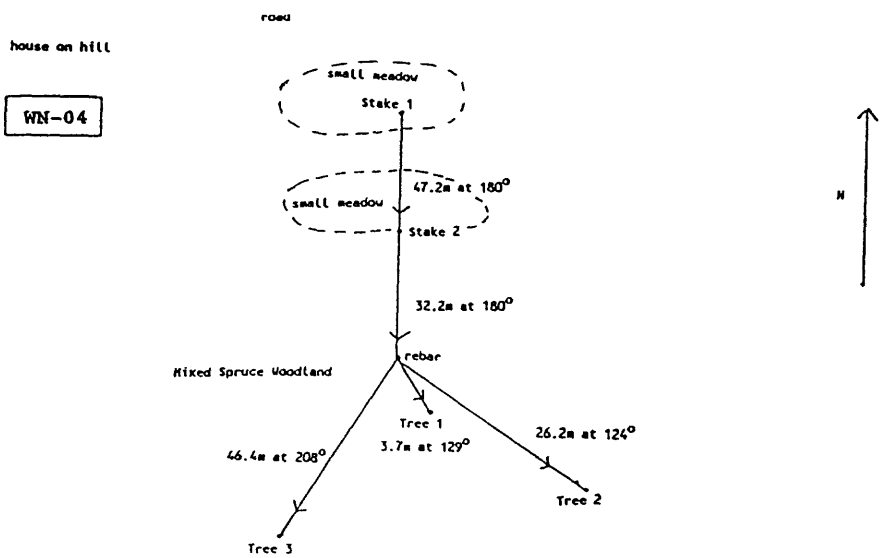
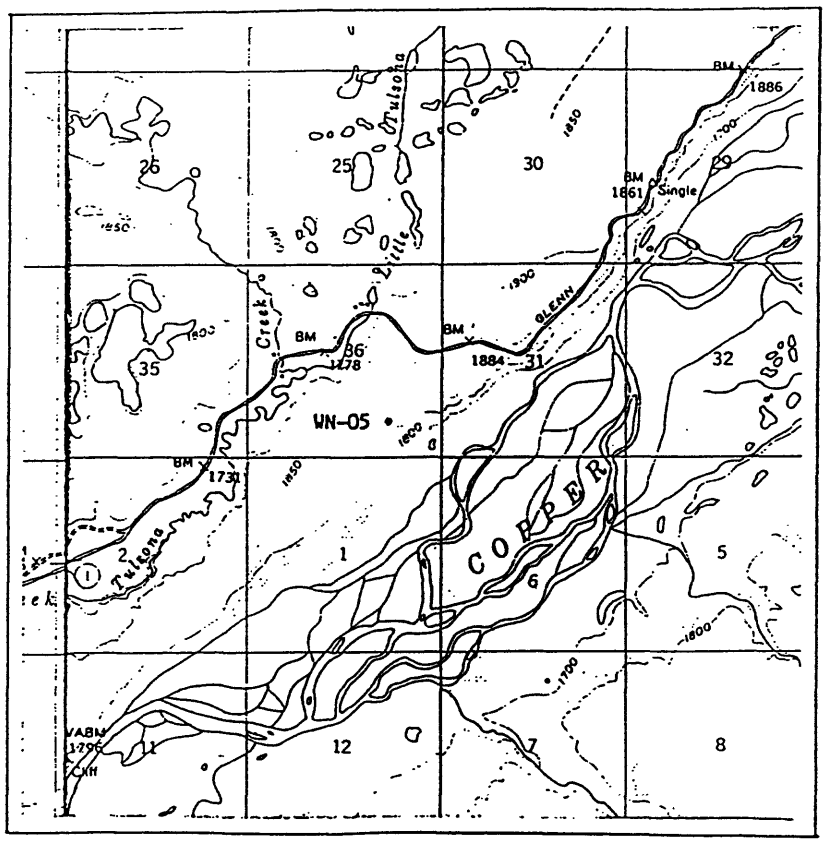






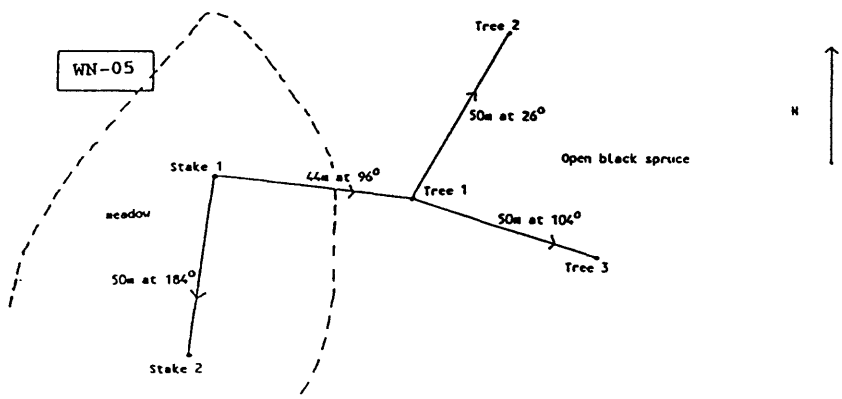
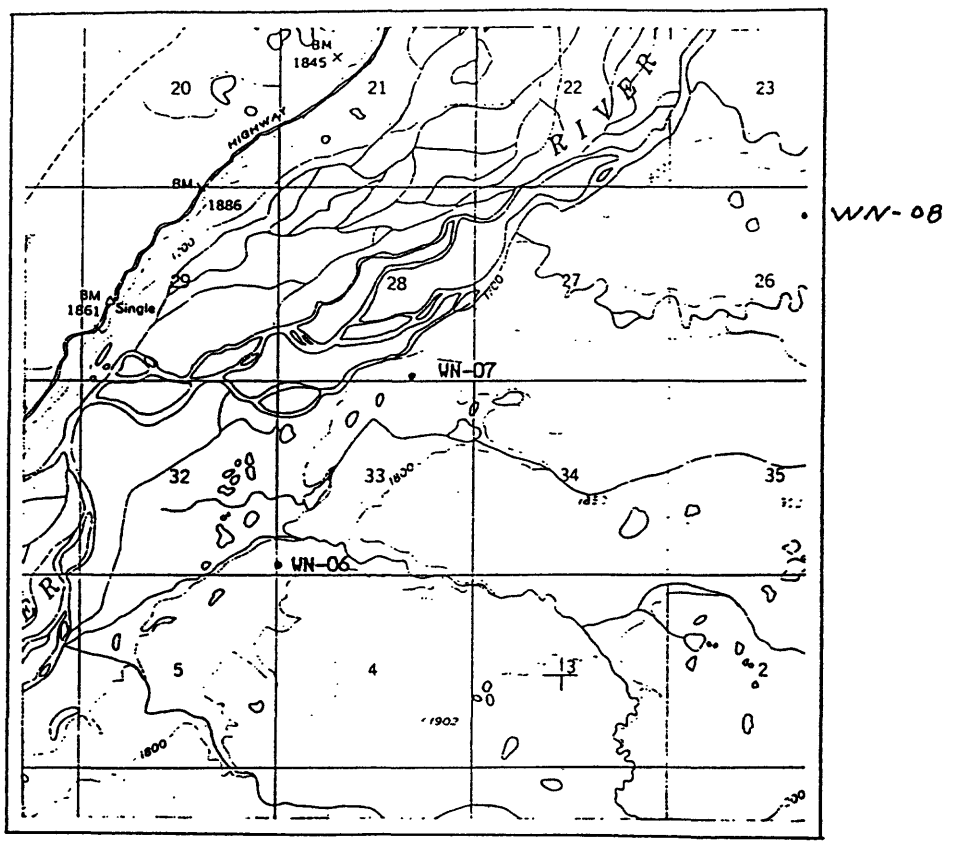
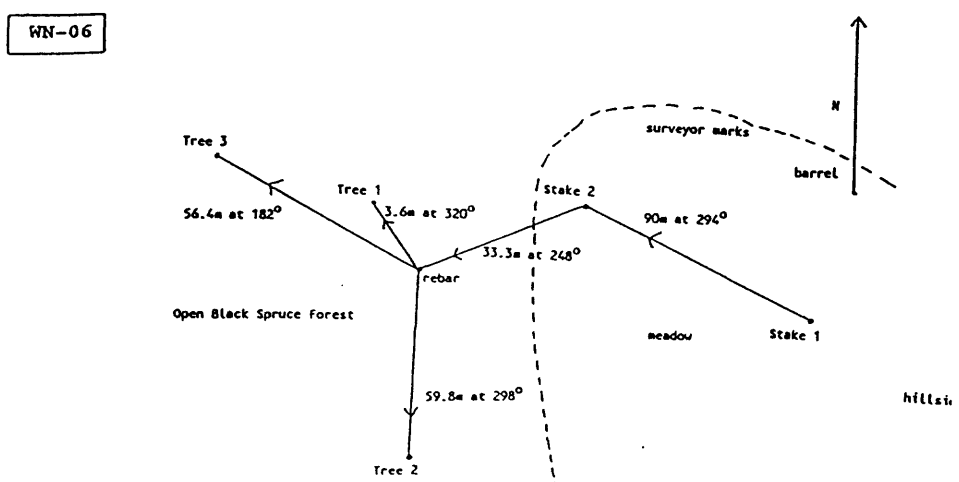


Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).





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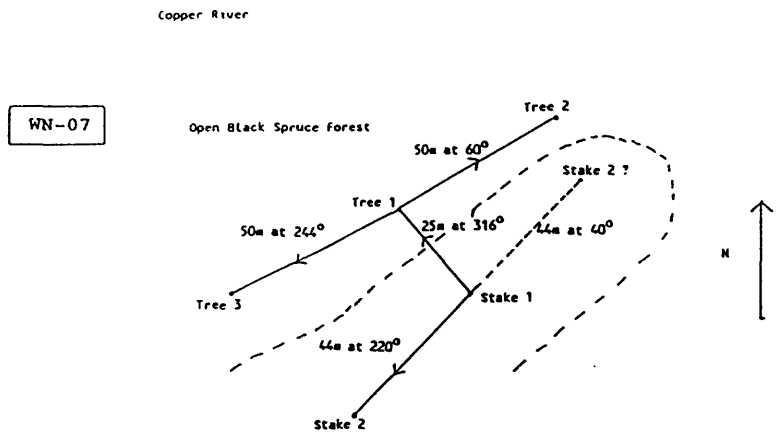


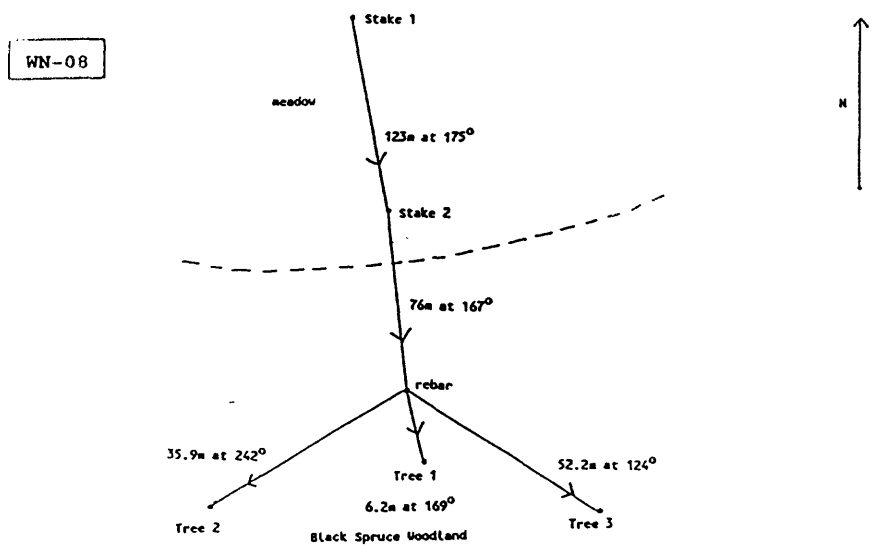
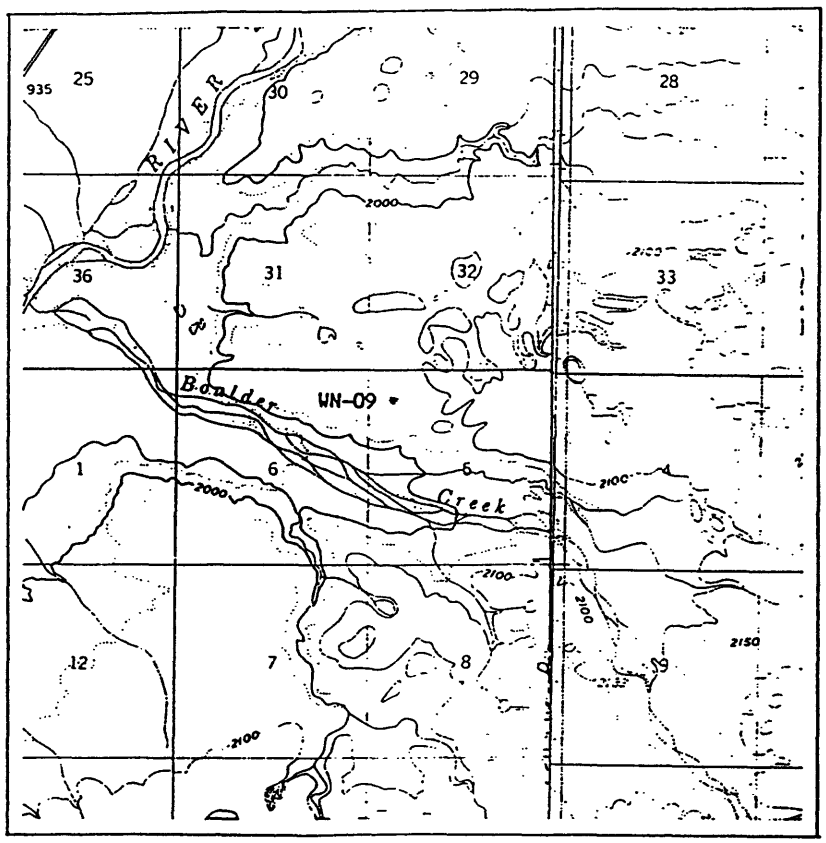


Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



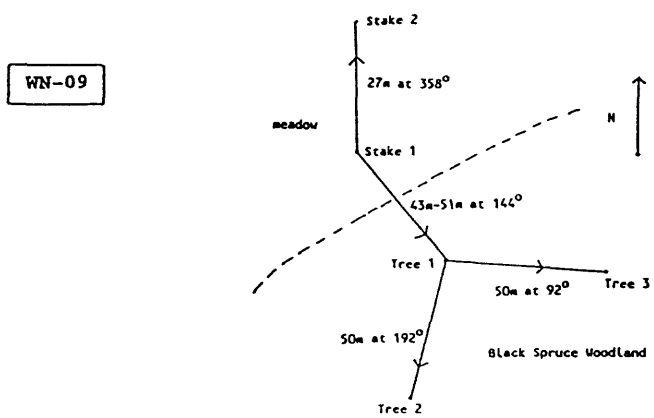


Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

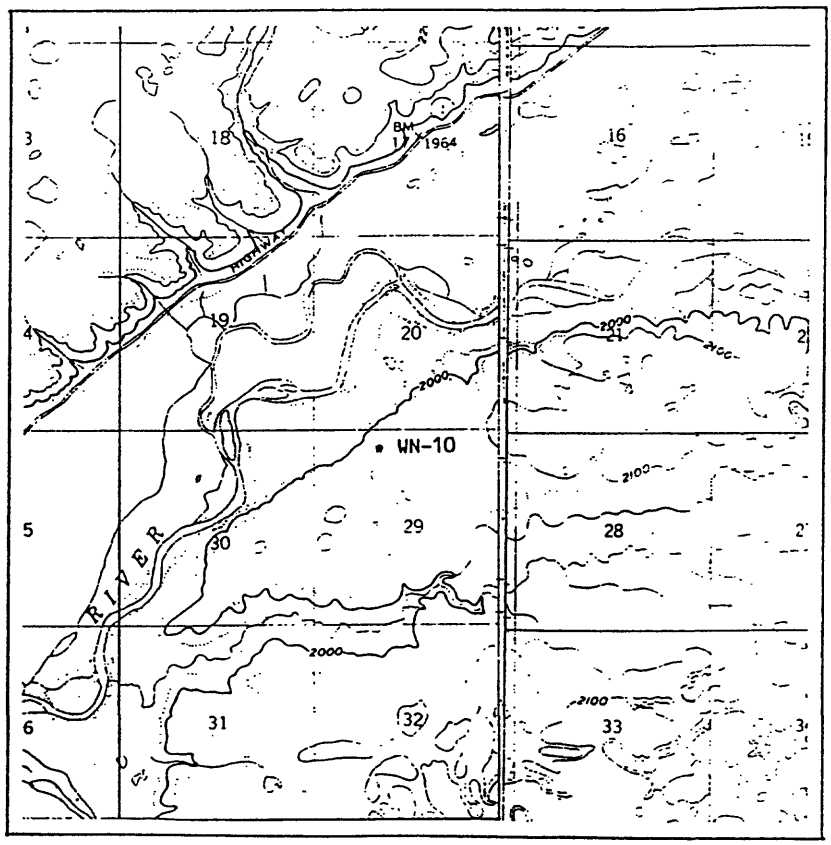
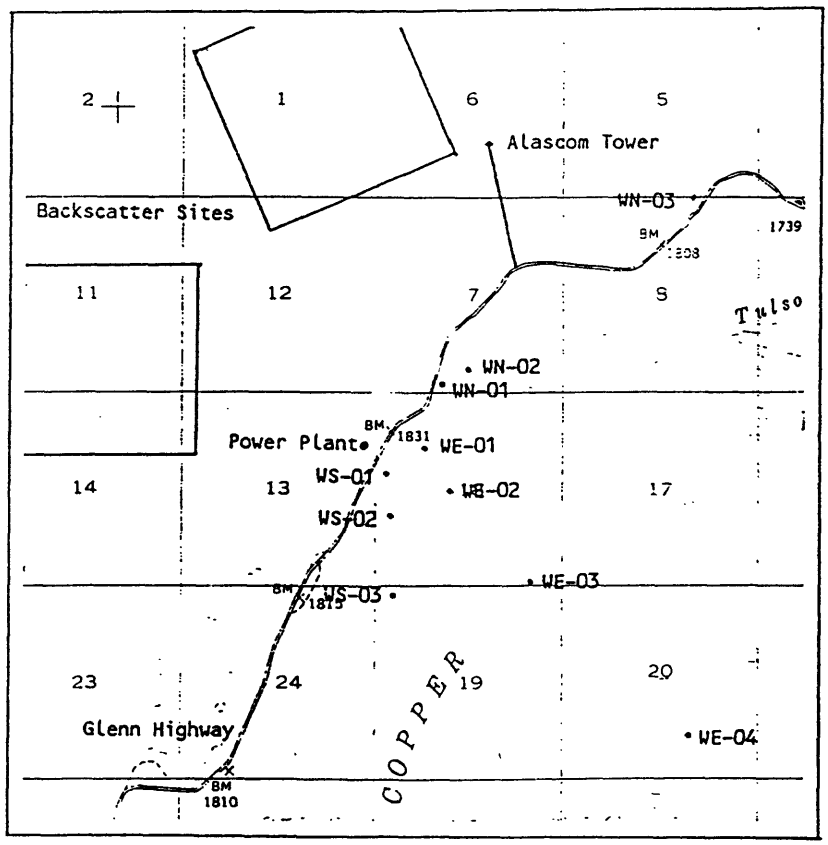


Figure 3.--Description of the sites on the North Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



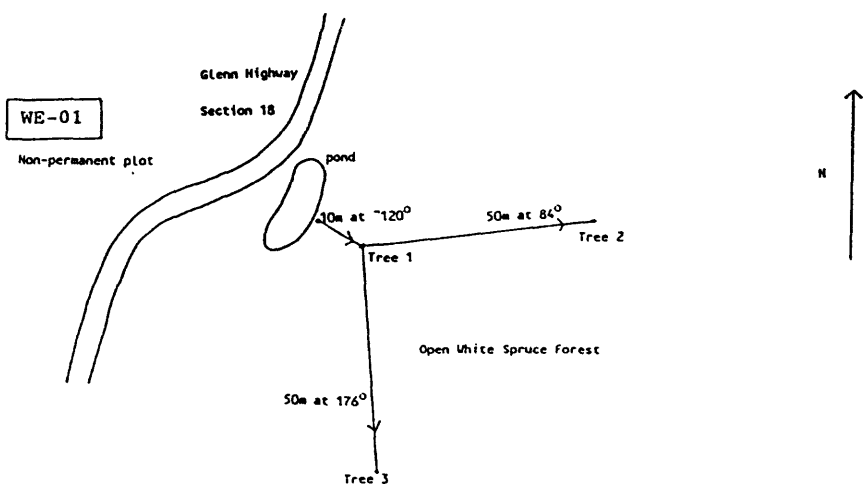


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska.

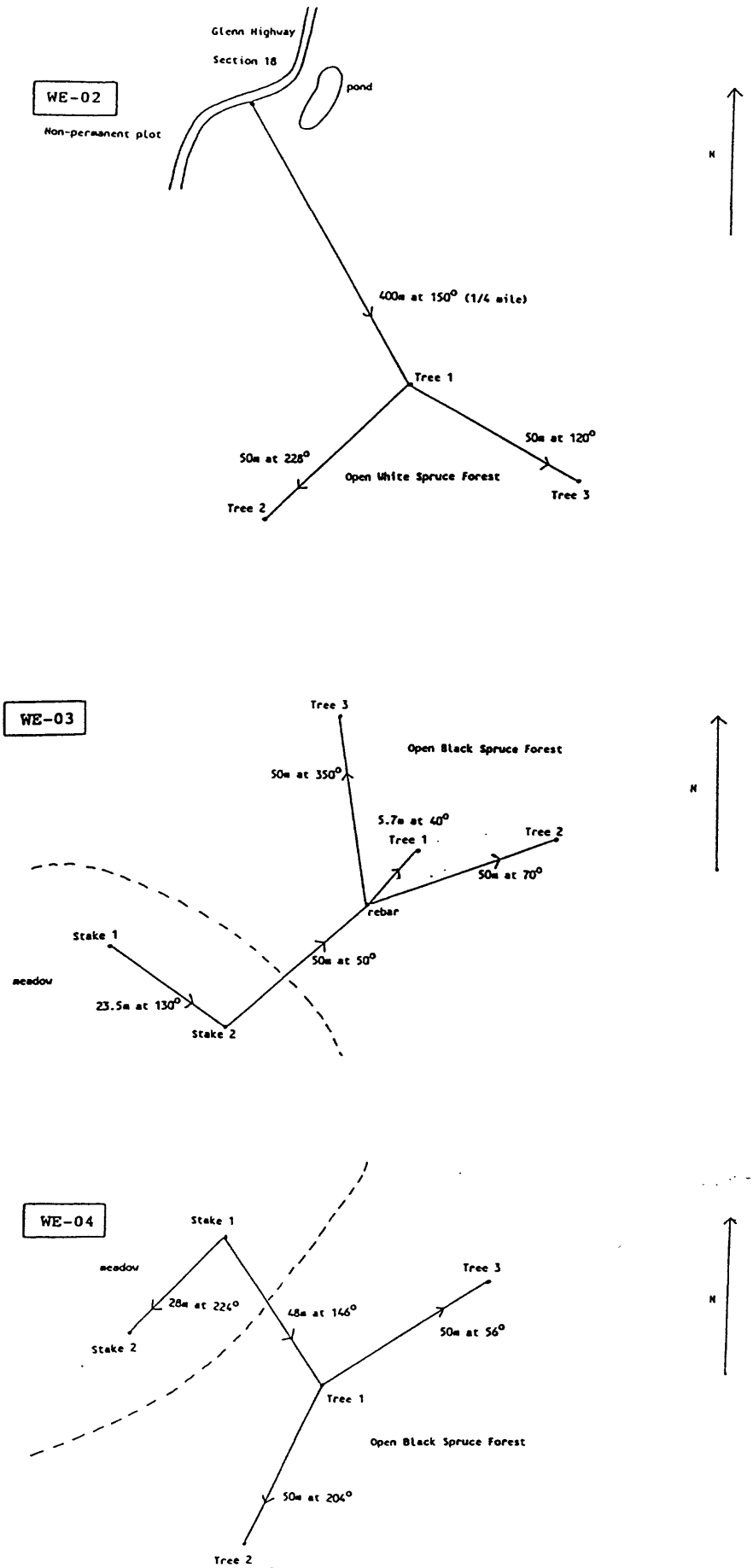
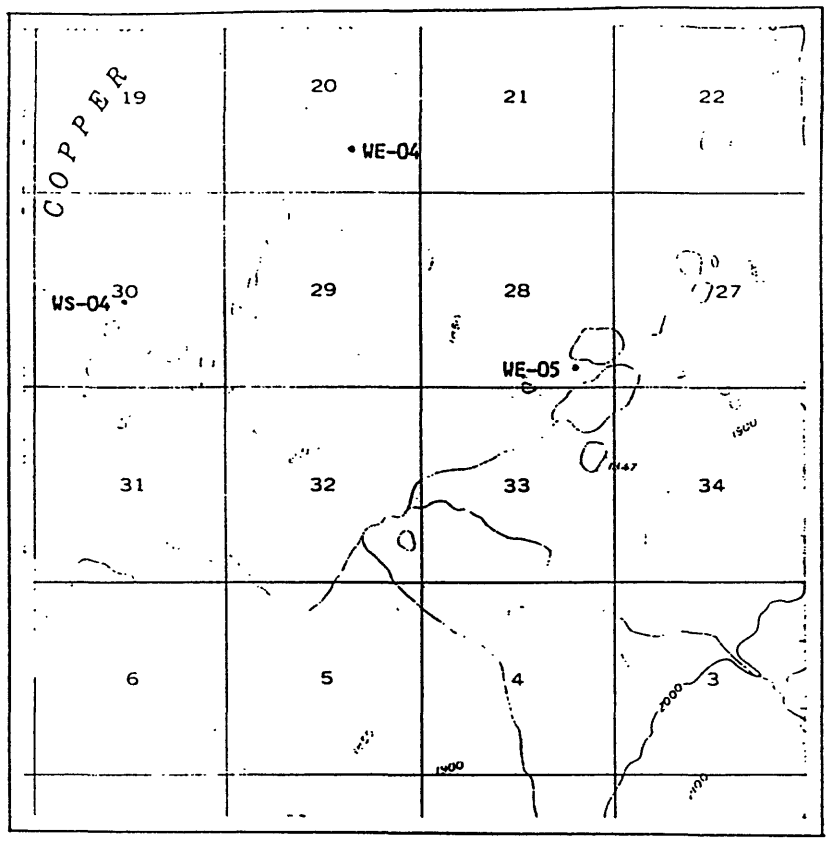


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



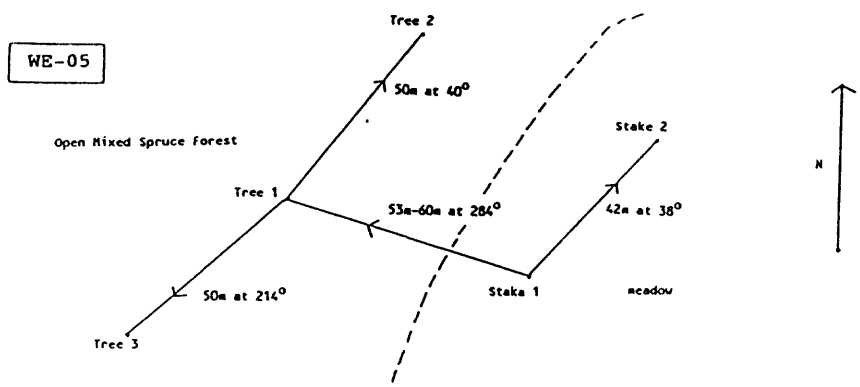
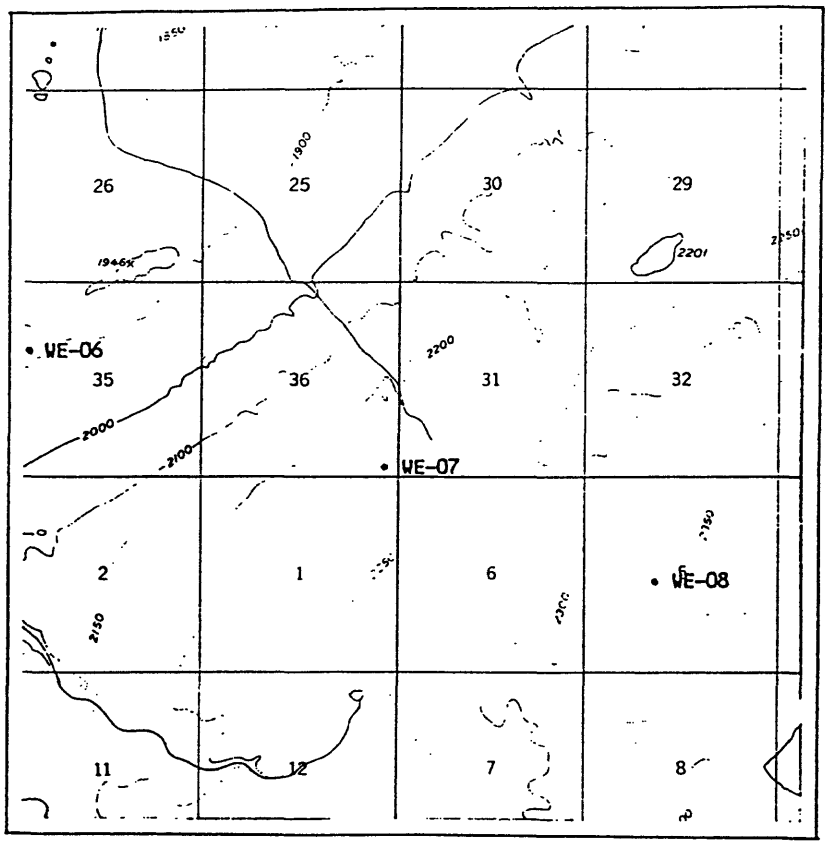


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



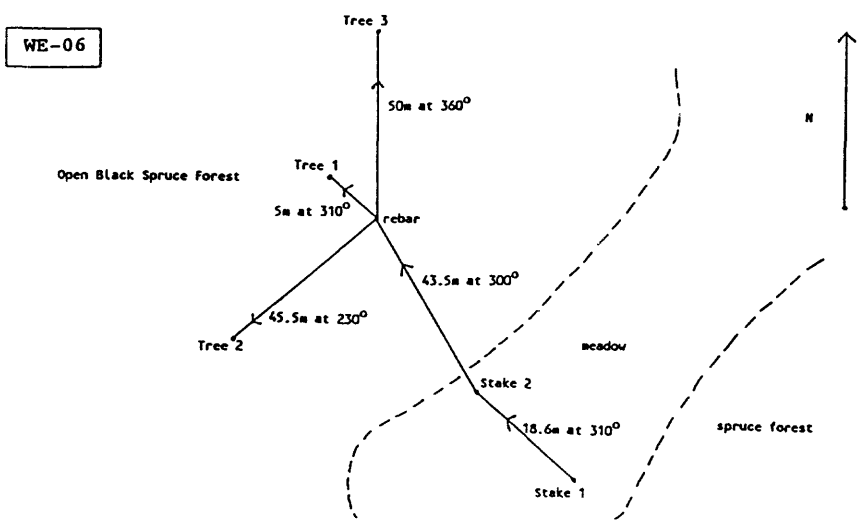


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

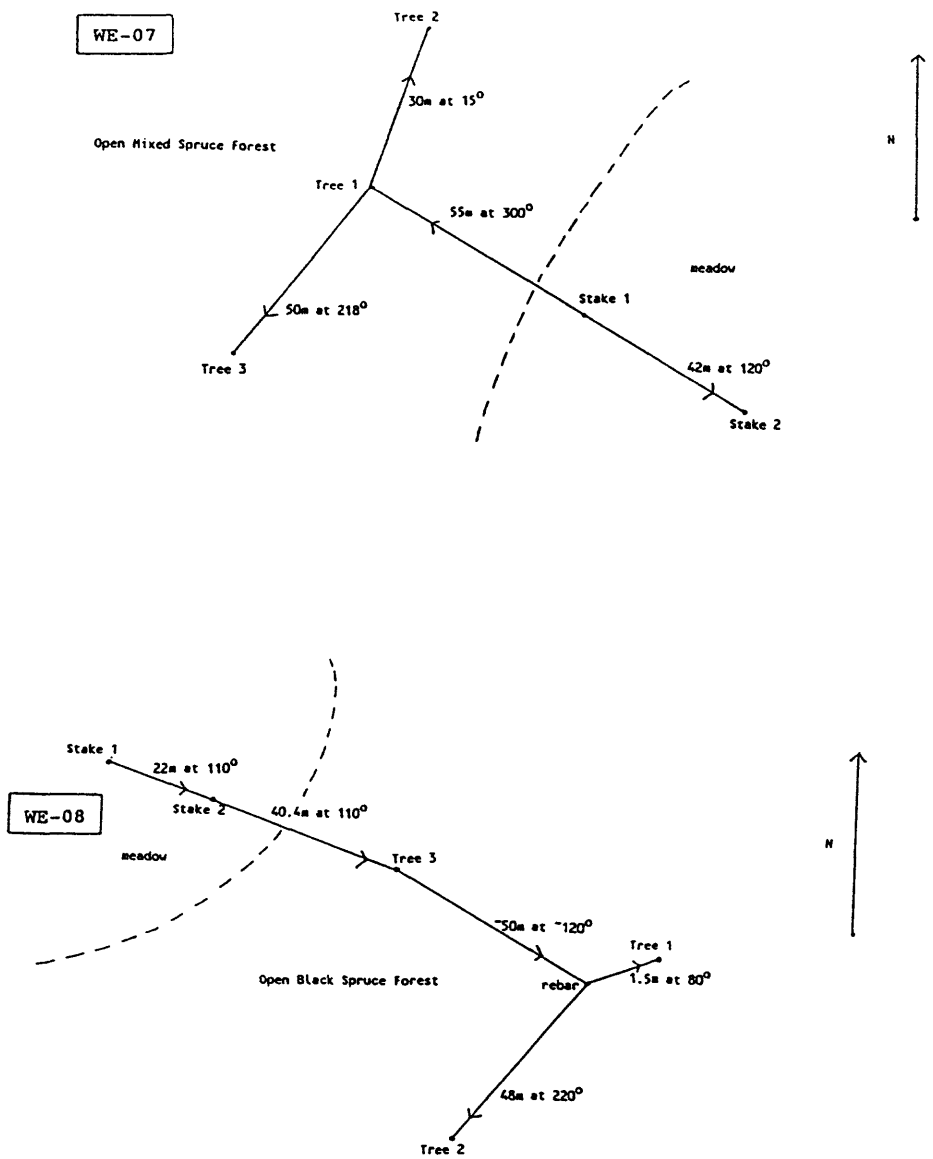
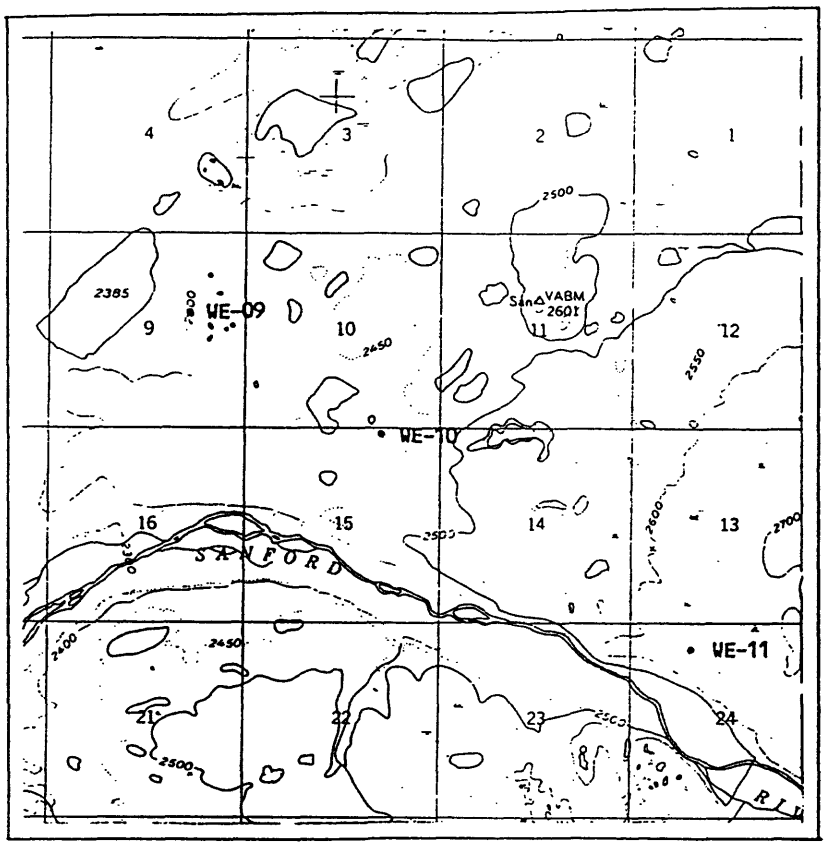


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



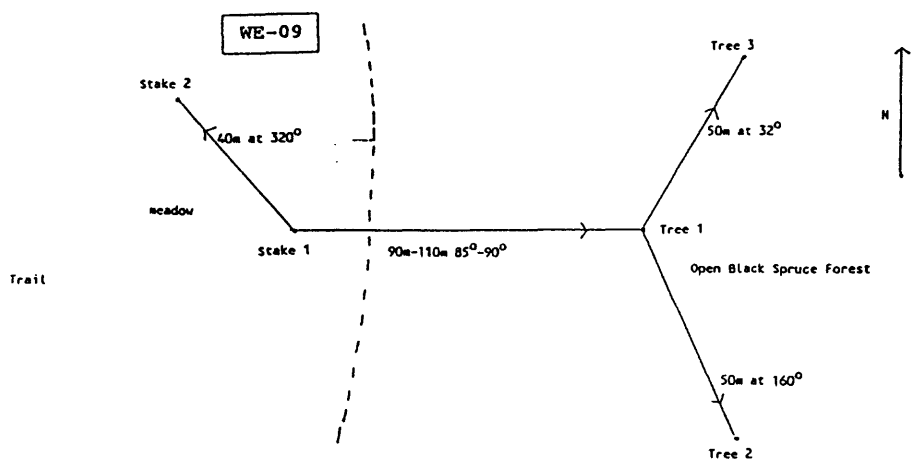
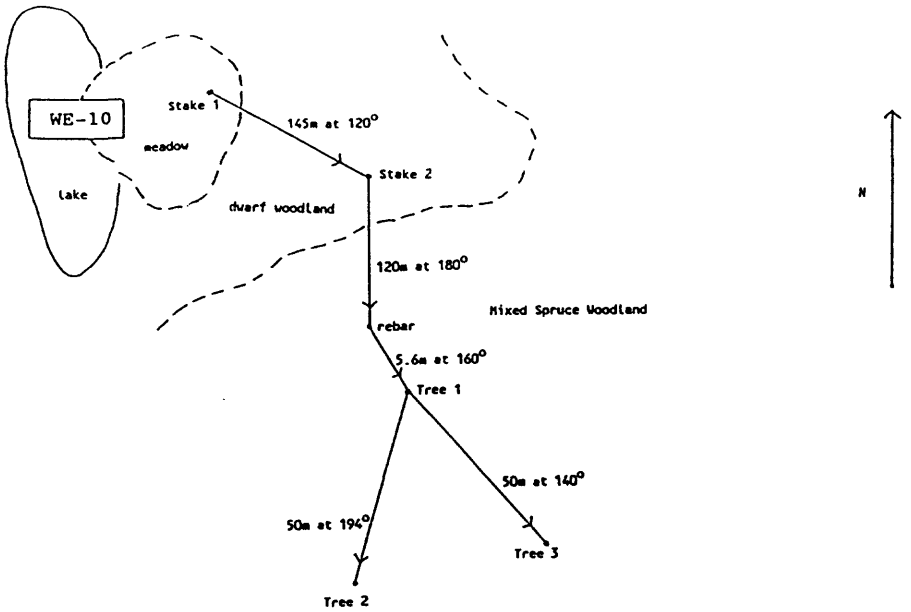


Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



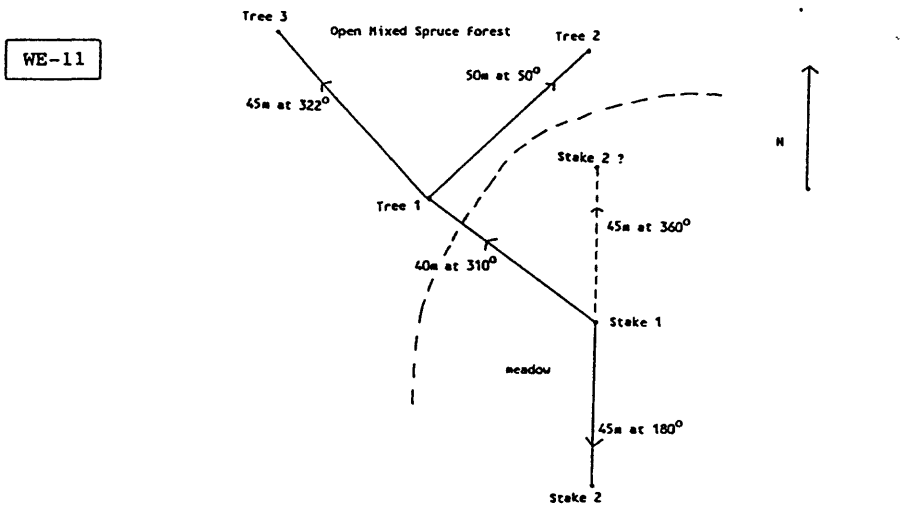
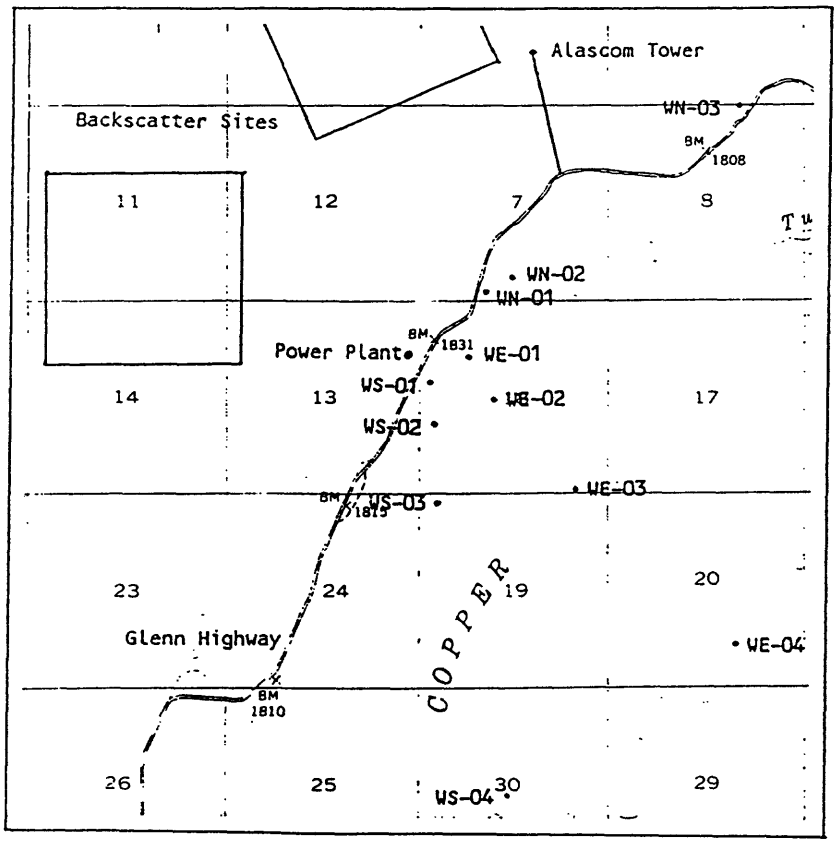
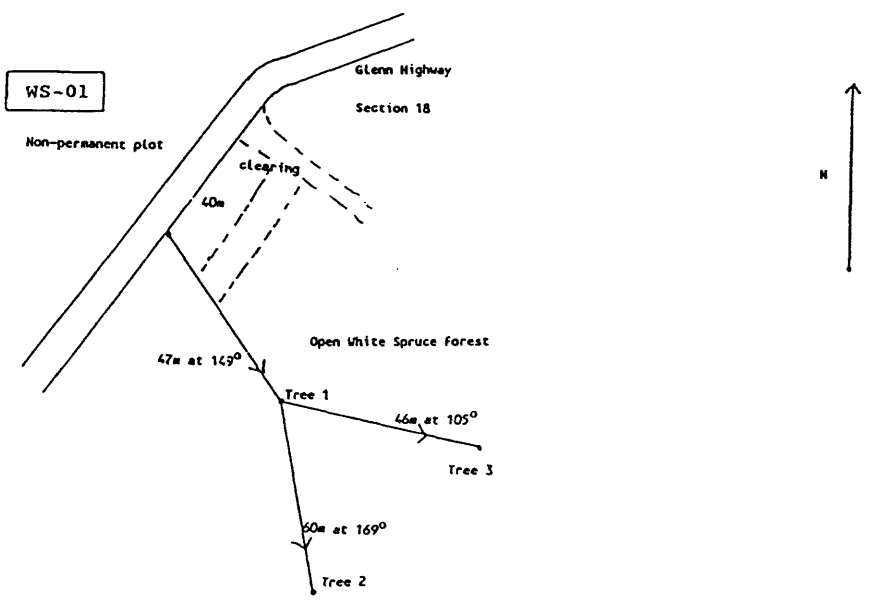
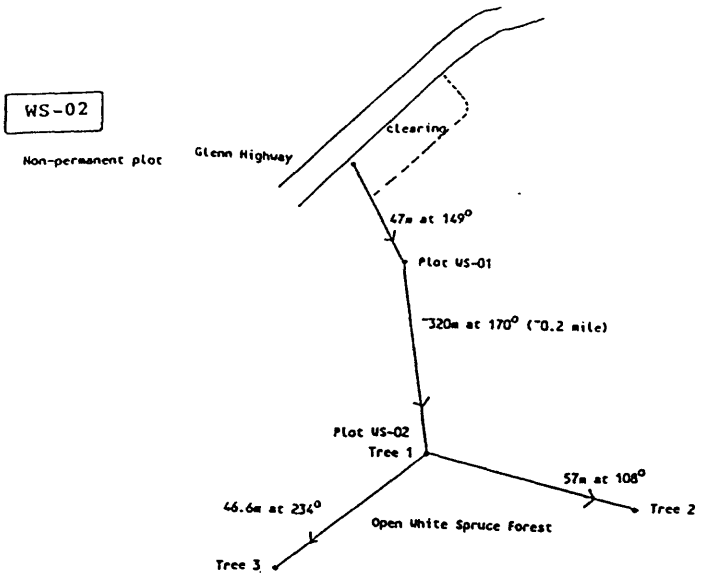


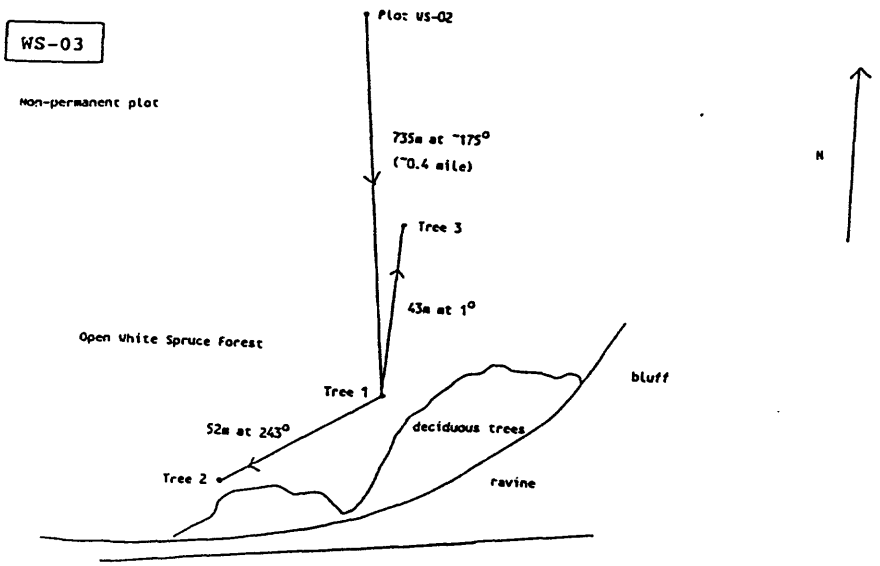
Figure 4.--Description of the sites on the East Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska.









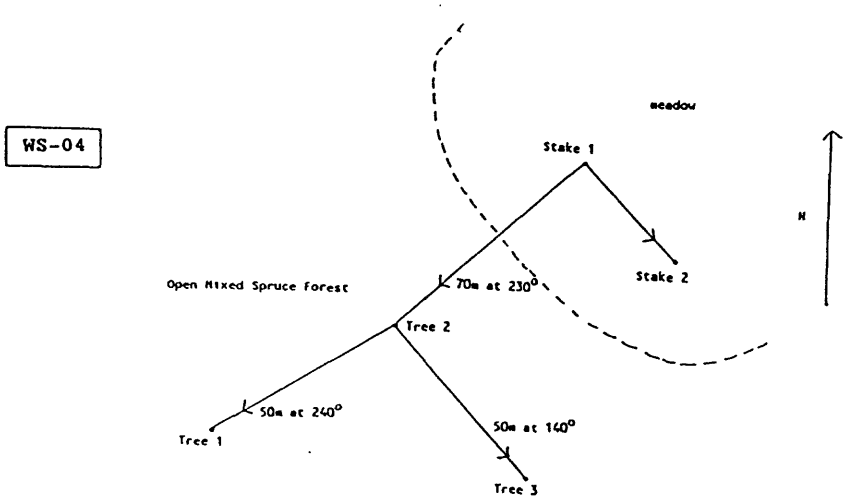
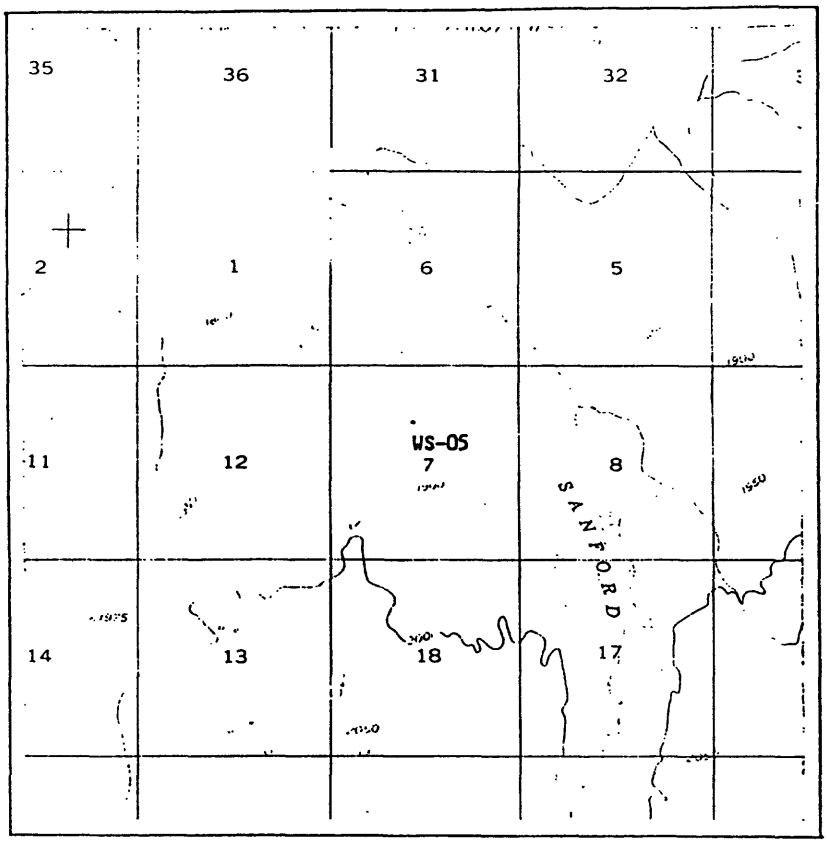


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



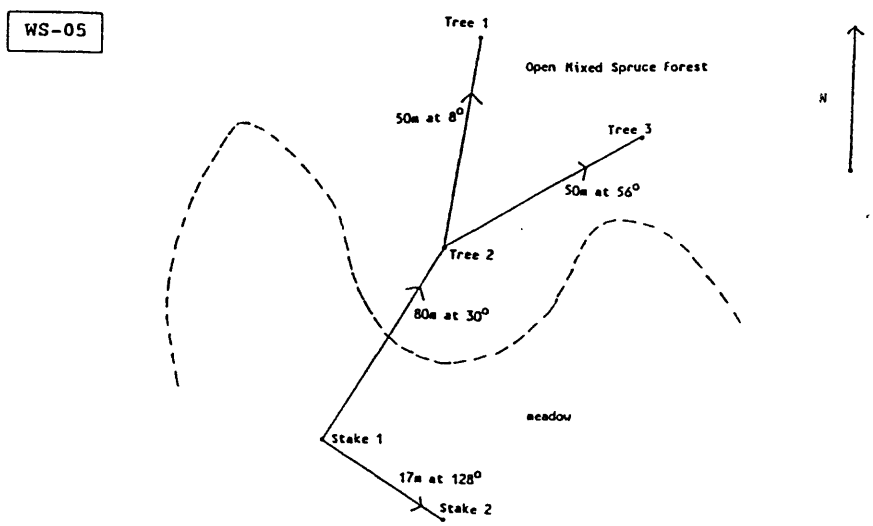
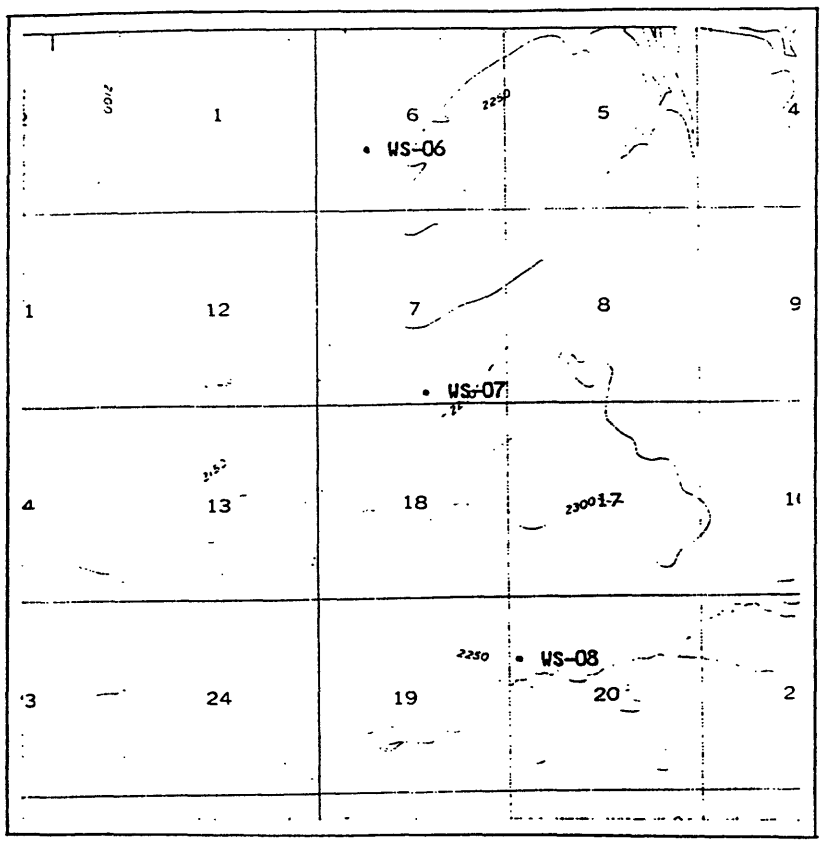


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



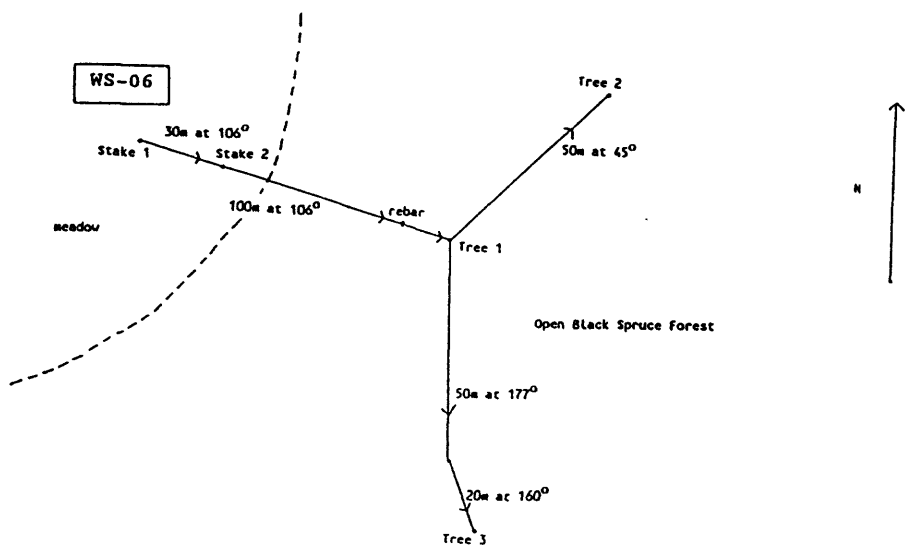


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

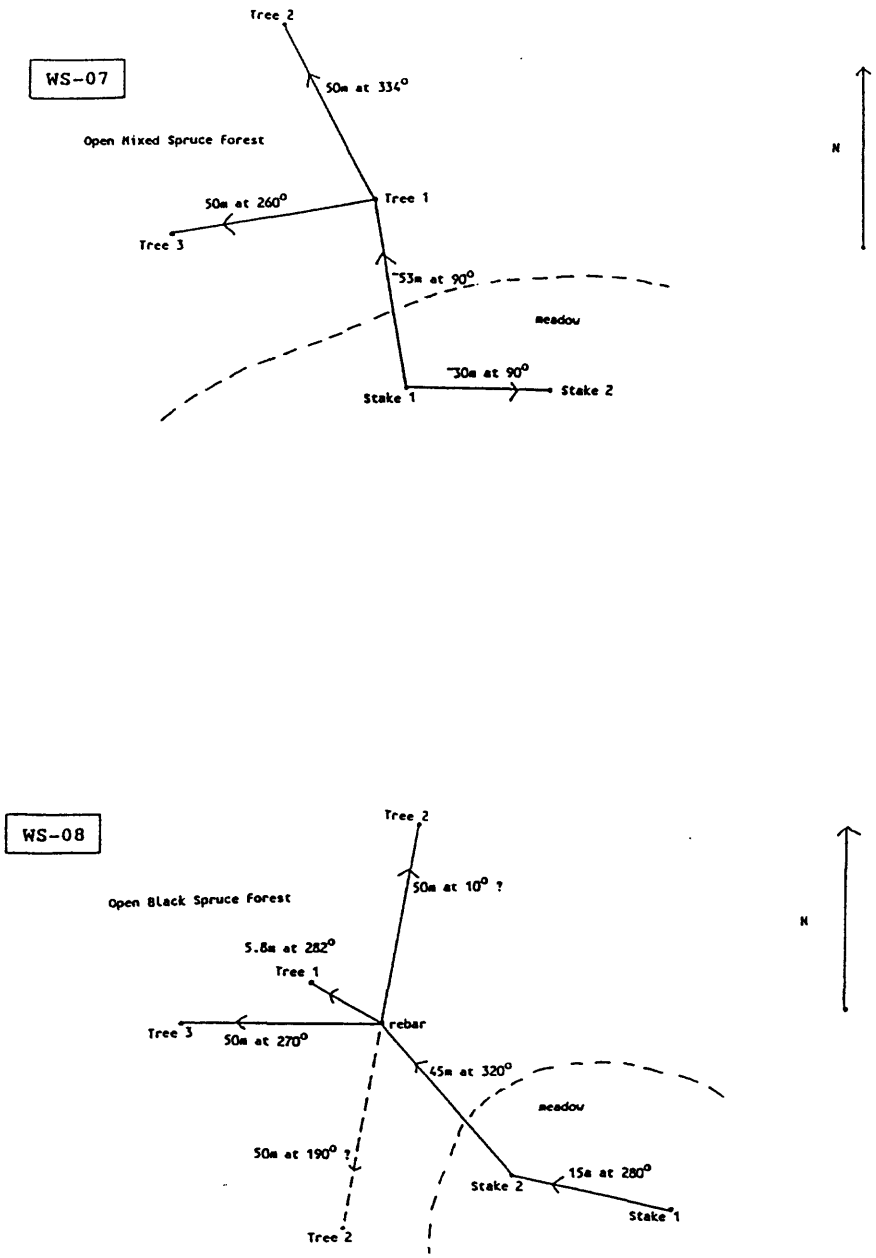


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).

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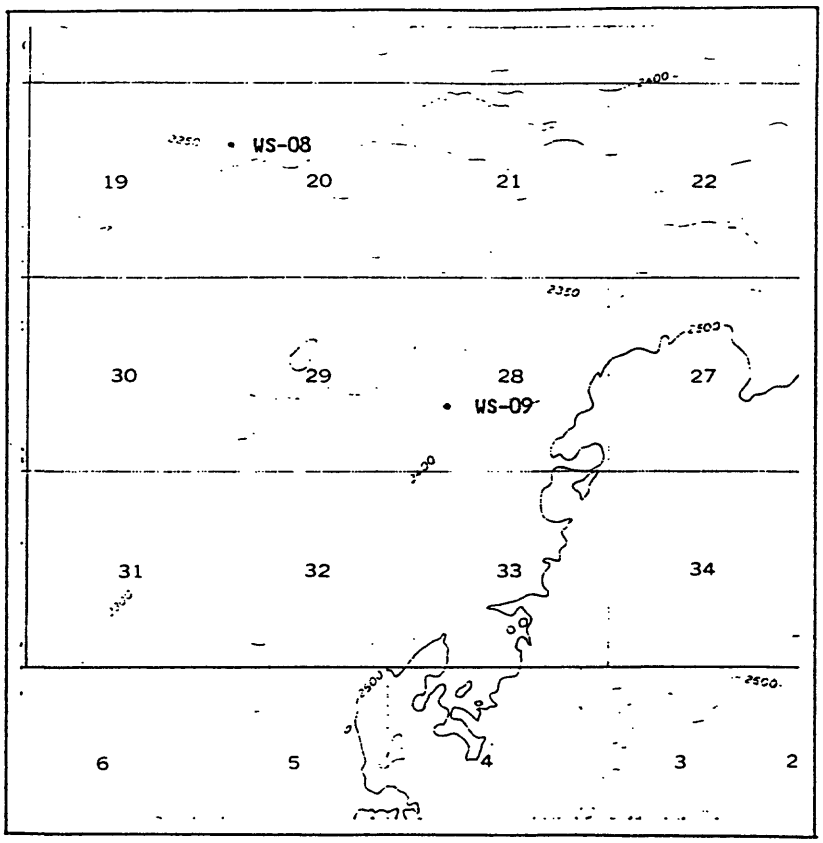


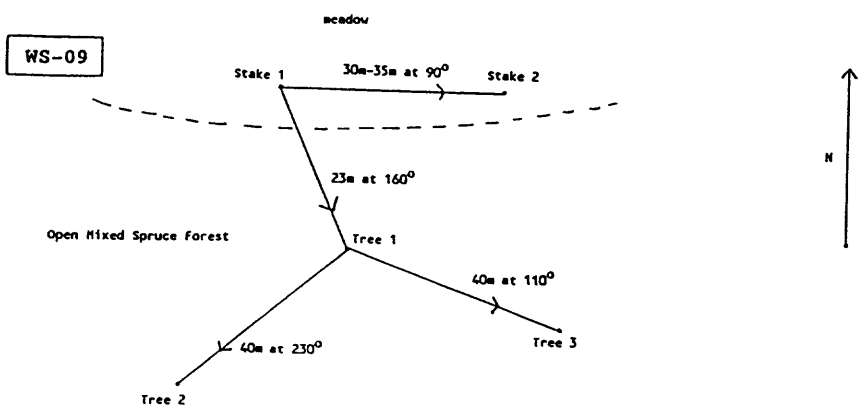
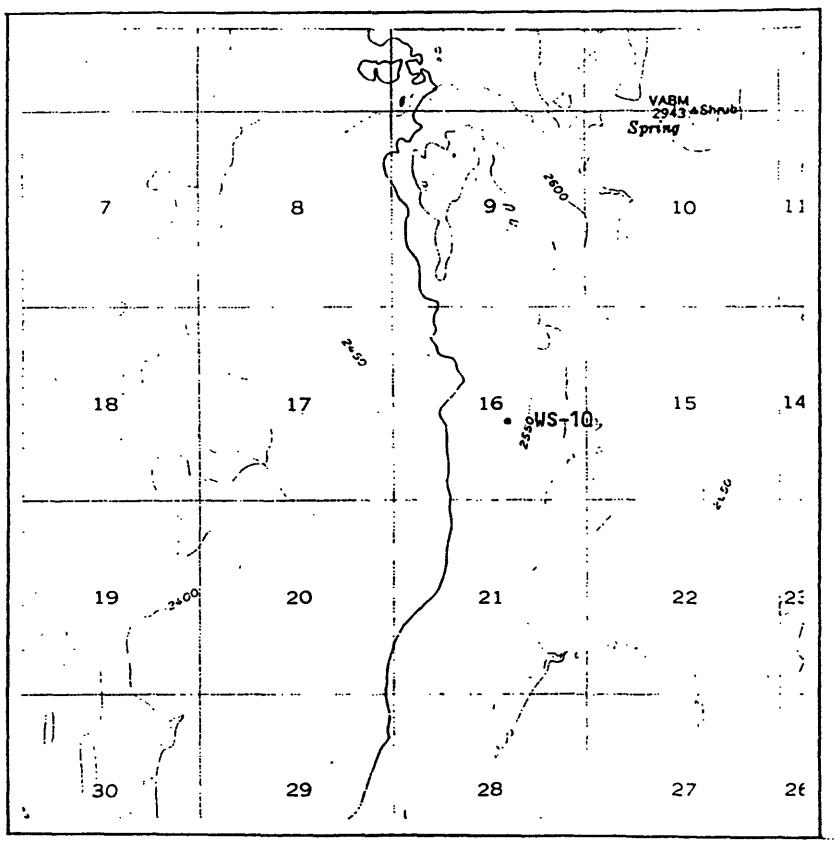


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



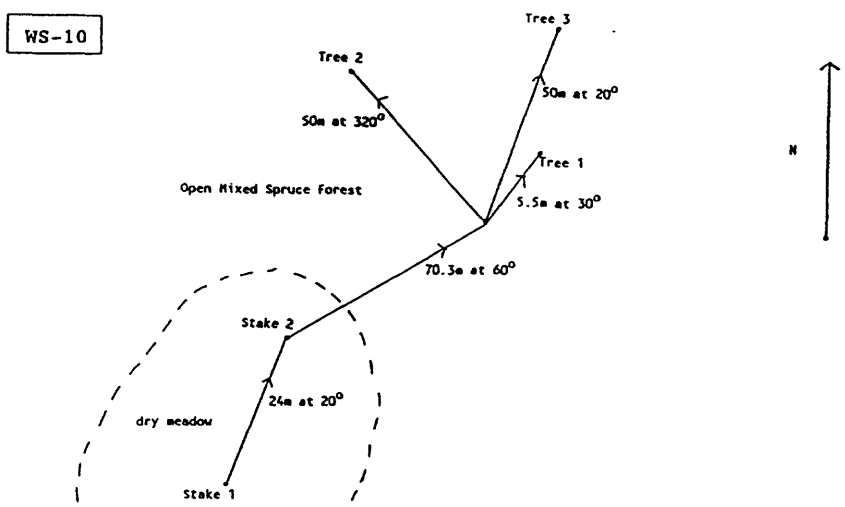
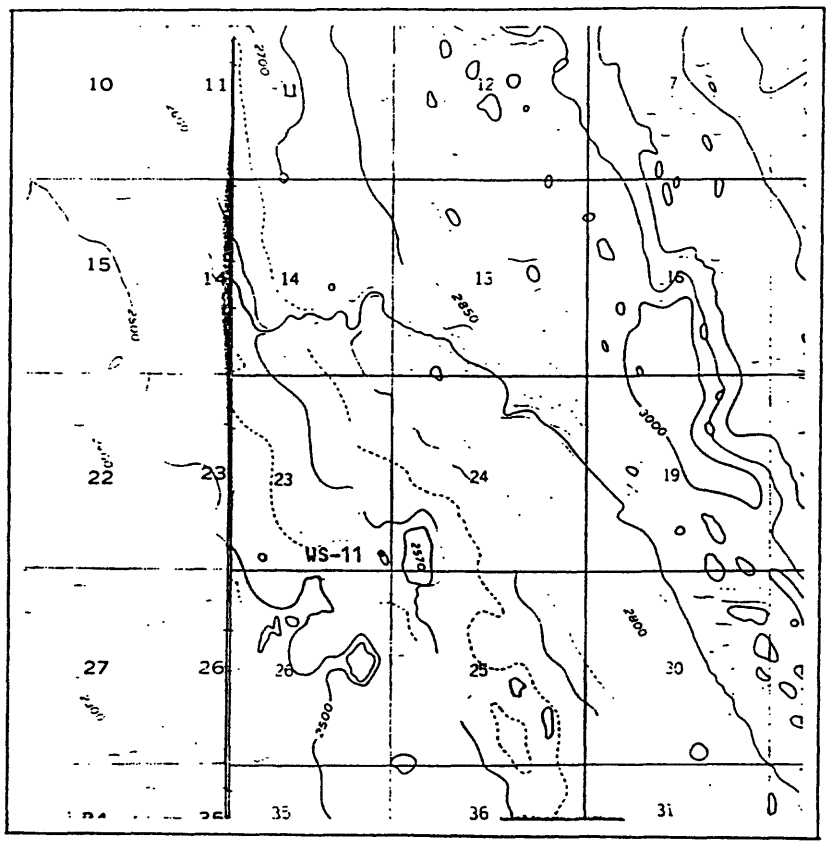


Figure 5.--Description of the sites on the South Traverse, Wrangell-Saint Elias National Park and Preserve study area, Alaska (continued).



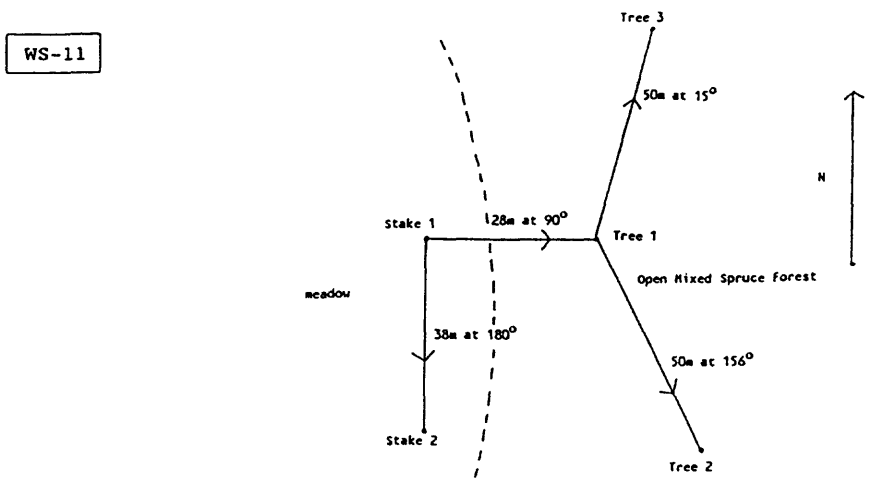


Table 1. Listing of approximate limits of determination for elements reported.

Analytical method	Medium	Determination limit	Variables
Inductively-coupled argon plasma optical emission spectroscopy	Soil and Plant[1,2]	2 ppm	Ag, Cd, La, Li, Mo, Ni, Sc, Sr, V, Y
		0.05 %	Al, Ca, Fe, K, Mg, Na, P, Ti
		1 ppm	Ba, Be, Co, Cr, Cu, Yb
		4 ppm	Ce, Ga, Ho, Mn, Nb, Nd, Pb, Th, Zn
		8 ppm	Au
		10 ppm	Bi
		20 ppm	Sn
		40 ppm	Ta
		100 ppm	U
Continuous-flow cold vapor	Soil[3]	0.02 ppm	Hg
	Plant[3]	0.01 ppm	
Combustion-IR	Soil[3]	0.05%	S
	Plant[3]	0.05%	
Ion Selective Electrode	Soil[3]	0.01%	F

[1] Determined on plant ash.
[2] Sample mass for plant ash was one-half that for soils, so determination limits for plant ash are twice those listed for soils. Values reported in Appendix Tables A2, A4, A6, A8, and A10 have been adjusted to be on a dry-weight basis.
[3] Determined on dry material.

Table 2.--Observed baseline range for element concentrations and ash yield for Hylocomium splendens (feather moss), Wrangell-Saint Elias National Park and Preserve study area, Alaska (dry-weight basis).

Variable, Unit of Measure	Wrangell-Saint Elias, Alaska Observed Baseline (n=67)	Denali National Park, Alaska (Crock and others, 1992) Observed Baseline (n=45)	Kenai Peninsula, Alaska (Crock and others, 1992) Calculated Baseline (n=21)
Al, %	0.375 - 3.48	0.0636 - 0.781	0.113 - 1.24
Ca, %	0.530 - 2.03	0.597 - 1.06	0.347 - 1.30
Fe, %	0.187 - 1.82	0.0478 - 0.529	0.059 - 0.527
K, %	0.219 - 0.627	0.153 - 0.539	0.298 - 0.559
Mg, %	0.157 - 0.988	0.147 - 0.277	0.085 - 0.307
Na, %	0.115 - 1.11	0.0327 - 0.159	0.040 - 0.432
P, %	0.065 - 0.082	0.0686 - 0.171	0.080 - 0.116
Ti, %	0.016 - 0.205	0.0028 - 0.035	0.005 - 0.057
Mn, ppm	104 - 752	56 - 1280	192 - 999
Ba, ppm	41 - 198	13 - 227	21 - 228
Ce, ppm	1.4 - 13	0.4 - 18	0.5 - 3.8
Co, ppm	1.3 - 10	0.4 - 2.5	0.4 - 2.7
Cr, ppm	3.9 - 38	0.9 - 16	1.4 - 8.1
Cu, ppm	5.5 - 23	9 - 25	3.0 - 6.9
Ga, ppm	0.9 - 7.9	0.3 - 2.2	0.4 - 2.2
La, ppm	0.6 - 7.5	0.3 - 10	0.6 - 2.6
Li, ppm	0.6 - 4.5	0.3 - 5.0	0.4 - 2.2
Mo, ppm	<0.3 - 1.6	0.7 - 2.8	
Nd, ppm	0.6 - 7.5	0.4 - 8.2	0.5 - 3.3
Ni, ppm	2.5 - 25	1.1 - 9.5	1.0 - 3.7
Pb, ppm	<0.6 - 3.2	0.7 - 4.7	0.6 - 7.0
Sc, ppm	0.6 - 7.9	<0.2 - 1.3	0.2 - 1.9
Sr, ppm	41 - 245	37 - 82	18 - 107
V, ppm	6.0 - 59	1.1 - 20	1.7 - 17
Y, ppm	0.6 - 7.5	0.2 - 2.5	0.3 - 2.9
Zn, ppm	24 - 60	22 - 81	16 - 77
Hg, ppm	0.04 - 0.12	<0.02 - 0.13	0.04 - 0.17
Ash, %	6.46 - 39.5	3.36 - 12.6	3.39 - 16.3
Total S, %	0.05 - 0.08	0.05 - 0.10	0.05 - 0.10

Table 3.--Observed baseline range for element concentrations and ash yield for Peltigera aphthosa (lichen), Wrangell-Saint Elias National Park and Preserve study area, Alaska (dry-weight basis).

Variable, Unit of Measure	Wrangell-Saint Elias Observed Baseline (n=67)	Denali National Park, Alaska (Crock and others, 1992) Observed Baseline (n=45)
Al, %	0.189 - 0.724	0.0215 - 0.241
Ca, %	0.269 - 0.657	0.168 - 0.656
Fe, %	0.103 - 0.407	0.0142 - 0.190
K, %	0.490 - 0.760	0.181 - 0.948
Mg, %	0.107 - 0.251	0.0575 - 0.204
Na, %	0.059 - 0.230	0.0116 - 0.0445
P, %	0.087 - 0.196	0.0986 - 0.368
Ti, %	0.0073 - 0.0400	0.0003 - 0.0077
Mn, ppm	50 - 285	32 - 494
Ba, ppm	19 - 60	9 - 49
Ce, ppm	0.8 - 3.1	<0.2 - 7.3
Co, ppm	0.6 - 2.4	0.2 - 2.0
Cr, ppm	1.6 - 6.7	0.4 - 3.6
Cu, ppm	5 - 11	5 - 18
Ga, ppm	0.4 - 1.7	<0.2 - 0.7
La, ppm	0.6 - 2.0	<0.1 - 4.1
Li, ppm	0.4 - 1.2	<0.1 - 1.0
Mo, ppm	<0.2 - 0.9	<0.2 - 1.5
Nd, ppm	0.4 - 2.0	<0.2 - 3.5
Ni, ppm	1.3 - 6.8	0.6 - 5.9
Pb, ppm	0.4 - 1.1	0.2 - 3.3
Sc, ppm	0.4 - 1.5	<0.1 - 0.4
Sr, ppm	19 - 53	11 - 38
V, ppm	3.1 - 12	0.4 - 3.9
Y, ppm	0.4 - 1.7	<0.1 - 0.8
Zn, ppm	21 - 50	20 - 95
Hg, ppm	0.04 - 0.12	<0.02 - 0.12
Ash, %	3.75 - 10.0	2.02 - 7.29
Total S, %	0.06 - 0.11	0.08 - 0.14

Table 4.--Observed baseline range for element concentrations and ash yield for Picea glauca (white spruce), twigs and needles, Wrangell-Saint Elias National Park and Preserve study area, Alaska (dry-weight basis).

Variable, Unit of Measure	Wrangell-Saint Elias, Alaska Observed Baseline (n=67)	Denali National Park, Alaska (Crock and others, 1992) Observed Baseline (n=23)	Kenai Peninsula, Alaska (Crock and others, 1992) Calculated Baseline (n=21)
Al, %	0.0125 - 0.0990	0.0002 - 0.0266	0.0066 - 0.0662
Ca, %	0.446 - 1.06	0.405 - 1.15	0.365 - 0.948
Fe, %	0.0054 - 0.0594	0.0026 - 0.0204	0.0039 - 0.0327
K, %	0.256 - 0.773	0.2784 - 0.624	0.295 - 0.870
Mg, %	0.063 - 0.127	0.0690 - 0.118	0.068 - 0.146
Na, %	0.0054 - 0.0345	0.0006 - 0.0048	0.0030 - 0.0335
P, %	0.0462 - 0.182	0.0710 - 0.179	0.100 - 0.230
Ti, %	0.0005 - 0.0079	<0.0002 - 0.0009	<0.0002 - 0.0036
Mn, ppm	61 - 1130	102 - 571	157 - 956
Ba, ppm	7 - 127	21 - 110	7 - 29
Ce, ppm	<0.2 - 0.4	<0.2 - 0.6	0.2 - 0.3
Co, ppm	0.1 - 0.4	0.1 - 0.4	0.1 - 0.4
Cr, ppm	0.3 - 2.6	0.2 - 0.8	0.2 - 1.2
Cu, ppm	1.6 - 2.9	1.3 - 7.5	1.9 - 4.0
Ga, ppm	<0.3 - 1.4	<0.2 - 0.6	0.1 - 0.4
La, ppm	<0.1 - 0.3	<0.1 - 0.4	0.2 - 0.4
Li, ppm	<0.1 - 0.8	<0.1 - 0.4	0.1 - 0.3
Ni, ppm	0.3 - 1.8	0.2 - 3.0	0.4 - 2.3
Sr, ppm	18 - 77	15 - 62	18 - 84
V, ppm	0.2 - 2.2	<0.1 - 0.4	0.1 - 0.9
Zn, ppm	36 - 103	39 - 84	20 - 79
Hg, ppm	<0.02 - 0.07	<0.02 - 0.05	<0.02 - 0.05
Ash, %	2.48 - 5.52	2.38 - 4.79	2.95 - 4.81
Total S, %	<0.05 - 0.08	0.05 - 0.09	0.05 - 0.09

Table 5.--Observed baseline range for element concentrations and ash yield for O2-Horizon soil samples, Wrangell-Saint Elias National Park and Preserve study area, Alaska (dry-weight basis).

Variable, Unit of Measure	Wrangell-Saint Elias, Alaska Observed Baseline (n=35)	Denali National Park, Alaska (Crock and others, 1992) Observed Baseline (n=21)	Kenai Peninsula, Alaska (Crock and others, 1992) Calculated Baseline (n=21)
Al, %	2.15 - 7.33	1.17 - 5.96	0.126 - 3.00
Ca, %	1.49 - 3.93	0.237 - 3.18	0.102 - 1.25
Fe, %	0.943 - 3.46	0.728 - 4.00	0.060 - 1.44
K, %	0.309 - 1.14	0.270 - 2.225	0.032 - 0.468
Mg, %	0.440 - 1.76	0.148 - 0.650	0.024 - 0.454
Na, %	0.681 - 2.43	0.130 - 0.780	0.043 - 1.04
P, %	0.045 - 0.100	0.053 - 0.180	0.019 - 0.095
Ti, %	0.0814 - 0.434	0.0343 - 0.325	0.007 - 0.177
Mn, ppm	152 - 1240	69 - 2390	30 - 1000
Ba, ppm	141 - 505	21 - 1691.	25 - 353
Ce, ppm	7.9 - 26	9 - 85	0.6 - 12
Co, ppm	4.7 - 22	5 - 19	0.3 - 6.0
Cr, ppm	15 - 67	14 - 85	1.2 - 21
Cu, ppm	18 - 52	10 - 42	1.3 - 11
Ga, ppm	4.2 - 15	3 - 16	0.3 - 8.4
La, ppm	4.7 - 16	5 - 47	0.4 - 7.5
Li, ppm	3.7 - 102	4 - 23	0.3 - 6.7
Nd, ppm	5.2 - 17	6 - 37	0.3 - 8.6
Ni, ppm	9.4 - 41	10 - 37	0.6 - 7.9
Pb, ppm	2.1 - 31	3.5 - 20	0.7 - 4.0
Sc, ppm	3.4 - 13	2.7 - 11	0.3 - 5.8
Sr, ppm	162 - 486	36 - 190	10 - 147
V, ppm	32 - 121	19 - 117	2.1 - 43
Y, ppm	4.7 - 15	2.2 - 12	0.3 - 7.1
Yb, ppm	<0.5 - 1.8	<0.2 - 1.3	
Zn, ppm	13 - 242	25 - 136	4 - 47
As, ppm	<5 - 50	1.1 - 11	0.3 - 1.5
Hg, ppm	0.02 - 0.10	0.06 - 0.14	0.10 - 0.34
Ash, %	52.4 - 88.6	14.3 - 85.2	14.1 - 65.7
Total S, %	<0.05 - 1.55	0.07 - 0.23	0.07 - 0.18

Table 6. Baseline data for element concentrations in samples of surficial materials from Alaska (Gough and others, 1988).

Variable, unit of measure	Geometric mean	Geometric deviation	Observed range
pH[1]	5.5	1.20	3.7 - 9.0
Al, %	6.2	1.38	1.2 - 10
As, ppm	6.7	2.31	<10 - 750
Ash, %	85	1.33	6.6 - 99.7
Ba, ppm	595	1.67	39 -3100
Ca, %	1.3	2.61	0.04- 10
Ce, ppm	28	1.84	<5 - 180
Co, ppm	13	1.67	<2 - 55
Cr, ppm	50	2.00	5 - 390
Cu, ppm	24	1.81	3 - 810
Fe, %	3.5	1.52	0.55- 10
Ga, ppm	15	1.44	<4 - 32
K, %	1.2	1.57	0.09- 4.1
La, ppm	19	1.68	<2 - 120
Li, ppm	26	1.74	<2 - 130
Mg, %	0.98	1.84	0.13- 7.4
Mn, ppm	510	2.07	<200 -4000
Na, %	1.2	1.74	<0.07- 3.6
Nd, ppm	23	1.73	<4 - 120
Ni, ppm	24	2.17	<3 - 320
P, %	0.078	1.55	<0.02- 0.34
Pb, ppm	12	1.74	<4 - 310
Sc, ppm	13	1.67	<2 - 39
Sr, ppm	159	1.93	21 - 760
Ti, %	0.48	1.48	0.09- 1.5
V, ppm	112	1.69	11 - 490
Y, ppm	14	1.55	<4 - 100
Yb, ppm	1.4	1.60	<1 - 6
Zn, ppm	70	1.64	<20 -2700

[1] Measured in standard units, not transformed to logarithms.

EXPLANATION OF APPENDIXES

These tables give the sample identification, location, and chemical composition as it was determined for the plants and soil samples collected in 1990 for the Wrangell-Saint Elias National Park and Preserve study area. The Sample ID's are keyed as follows:

Tables A1-A4

First position: W for the 1990 WSEP study.

Second position: Sampling site group: E - East Traverse; N - North Traverse; S - South Traverse.

Third and fourth positions: Site number in a given traverse, with the larger number being farther away from the proposed power plant.

Fifth position: Sample medium: M - feather moss; L - P. aphthosa lichen.

Sixth position: Location in a given site (1, 2, 3); Blank or a C, laboratory-made composite sample from the site's sampling locations; X a laboratory-prepared duplicate split of the composite sample.

Tables A5-A6

First position: W for the 1990 WSEP study.

Second position: Sampling site group: E - East Traverse; N - North Traverse; S - South Traverse.

Third and fourth positions: Site number in a given traverse, with the larger number being farther away from the proposed power plant.

Fifth and Sixth position: Sample medium: SP - white spruce.

Seventh position: Location (1, 2, 3); Blank or a C, laboratory-made composite sample from the site's sampling locations.

Eighth position: Analytical split: Blank or X.

Tables A9-A10

First position: W for the 1990 WSEP study.

Second position: Sampling site group: E - East Traverse; N - North Traverse; S - South Traverse.

Third and fourth positions: Site number in a given traverse, with the larger number being farther away from the proposed power plant. Each sample was a composite of three points in a randomly chosen location at each site.

Fifth position: Sample medium: S - O2 soil horizon.

Sixth position: Analytical split: Blank or X.

Table A1.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					East Traverse					
WE01MC	622330	1450700	6.3	9.5	3.4	2.6	2.4	2.0	0.81	0.39
WE01MX	622330	1450700	6.1	9.8	3.3	2.7	2.4	2.0	0.86	0.39
WE02M1	622318	1450648	6.1	11	3.3	2.6	2.2	1.9	0.74	0.38
WE02M2	622530	1450648	6.1	11	3.3	2.2	2.2	2.0	0.66	0.38
WE02M3	622318	1450648	6.6	8.9	3.6	2.3	2.3	2.1	0.62	0.42
WE02MC	622318	1450648	6.4	10	3.4	2.4	2.2	2.0	0.66	0.38
WE03MC	622248	1450554	7.6	6.8	4.0	2.4	2.2	2.4	0.52	0.48
WE04MC	622142	1450430	8.0	6.2	4.1	2.2	2.4	2.6	0.36	0.47
WE05M1	622218	1450342	7.9	6.2	4.0	2.0	2.4	2.6	0.34	0.46
WE05M2	622218	1450342	7.1	7.1	3.6	2.8	2.6	2.4	0.54	0.42
WE05M3	622218	1450342	8.3	5.6	4.1	1.8	2.2	2.6	0.32	0.51
WE05MC	622218	1450342	8.0	6.1	4.0	2.1	2.3	2.6	0.35	0.46
WE06MC	622054	1445948	8.7	6.0	4.3	1.7	2.2	2.8	0.25	0.51
WE07MC	622006	1445630	8.3	5.9	4.2	1.8	2.3	2.7	0.31	0.50
WE08M1	621936	1445318	7.9	6.7	3.9	2.2	2.7	2.5	0.46	0.48
WE08M2	621936	1445318	7.8	7.4	3.9	2.5	2.8	2.5	0.55	0.47
WE08M3	621936	1445318	7.7	7.2	3.8	2.8	2.7	2.4	0.62	0.43
WE08MC	621936	1445318	7.8	7.1	3.9	2.5	2.8	2.5	0.53	0.46
WE09MC	621842	1445136	8.7	5.7	4.4	1.9	2.4	2.8	0.29	0.50
WE10MC	621830	1444918	8.8	5.4	4.5	1.7	2.6	2.8	0.27	0.52
WE11M1	621730	1444642	8.7	5.4	4.4	1.6	2.4	2.8	0.24	0.52
WE11M2	621730	1444642	9.0	5.3	4.6	1.7	2.5	2.9	0.20	0.52
WE11M3	621730	1444642	8.8	5.1	4.6	1.5	2.5	2.8	0.20	0.52
WE11MC	621730	1444642	8.9	5.4	4.5	1.6	2.5	2.9	0.20	0.50
					North Traverse					
WN01MC	622318	1450648	6.2	10	3.4	2.6	2.3	2.0	0.75	0.40
WN01MX	622548	1450648	6.4	10	3.5	2.8	2.4	2.1	0.75	0.40
WN02MC	622342	1450612	6.5	11	3.5	2.8	2.4	2.1	0.78	0.40
WN03M1	622424	1450542	7.9	6.1	4.2	2.1	2.2	2.5	0.42	0.50
WN03M2	622424	1450542	7.6	6.6	4.0	2.1	2.4	2.4	0.47	0.49
WN03M3	622424	1450542	7.5	7.4	4.0	2.3	2.2	2.3	0.57	0.46
WN03MC	622424	1450542	7.5	6.4	4.0	2.1	2.3	2.3	0.47	0.48
WN04MC	622512	1450512	8.0	5.9	4.3	1.9	2.4	2.5	0.33	0.49
WN05MC	622642	1445936	8.0	6.0	4.4	2.1	2.3	2.5	0.35	0.50
WN06M1	622448	1445242	7.5	7.1	4.3	2.2	2.2	2.3	0.50	0.48
WN06M2	622448	1445242	7.8	6.4	4.4	2.3	2.4	2.4	0.47	0.50
WN06M3	622448	1445242	7.6	6.6	4.2	2.4	2.4	2.4	0.50	0.48
WN06MC	622448	1445242	7.6	6.2	4.1	2.2	2.2	2.3	0.43	0.49
WN07MC	622618	1445130	7.9	6.0	4.5	1.9	2.2	2.4	0.36	0.52
WN08MC	622712	1444900	7.3	7.6	3.5	2.7	2.3	2.3	0.71	0.41
WN09M1	623518	1443142	6.5	7.4	3.2	4.0	2.8	2.0	1.1	0.38
WN09M3	623518	1443142	5.8	8.2	2.9	4.7	3.0	1.8	1.3	0.34
WN09M3	623518	1443142	5.8	8.0	2.9	4.0	3.1	1.8	1.0	0.34
WN09MC	623512	1443142	6.5	8.6	3.3	4.4	3.2	2.1	1.2	0.38
WN10MC	623700	1443030	6.7	11	3.4	3.2	2.6	2.1	0.78	0.39
WN10MX	625130	1443030	6.8	11	3.4	3.2	2.6	2.1	0.79	0.38

Table A1.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					South Traverse					
WS01MC	622324	1450724	5.5	12	3.0	3.8	2.4	1.8	0.93	0.33
WS01MX	622324	1450724	5.5	11	2.9	3.6	2.4	1.7	0.93	0.34
WS02MC	622312	1450718	6.2	10	3.4	3.7	2.6	2.0	0.92	0.38
WS03M1	622248	1450712	5.7	11	3.1	3.8	2.6	1.8	1.1	0.33
WS03M2	622218	1450712	6.2	12	3.4	2.7	2.5	2.0	0.73	0.37
WS03M3	622248	1450712	6.6	9.6	3.5	3.5	2.5	2.0	0.99	0.37
WS03MC	622248	1450712	6.0	11	3.3	3.2	2.5	1.9	0.88	0.36
WS04MC	622118	1450630	7.9	6.4	4.1	2.2	2.3	2.5	0.40	0.48
WS05MC	621900	1450648	7.8	6.1	3.9	2.1	2.1	2.5	0.40	0.46
WS06M1	621300	1450436	7.7	7.2	3.8	2.3	2.2	2.5	0.46	0.46
WS06M2	621300	1450436	7.8	6.9	3.9	2.1	2.2	2.5	0.42	0.46
WS06M3	621300	1450436	7.8	6.8	3.8	2.3	2.2	2.5	0.46	0.46
WS06MC	621300	1450436	7.9	7.0	3.9	2.3	2.2	2.5	0.43	0.46
WS07MC	621206	1450412	7.0	8.6	3.7	2.8	2.3	2.3	0.74	0.41
WS08MC	621206	1450554	6.6	9.5	3.5	2.9	2.3	2.1	0.90	0.39
WS09M1	621100	1450554	5.8	11	3.2	3.0	2.6	1.8	0.91	0.36
WS09M2	621100	1450354	5.5	11	3.1	3.5	2.4	1.7	1.1	0.35
WS09M3	621100	1450354	6.2	11	3.2	4.1	2.3	2.0	1.2	0.24
WS09MC	621100	1450354	5.7	11	3.1	3.6	2.4	1.8	1.1	0.34
WS10MC	620730	1450318	5.1	13	2.9	3.3	1.8	1.5	1.1	0.32
WS11MC	620112	1445918	5.7	11	3.2	4.4	2.4	1.7	1.4	0.24
WS11MX	620112	1445918	5.6	11	3.2	4.2	2.4	1.7	1.5	0.33

Table A1.--Hyloconium splendens (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					East Traverse				
WE01MC	1600	<4	<20	<20	790	<2	<20	<4	23
WE01MX	1700	<4	<20	<20	810	<2	<20	<4	23
WE02M1	1900	<4	<20	<20	940	<2	<20	<4	21
WE02M2	1300	<4	<20	<20	920	<2	<20	<4	31
WE02M3	1500	<4	<20	<20	850	<2	<20	<4	28
WE02MC	1500	<4	<20	<20	900	<2	<20	<4	29
WE03MC	2900	<4	<20	<20	700	<2	<20	<4	28
WE04MC	1800	<4	<20	<20	610	<2	<20	<4	30
WE05M1	1000	<4	<20	<20	610	<2	<20	<4	32
WE05M2	1200	<4	<20	<20	600	<2	<20	<4	28
WE05M3	1500	<4	<20	<20	620	<2	<20	<4	28
WE05MC	1300	<4	<20	<20	610	<2	<20	<4	32
WE06MC	1100	<4	<20	<20	630	<2	<20	<4	35
WE07MC	2500	<4	<20	<20	570	<2	<20	<4	33
WE08M1	2000	<4	<20	<20	520	<2	<20	<4	27
WE08M2	2600	<4	<20	<20	530	<2	<20	<4	27
WE08M3	3500	<4	<20	<20	530	<2	<20	<4	31
WE08MC	2600	<4	<20	<20	520	<2	<20	<4	31
WE09MC	2800	<4	<20	<20	530	<2	<20	<4	33
WE10MC	2300	<4	<20	<20	520	<2	<20	<4	34
WE11M1	2000	<4	<20	<20	510	<2	<20	<4	29
WE11M2	1800	<4	<20	<20	510	<2	<20	<4	34
WE11M3	1400	<4	<20	<20	500	<2	<20	<4	27
WE11MC	1800	<4	<20	<20	510	<2	<20	<4	33
					North Traverse				
WN01MC	1800	<4	<20	<20	770	<2	<20	<4	24
WN01MX	1800	<4	<20	<20	790	<2	<20	<4	29
WN02MC	1300	<4	<20	<20	870	<2	<20	<4	27
WN03M1	2200	<4	<20	<20	690	<2	<20	<4	36
WN03M2	2100	<4	<20	<20	670	<2	<20	<4	29
WN03M3	2500	<4	<20	<20	750	<2	<20	<4	35
WN03MC	2200	<4	<20	<20	680	<2	<20	<4	28
WN04MC	1900	<4	<20	<20	670	<2	<20	<4	35
WN05MC	2800	<4	<20	<20	710	<2	<20	<4	36
WN06M1	3400	<4	<20	<20	670	<2	<20	<4	39
WN06M2	2900	<4	<20	<20	730	<2	<20	<4	39
WN06M3	3400	<4	<20	<20	680	<2	<20	<4	35
WN06MC	3000	<4	<20	<20	670	<2	<20	<4	33
WN07MC	2700	<4	<20	<20	710	<2	<20	<4	34
WN08MC	5100	<4	<20	<20	680	<2	<20	<4	24
WN09M1	7600	<4	<20	<20	650	<2	<20	<4	23
WN09M3	6300	<4	<20	<20	630	<2	<20	<4	22
WN09M3	6600	<4	<20	<20	640	<2	<20	<4	23
WN09MC	7600	<4	<20	<20	700	<2	<20	<4	30
WN10MC	3000	<4	<20	<20	710	<2	<20	<4	29
WN10MX	3100	<4	<20	<20	730	<2	<20	<4	32

Table A1.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					South Traverse				
WS01MC	1600	<4	<20	<20	810	<2	<20	<4	24
WS01MX	1600	<4	<20	<20	790	<2	<20	<4	20
WS02MC	2800	<4	<20	<20	780	<2	<20	<4	27
WS03M1	1100	<4	<20	<20	1100	<2	<20	<4	26
WS03M2	1500	<4	<20	<20	990	<2	<20	<4	27
WS03M3	3400	<4	<20	<20	880	<2	<20	<4	23
WS03MC	1900	<4	<20	<20	950	<2	<20	<4	29
WS04MC	2500	<4	<20	<20	620	<2	<20	<4	33
WS05MC	1700	<4	<20	<20	640	<2	<20	<4	30
WS06M1	2000	<4	<20	<20	620	<2	<20	<4	30
WS06M2	1800	<4	<20	<20	630	<2	<20	<4	32
WS06M3	1300	<4	<20	<20	620	<2	<20	<4	30
WS06MC	1700	<4	<20	<20	630	<2	<20	<4	32
WS07MC	1900	<4	<20	<20	660	<2	<20	<4	31
WS08MC	2000	<4	<20	<20	790	<2	<20	<4	30
WS09M1	5800	<4	<20	<20	660	<2	<20	<4	23
WS09M2	4800	<4	<20	<20	640	<2	<20	<4	23
WS09M3	4600	<4	<20	<20	1100	<2	<20	<4	28
WS09MC	5300	<4	<20	<20	820	<2	<20	<4	22
WS10MC	8200	<4	<20	<20	1100	<2	<20	<4	21
WS11MC	8100	<4	<20	<20	1100	<2	<20	<4	28
WS11MX	8100	<4	<20	<20	1100	<2	<20	<4	26

Table A1.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co,ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
				East Traverse					
WE01MC	20	74	64	<4	10	<8	10	10	4
WE01MX	20	74	63	<4	10	<8	10	10	4
WE02M1	20	71	61	<4	10	<8	10	10	<4
WE02M2	20	71	58	<4	10	<8	10	10	6
WE02M3	20	77	62	<4	10	<8	10	10	<4
WE02MC	20	76	61	<4	10	<8	10	10	5
WE03MC	21	88	63	<4	20	<8	20	10	<4
WE04MC	21	88	65	<4	20	<8	10	10	<4
WE05M1	20	88	58	<4	20	<8	20	10	<4
WE05M2	20	79	59	<4	20	<8	10	10	5
WE05M3	20	88	57	<4	20	<8	10	10	<4
WE05MC	20	86	56	<4	20	<8	20	10	<4
WE06MC	22	93	57	<4	20	<8	20	10	<4
WE07MC	23	87	62	<4	20	<8	20	10	<4
WE08M1	22	77	63	<4	20	<8	10	10	<4
WE08M2	21	78	72	<4	20	<8	10	10	<4
WE08M3	23	77	76	<4	20	<8	10	10	<4
WE08MC	22	82	69	<4	20	<8	10	10	<4
WE09MC	23	89	63	<4	21	<8	20	10	<4
WE10MC	24	92	63	<4	20	<8	20	10	<4
WE11M1	25	87	60	<4	20	<8	20	10	<4
WE11M2	24	99	61	<4	21	<8	20	10	<4
WE11M3	25	97	59	<4	20	<8	10	10	<4
WE11MC	24	100	61	<4	20	<8	20	10	<4
				North Traverse					
WN01MC	20	73	69	<4	10	<8	10	10	<4
WN01MX	21	77	68	<4	10	<8	10	10	<4
WN02MC	20	76	63	<4	10	<8	10	10	4
WN03M1	22	92	65	<4	20	<8	20	10	<4
WN03M2	21	88	67	<4	20	<8	20	10	<4
WN03M3	21	89	70	<4	20	<8	20	10	<4
WN03MC	21	88	67	<4	20	<8	10	10	<4
WN04MC	22	94	60	<4	20	<8	20	10	<4
WN05MC	21	95	62	<4	20	<8	20	20	<4
WN06M1	23	91	73	<4	20	<8	20	10	<4
WN06M2	23	100	74	<4	20	<8	20	20	<4
WN06M3	22	93	72	<4	20	<8	20	10	<4
WN06MC	21	90	69	<4	20	<8	20	10	<4
WN07MC	24	97	66	<4	20	<8	20	20	<4
WN08MC	20	72	72	<4	20	<8	10	10	<4
WN09M1	20	65	88	<4	20	<8	10	10	7
WN09M3	20	61	92	<4	20	<8	10	10	7
WN09M3	20	59	85	<4	20	<8	10	10	8
WN09MC	21	67	97	<4	22	<8	10	10	10
WN10MC	20	69	91	<4	20	<8	10	10	4
WN10MX	20	73	81	<4	20	<8	10	10	<4

Table A1.--Hylocomium splendens (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co,ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					South Traverse				
WS01MC	20	69	63	<4	10	<8	10	10	<4
WS01MX	20	66	60	<4	10	<8	10	10	<4
WS02MC	20	74	71	<4	20	<8	10	10	5
WS03M1	20	70	67	<4	10	<8	10	10	8
WS03M2	20	75	61	<4	10	<8	10	10	5
WS03M3	20	75	72	<4	10	<8	10	10	<4
WS03MC	20	73	65	<4	10	<8	10	10	7
WS04MC	23	88	61	<4	20	<8	20	10	<4
WS05MC	20	87	59	<4	20	<8	20	10	<4
WS06M1	21	83	65	<4	20	<8	20	10	<4
WS06M2	20	84	57	<4	20	<8	20	10	<4
WS06M3	20	80	60	<4	20	<8	20	10	<4
WS06MC	20	84	60	<4	20	<8	20	10	<4
WS07MC	20	78	64	<4	20	<8	20	10	4
WS08MC	20	72	72	<4	20	<8	20	10	5
WS09M1	20	62	85	<4	20	<8	10	10	<4
WS09M2	20	64	90	<4	20	<8	10	10	<4
WS09M3	20	58	74	<4	20	<8	10	10	<4
WS09MC	20	61	81	<4	20	<8	10	10	<4
WS10MC	20	59	74	<4	20	<8	10	10	<4
WS11MC	20	67	83	<4	21	<8	10	10	<4
WS11MX	20	61	82	<4	20	<8	10	10	<4

Table A1.--Hyloconium splendens (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb,ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					East Traverse					
WE01MC	<8	10	42	22	10	<10	710	<80	<8	<200
WE01MX	<8	10	43	22	10	<10	720	<80	<8	<200
WE02M1	<8	10	43	20	10	<10	760	<80	<8	<200
WE02M2	<8	20	39	10	10	<10	760	<80	<8	<200
WE02M3	<8	20	43	10	10	<10	710	<80	<8	<200
WE02MC	<8	20	44	10	10	<10	750	<80	<8	<200
WE03MC	<8	20	50	10	20	<10	590	<80	<8	<200
WE04MC	<8	20	50	<8	20	<10	610	<80	<8	<200
WE05M1	<8	20	49	<8	20	<10	620	<80	<8	<200
WE05M2	<8	20	46	<8	10	<10	640	<80	<8	<200
WE05M3	<8	10	50	9	20	<10	600	<80	<8	<200
WE05MC	<8	20	48	<8	20	<10	620	<80	<8	<200
WE06MC	<8	20	51	<8	20	<10	660	<80	<8	<200
WE07MC	<8	20	52	<8	20	<10	630	<80	<8	<200
WE08M1	<8	20	52	10	10	<10	700	<80	<8	<200
WE08M2	<8	10	54	10	10	<10	760	<80	<8	<200
WE08M3	<8	20	53	<8	10	<10	710	<80	<8	<200
WE08MC	<8	20	52	8	20	<10	720	<80	<8	<200
WE09MC	<8	20	57	<8	20	<10	640	<80	<8	<200
WE10MC	<8	20	61	<8	20	<10	630	<80	<8	<200
WE11M1	<8	10	60	<8	20	<10	620	<80	<8	<200
WE11M2	<8	20	62	<8	20	<10	620	<80	<8	<200
WE11M3	<8	10	63	8	20	<10	620	<80	<8	<200
WE11MC	<8	20	60	<8	20	<10	630	<80	<8	<200
					North Traverse					
WN01MC	<8	10	44	20	10	<10	720	<80	<8	<200
WN01MX	<8	20	43	20	10	<10	740	<80	<8	<200
WN02MC	<8	20	45	10	10	<10	820	<80	<8	<200
WN03M1	<8	20	50	10	20	<10	580	<80	<8	<200
WN03M2	<8	10	50	20	20	<10	610	<80	<8	<200
WN03M3	<8	20	48	10	20	<10	630	<80	<8	<200
WN03MC	<8	10	50	21	20	<10	590	<80	<8	<200
WN04MC	<8	20	49	10	20	<10	570	<80	<8	<200
WN05MC	<8	20	50	8	20	<10	560	<80	<8	<200
WN06M1	<8	20	52	10	20	<10	530	<80	<8	<200
WN06M2	<8	20	53	10	20	<10	570	<80	<8	<200
WN06M3	<8	20	53	8	20	<10	550	<80	<8	<200
WN06MC	<8	10	53	10	20	<10	540	<80	<8	<200
WN07MC	<8	20	55	10	20	<10	530	<80	<8	<200
WN08MC	<8	10	45	20	10	<10	610	<80	<8	<200
WN09M1	<8	10	42	10	10	<10	590	<80	<8	<200
WN09M3	<8	10	44	10	10	<10	640	<80	<8	<200
WN09M3	<8	10	42	10	10	<10	670	<80	<8	<200
WN09MC	<8	10	45	8	10	<10	690	<80	<8	<200
WN10MC	<8	20	44	10	10	<10	710	<80	<8	<200
WN10MX	<8	21	45	10	10	<10	720	<80	<8	<200

Table A1.--Hyloconium splendens (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb,ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					South Traverse					
WS01MC	<8	20	37	20	10	<10	830	<80	<8	<200
WS01MX	<8	10	37	21	10	<10	800	<80	<8	<200
WS02MC	<8	20	42	8	10	<10	690	<80	<8	<200
WS03M1	<8	20	40	<8	10	<10	870	<80	<8	<200
WS03M2	<8	20	42	10	10	<10	880	<80	<8	<200
WS03M3	<8	10	47	10	10	<10	700	<80	<8	<200
WS03MC	<8	20	42	10	10	<10	790	<80	<8	<200
WS04MC	<8	20	52	<8	20	<10	610	<80	<8	<200
WS05MC	<8	10	53	10	20	<10	610	<80	<8	<200
WS06M1	<8	20	43	<8	20	<10	620	<80	<8	<200
WS06M2	<8	20	44	<8	20	<10	630	<80	<8	<200
WS06M3	<8	20	46	10	20	<10	630	<80	<8	<200
WS06MC	<8	20	44	<8	20	<10	630	<80	<8	<200
WS07MC	<8	20	41	9	10	<10	650	<80	<8	<200
WS08MC	<8	20	35	10	10	<10	680	<80	<8	<200
WS09M1	<8	10	37	10	10	<10	740	<80	<8	<200
WS09M2	<8	10	35	10	10	<10	710	<80	<8	<200
WS09M3	<8	10	33	10	10	<10	910	<80	<8	<200
WS09MC	<8	10	35	10	10	<10	790	<80	<8	<200
WS10MC	<8	10	35	20	10	<10	730	<80	<8	<200
WS11MC	<8	20	37	10	10	<10	700	<80	<8	<200
WS11MX	<8	10	38	20	10	<10	690	<80	<8	<200

Table A1.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	Total S, %*	Ash, %*
				East Traverse			
WE01MC	110	10	<2	280	0.06	0.06	12.7
WE01MX	110	10	<2	290	0.06	0.06	12.3
WE02M1	110	10	<2	300	0.06	0.06	12.3
WE02M2	110	10	<2	370	0.06	0.06	14.7
WE02M3	120	10	<2	380	0.06	0.06	13.8
WE02MC	110	10	<2	350	0.06	0.06	13.9
WE03MC	130	10	2	310	0.06	0.07	16.1
WE04MC	140	10	<2	230	0.06	0.06	18.2
WE05M1	140	10	<2	180	0.06	0.05	20.6
WE05M2	120	10	<2	180	0.04	0.06	19.1
WE05M3	140	10	<2	160	0.06	0.06	26.7
WE05MC	140	10	2	160	0.06	0.06	24.0
WE06MC	140	20	<2	110	0.04	0.05	31.3
WE07MC	140	20	2	210	0.06	0.06	21.6
WE08M1	130	10	<2	200	0.06	0.06	14.7
WE08M2	130	10	<2	290	0.08	0.06	12.8
WE08M3	120	10	<2	240	0.06	0.07	11.6
WE08MC	130	10	<2	230	0.08	0.06	13.2
WE09MC	140	20	2	170	0.08	0.05	23.0
WE10MC	140	20	2	150	0.06	0.06	28.3
WE11M1	140	10	2	160	0.08	0.05	37.6
WE11M2	150	20	2	130	0.08	0.05	36.9
WE11M3	150	10	<2	110	0.06	0.05	39.5
WE11MC	140	20	2	140	0.06	0.05	37.6
				North Traverse			
WN01MC	110	10	<2	250	0.04	0.07	12.7
WN01MX	120	10	<2	260	0.06	0.07	13.1
WN02MC	120	10	<2	240	0.06	0.07	13.2
WN03M1	140	20	<2	220	0.06	0.06	16.4
WN03M2	140	10	<2	210	0.06	0.06	13.9
WN03M3	130	10	<2	300	0.06	0.06	13.6
WN03MC	130	10	<2	230	0.06	0.06	14.3
WN04MC	150	20	2	180	0.06	0.08	23.3
WN05MC	150	20	<2	230	0.06	0.07	22.3
WN06M1	140	20	<2	330	0.08	0.06	14.1
WN06M2	150	20	2	250	0.06	0.06	14.8
WN06M3	140	20	2	240	0.06	0.06	14.3
WN06MC	140	10	2	250	0.08	0.06	16.2
WN07MC	150	20	<2	220	0.10	0.07	21.6
WN08MC	110	10	<2	350	0.08	0.06	10.1
WN09M1	100	10	<2	600	0.08	0.08	7.20
WN09M3	93	10	<2	470	0.06	0.08	6.46
WN09M3	94	10	<2	390	0.06	0.07	6.87
WN09MC	110	10	<2	550	0.06	0.07	6.95
WN10MC	110	10	<2	490	0.06	0.06	8.61
WN10MX	120	10	<2	510	0.04	0.07	8.67

Table A1.--*Hyloconium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	Total S, %*	Ash, %*
				South Traverse			
WS01MC	98	10	<2	350	0.04	0.07	9.21
WS01MX	96	10	<2	330	0.04	0.07	9.23
WS02MC	110	10	<2	310	0.06	0.07	9.73
WS03M1	100	10	<2	460	0.04	0.05	9.48
WS03M2	110	10	<2	430	0.04	0.06	12.2
WS03M3	110	10	<2	370	0.06	0.06	9.41
WS03MC	110	10	<2	410	0.04	0.05	10.6
WS04MC	140	20	<2	200	0.04	0.06	18.2
WS05MC	130	10	2	140	0.04	0.05	20.3
WS06M1	130	10	2	210	0.10	0.06	17.7
WS06M2	130	10	<2	270	0.08	0.06	19.7
WS06M3	130	10	<2	180	0.08	0.06	17.2
WS06MC	130	20	2	220	0.08	0.06	18.6
WS07MC	120	10	<2	210	0.08	0.06	11.4
WS08MC	110	10	<2	250	0.10	0.07	10.8
WS09M1	100	10	<2	350	0.10	0.08	7.31
WS09M2	98	10	<2	380	0.10	0.08	7.94
WS09M3	94	10	<2	320	0.06	0.06	7.70
WS09MC	97	10	<2	350	0.08	0.08	7.35
WS10MC	91	10	<2	410	0.12	0.08	8.72
WS11MC	96	10	<2	360	0.08	0.07	6.79
WS11MX	97	10	<2	350	0.08	0.07	6.90

Table A2.--*Hyloconium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Ash, %	Na, %
					East Traverse				
WE01MC	622330	1450700	0.80	1.21	0.43	0.33	0.30	12.7	0.25
WE01MX	622330	1450700	0.75	1.21	0.41	0.33	0.30	12.3	0.25
WE02M1	622318	1450648	0.75	1.35	0.41	0.32	0.27	12.3	0.23
WE02M2	622530	1450648	0.90	1.62	0.49	0.32	0.32	14.7	0.29
WE02M3	622318	1450648	0.91	1.23	0.50	0.32	0.32	13.8	0.29
WE02MC	622318	1450648	0.89	1.39	0.47	0.33	0.31	13.9	0.28
WE03MC	622248	1450554	1.22	1.09	0.64	0.39	0.35	16.1	0.39
WE04MC	622142	1450430	1.46	1.13	0.75	0.40	0.44	18.2	0.47
WE05M1	622218	1450342	1.63	1.28	0.82	0.41	0.49	20.6	0.54
WE05M2	622218	1450342	1.36	1.36	0.69	0.53	0.50	19.1	0.46
WE05M3	622218	1450342	2.22	1.50	1.09	0.48	0.59	26.7	0.69
WE05MC	622218	1450342	1.92	1.46	0.96	0.50	0.55	24.0	0.62
WE06MC	622054	1445948	2.72	1.88	1.35	0.53	0.69	31.3	0.88
WE07MC	622006	1445630	1.79	1.27	0.91	0.39	0.50	21.6	0.58
WE08M1	621936	1445318	1.16	0.98	0.57	0.32	0.40	14.7	0.37
WE08M2	621936	1445318	1.00	0.95	0.50	0.32	0.36	12.8	0.32
WE08M3	621936	1445318	0.89	0.84	0.44	0.32	0.31	11.6	0.28
WE08MC	621936	1445318	1.03	0.94	0.51	0.33	0.37	13.2	0.33
WE09MC	621842	1445136	2.00	1.31	1.01	0.44	0.55	23.0	0.64
WE10MC	621830	1444918	2.49	1.53	1.27	0.48	0.74	28.3	0.79
WE11M1	621730	1444642	3.27	2.03	1.65	0.60	0.90	37.6	1.05
WE11M2	621730	1444642	3.32	1.96	1.70	0.63	0.92	36.9	1.07
WE11M3	621730	1444642	3.48	2.01	1.82	0.59	0.99	39.5	1.11
WE11MC	621730	1444642	3.35	2.03	1.69	0.60	0.94	37.6	1.09
					North Traverse				
WN01MC	622318	1450648	0.79	1.27	0.43	0.33	0.29	12.7	0.25
WN01MX	622548	1450648	0.84	1.31	0.46	0.37	0.31	13.1	0.28
WN02MC	622342	1450612	0.86	1.45	0.46	0.37	0.32	13.2	0.28
WN03M1	622424	1450542	1.30	1.00	0.69	0.34	0.36	16.4	0.41
WN03M2	622424	1450542	1.06	0.92	0.56	0.29	0.33	13.9	0.33
WN03M3	622424	1450542	1.02	1.01	0.54	0.31	0.30	13.6	0.31
WN03MC	622424	1450542	1.07	0.92	0.57	0.30	0.33	14.3	0.33
WN04MC	622512	1450512	1.86	1.37	1.00	0.44	0.56	23.3	0.58
WN05MC	622642	1445936	1.78	1.34	0.98	0.47	0.51	22.3	0.56
WN06M1	622448	1445242	1.06	1.00	0.61	0.31	0.31	14.1	0.32
WN06M2	622448	1445242	1.15	0.95	0.65	0.34	0.36	14.8	0.36
WN06M3	622448	1445242	1.09	0.94	0.60	0.34	0.34	14.3	0.34
WN06MC	622448	1445242	1.23	1.00	0.66	0.36	0.36	16.2	0.37
WN07MC	622618	1445130	1.71	1.30	0.97	0.41	0.48	21.6	0.52
WN08MC	622712	1444900	0.74	0.77	0.35	0.27	0.23	10.1	0.23
WN09M1	623518	1443142	0.47	0.53	0.23	0.29	0.20	7.20	0.14
WN09M3	623518	1443142	0.37	0.53	0.19	0.30	0.19	6.46	0.12
WN09M3	623518	1443142	0.40	0.55	0.20	0.27	0.21	6.87	0.12
WN09MC	623512	1443142	0.45	0.60	0.23	0.31	0.22	6.95	0.15
WN10MC	623700	1443030	0.58	0.95	0.29	0.28	0.22	8.61	0.18
WN10MX	625130	1443030	0.59	0.95	0.29	0.28	0.23	8.67	0.18

Table A2.--*Hyloconium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Ash, %	Na, %
					South Traverse				
WS01MC	622324	1450724	0.51	1.11	0.28	0.35	0.22	9.21	0.17
WS01MX	622324	1450724	0.51	1.02	0.27	0.33	0.22	9.23	0.16
WS02MC	622312	1450718	0.60	0.97	0.33	0.36	0.25	9.73	0.19
WS03M1	622248	1450712	0.54	1.04	0.29	0.36	0.25	9.48	0.17
WS03M2	622218	1450712	0.76	1.46	0.41	0.33	0.31	12.2	0.24
WS03M3	622248	1450712	0.62	0.90	0.33	0.33	0.24	9.41	0.19
WS03MC	622248	1450712	0.64	1.17	0.35	0.34	0.27	10.6	0.20
WS04MC	622118	1450630	1.44	1.16	0.75	0.40	0.42	18.2	0.46
WS05MC	621900	1450648	1.58	1.24	0.79	0.43	0.43	20.3	0.51
WS06M1	621300	1450436	1.36	1.27	0.67	0.41	0.39	17.7	0.44
WS06M2	621300	1450436	1.54	1.36	0.77	0.41	0.43	19.7	0.49
WS06M3	621300	1450436	1.34	1.17	0.65	0.40	0.38	17.2	0.43
WS06MC	621300	1450436	1.47	1.30	0.73	0.43	0.41	18.6	0.47
WS07MC	621206	1450412	0.80	0.98	0.42	0.32	0.26	11.4	0.26
WS08MC	621206	1450554	0.71	1.03	0.38	0.31	0.25	10.8	0.23
WS09M1	621100	1450554	0.42	0.80	0.23	0.22	0.19	7.31	0.13
WS09M2	621100	1450354	0.44	0.87	0.25	0.28	0.19	7.94	0.13
WS09M3	621100	1450354	0.48	0.85	0.25	0.32	0.18	7.70	0.15
WS09MC	621100	1450354	0.42	0.81	0.23	0.26	0.18	7.35	0.13
WS10MC	620730	1450318	0.44	1.13	0.25	0.29	0.16	8.72	0.13
WS11MC	620112	1445918	0.39	0.75	0.22	0.30	0.16	6.79	0.12
WS11MX	620112	1445918	0.39	0.76	0.22	0.29	0.17	6.90	0.12

Table A2.--*Hyloconium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	P, %	Ti, %	Mn, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm
				East Traverse				
WE01MC	0.10	0.050	203	100	2.9	2.5	9.4	8.1
WE01MX	0.11	0.048	209	100	2.8	2.5	9.1	7.7
WE02M1	0.09	0.047	234	116	2.6	2.5	8.7	7.5
WE02M2	0.10	0.056	191	135	4.6	2.9	10	8.5
WE02M3	0.09	0.058	207	117	3.9	2.8	11	8.6
WE02MC	0.09	0.053	209	125	4.0	2.8	11	8.5
WE03MC	0.08	0.077	467	113	4.5	3.4	14	10
WE04MC	0.07	0.086	328	111	5.5	3.8	16	12
WE05M1	0.07	0.095	206	126	6.6	4.1	18	12
WE05M2	0.10	0.080	229	115	5.3	3.8	15	11
WE05M3	0.09	0.136	401	166	7.5	5.3	24	15
WE05MC	0.08	0.110	312	146	7.7	4.8	21	13
WE06MC	0.08	0.160	344	197	11.0	6.9	29	18
WE07MC	0.07	0.108	540	123	7.1	5.0	19	13
WE08M1	0.07	0.071	294	76	4.0	3.2	11	9.3
WE08M2	0.07	0.060	333	68	3.5	2.7	10	9.2
WE08M3	0.07	0.050	406	61	3.6	2.7	9.9	8.8
WE08MC	0.07	0.061	343	69	4.1	2.9	11	9.1
WE09MC	0.07	0.115	644	122	7.6	5.3	21	15
WE10MC	0.08	0.147	651	147	9.6	6.8	26	18
WE11M1	0.09	0.196	752	192	10.9	9.4	33	23
WE11M2	0.07	0.192	664	188	12.5	8.9	37	23
WE11M3	0.08	0.205	553	198	10.7	9.9	38	23
WE11MC	0.08	0.188	677	192	12.4	9.0	38	23
				North Traverse				
WN01MC	0.10	0.051	229	98	3.0	2.5	9.3	8.8
WN01MX	0.10	0.052	236	103	3.8	2.8	10	8.9
WN02MC	0.10	0.053	172	115	3.6	2.6	10	8.3
WN03M1	0.07	0.082	361	113	5.9	3.6	15	11
WN03M2	0.07	0.068	292	93	4.0	2.9	12	9.3
WN03M3	0.08	0.063	340	102	4.8	2.9	12	9.5
WN03MC	0.07	0.069	315	97	4.0	3.0	13	9.6
WN04MC	0.08	0.114	443	156	8.2	5.1	22	14
WN05MC	0.08	0.112	624	158	8.0	4.7	21	14
WN06M1	0.07	0.068	479	94	5.5	3.2	13	10
WN06M2	0.07	0.074	429	108	5.8	3.4	15	11
WN06M3	0.07	0.069	486	97	5.0	3.1	13	10
WN06MC	0.07	0.079	486	109	5.3	3.4	15	11
WN07MC	0.08	0.112	583	153	7.3	5.2	21	14
WN08MC	0.07	0.041	515	69	2.4	2.0	7.3	7.3
WN09M1	0.08	0.027	547	47	1.7	1.4	4.7	6.3
WN09M3	0.08	0.022	407	41	1.4	1.3	3.9	5.9
WN09M3	0.07	0.023	453	44	1.6	1.4	4.1	5.8
WN09MC	0.08	0.026	528	49	2.1	1.5	4.7	6.7
WN10MC	0.07	0.034	258	61	2.5	1.7	5.9	7.8
WN10MX	0.07	0.033	269	63	2.8	1.7	6.3	7.0

Table A2.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	P, %	Ti, %	Mn, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm
				South Traverse				
WS01MC	0.09	0.030	147	75	2.2	1.8	6.4	5.8
WS01MX	0.09	0.031	148	73	1.8	1.8	6.1	5.5
WS02MC	0.09	0.037	272	76	2.6	1.9	7.2	6.9
WS03M1	0.10	0.031	104	104	2.5	1.9	6.6	6.4
WS03M2	0.09	0.045	183	121	3.3	2.4	9.2	7.4
WS03M3	0.09	0.035	320	83	2.2	1.9	7.1	6.8
WS03MC	0.09	0.038	201	101	3.1	2.1	7.7	6.9
WS04MC	0.07	0.087	455	113	6.0	4.2	16	11
WS05MC	0.08	0.093	345	130	6.1	4.1	18	12
WS06M1	0.08	0.081	354	110	5.3	3.7	15	12
WS06M2	0.08	0.091	355	124	6.3	3.9	17	11
WS06M3	0.08	0.079	224	107	5.2	3.4	14	10
WS06MC	0.08	0.086	316	117	6.0	3.7	16	11
WS07MC	0.08	0.047	217	75	3.5	2.3	8.9	7.3
WS08MC	0.10	0.042	216	85	3.2	2.2	7.8	7.8
WS09M1	0.07	0.026	424	48	1.7	1.5	4.5	6.2
WS09M2	0.09	0.028	381	51	1.8	1.6	5.1	7.1
WS09M3	0.09	0.018	354	85	2.2	1.5	4.5	5.7
WS09MC	0.08	0.025	390	60	1.6	1.5	4.5	6.0
WS10MC	0.10	0.028	715	96	1.8	1.7	5.1	6.5
WS11MC	0.10	0.016	550	75	1.9	1.4	4.5	5.6
WS11MX	0.10	0.023	559	76	1.8	1.4	4.2	5.7

Table A2.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ga, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni,ppm	Pb, ppm	Sc, ppm
				East Traverse				
WE01MC	1.3	1.3	1.3	0.5	1.3	5.3	2.8	1.3
WE01MX	1.2	1.2	1.2	0.5	1.2	5.3	2.7	1.2
WE02M1	1.2	1.2	1.2	0.9	1.2	5.3	2.5	1.2
WE02M2	1.5	1.5	1.5	0.6	2.9	5.7	1.5	1.5
WE02M3	1.4	1.4	1.4	0.7	2.8	5.9	1.4	1.4
WE02MC	1.4	1.4	1.4	<0.5	2.8	6.1	1.4	1.4
WE03MC	3.2	3.2	1.6	<0.5	3.2	8.1	1.6	3.2
WE04MC	3.6	1.8	1.8	<0.5	3.6	9.1	<0.5	3.6
WE05M1	4.1	4.1	2.1	<0.5	4.1	10	<0.5	4.1
WE05M2	3.8	1.9	1.9	1.0	3.8	8.8	<0.5	1.9
WE05M3	5.3	2.7	2.7	<0.5	2.7	14	2.4	5.3
WE05MC	4.8	4.8	2.4	<0.5	4.8	12	<0.5	4.8
WE06MC	6.3	6.3	3.1	<0.5	6.3	16	<0.5	6.3
WE07MC	4.3	4.3	2.2	<0.5	4.3	11	<0.5	4.3
WE08M1	2.9	1.5	1.5	<0.5	2.9	7.6	1.5	1.5
WE08M2	2.6	1.3	1.3	<0.5	1.3	6.9	1.3	1.3
WE08M3	2.3	1.2	1.2	<0.5	2.3	6.1	<0.5	1.2
WE08MC	2.6	1.3	1.3	<0.5	2.6	6.9	1.1	2.6
WE09MC	4.8	4.6	2.3	<0.5	4.6	13	<0.5	4.6
WE10MC	5.7	5.7	2.8	<0.5	5.7	17	<0.5	5.7
WE11M1	7.5	7.5	3.8	<0.5	3.8	23	<0.5	7.5
WE11M2	7.7	7.4	3.7	<0.5	7.4	23	<0.5	7.4
WE11M3	7.9	4.0	4.0	<0.5	4.0	25	3.2	7.9
WE11MC	7.5	7.5	3.8	<0.5	7.5	23	<0.5	7.5
				North Traverse				
WN01MC	1.3	1.3	1.3	<0.5	1.3	5.6	2.5	1.3
WN01MX	1.3	1.3	1.3	<0.5	2.6	5.6	2.6	1.3
WN02MC	1.3	1.3	1.3	0.5	2.6	5.9	1.3	1.3
WN03M1	3.3	3.3	1.6	<0.5	3.3	8.2	1.6	3.3
WN03M2	2.8	2.8	1.4	<0.5	1.4	7.0	2.8	2.8
WN03M3	2.7	2.7	1.4	<0.5	2.7	6.5	1.4	2.7
WN03MC	2.9	1.4	1.4	<0.5	1.4	7.2	3.0	2.9
WN04MC	4.7	4.7	2.3	<0.5	4.7	11	2.3	4.7
WN05MC	4.5	4.5	4.5	<0.5	4.5	11	1.8	4.5
WN06M1	2.8	2.8	1.4	<0.5	2.8	7.3	1.4	2.8
WN06M2	3.0	3.0	3.0	<0.5	3.0	7.8	1.5	3.0
WN06M3	2.9	2.9	1.4	<0.5	2.9	7.6	1.1	2.9
WN06MC	3.2	3.2	1.6	<0.5	1.6	8.6	1.6	3.2
WN07MC	4.3	4.3	4.3	<0.5	4.3	12	2.2	4.3
WN08MC	2.0	1.0	1.0	<0.5	1.0	4.5	2.0	1.0
WN09M1	1.4	0.7	0.7	0.5	0.7	3.0	0.7	0.7
WN09M3	1.3	0.6	0.6	0.5	0.6	2.8	0.6	0.6
WN09M3	1.4	0.7	0.7	0.5	0.7	2.9	0.7	0.7
WN09MC	1.5	0.7	0.7	0.7	0.7	3.1	0.6	0.7
WN10MC	1.7	0.9	0.9	0.3	1.7	3.8	0.9	0.9
WN10MX	1.7	0.9	0.9	<0.5	1.8	3.9	0.9	0.9

Table A2.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ga, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni,ppm	Pb, ppm	Sc, ppm
					South Traverse			
WS01MC	0.9	0.9	0.9	(0.5	1.8	3.4	1.8	0.9
WS01MX	0.9	0.9	0.9	(0.5	0.9	3.4	1.9	0.9
WS02MC	1.9	1.0	1.0	0.5	1.9	4.1	0.8	1.0
WS03M1	0.9	0.9	0.9	0.8	1.9	3.8	(0.5	0.9
WS03M2	1.2	1.2	1.2	0.6	2.4	5.1	1.2	1.2
WS03M3	0.9	0.9	0.9	(0.5	0.9	4.4	0.9	0.9
WS03MC	1.1	1.1	1.1	0.7	2.1	4.5	1.1	1.1
WS04MC	3.6	3.6	1.8	(0.5	3.6	9.5	(0.5	3.6
WS05MC	4.1	4.1	2.0	(0.5	2.0	11	2.0	4.1
WS06M1	3.5	3.5	1.8	(0.5	3.5	7.6	(0.5	3.5
WS06M2	3.9	3.9	2.0	(0.5	3.9	8.7	(0.5	3.9
WS06M3	3.4	3.4	1.7	(0.5	3.4	7.9	1.7	3.4
WS06MC	3.7	3.7	1.9	(0.5	3.7	8.2	(0.5	3.7
WS07MC	2.3	2.3	1.1	0.5	2.3	4.7	1.0	1.1
WS08MC	2.2	2.2	1.1	0.5	2.2	3.8	1.1	1.1
WS09M1	1.5	0.7	0.7	(0.5	0.7	2.7	0.7	0.7
WS09M2	1.6	0.8	0.8	(0.5	0.8	2.8	0.8	0.8
WS09M3	1.5	0.8	0.8	(0.5	0.8	2.5	0.8	0.8
WS09MC	1.5	0.7	0.7	(0.5	0.7	2.6	0.7	0.7
WS10MC	1.7	0.9	0.9	(0.5	0.9	3.1	1.7	0.9
WS11MC	1.4	0.7	0.7	(0.5	1.4	2.5	0.7	0.7
WS11MX	1.4	0.7	0.7	(0.5	0.7	2.6	1.4	0.7

Table A2.--Hyloconium splendens (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Sr, ppm	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm	Total S, %
				East Traverse			
WE01MC	90	14	1.3	<0.2	36	0.06	0.06
WE01MX	89	14	1.2	<0.2	36	0.06	0.06
WE02M1	93	14	1.2	<0.2	37	0.06	0.06
WE02M2	112	16	1.5	<0.2	54	0.06	0.06
WE02M3	98	17	1.4	<0.2	52	0.06	0.06
WE02MC	104	15	1.4	<0.2	49	0.06	0.06
WE03MC	95	21	1.6	0.3	50	0.06	0.07
WE04MC	111	25	1.8	<0.2	42	0.06	0.06
WE05M1	128	29	2.1	<0.2	37	0.06	0.05
WE05M2	122	23	1.9	<0.2	34	0.04	0.06
WE05M3	160	37	2.7	<0.2	43	0.06	0.06
WE05MC	149	34	2.4	0.5	38	0.06	0.06
WE06MC	207	44	6.3	<0.2	34	0.04	0.05
WE07MC	136	30	4.3	0.4	45	0.06	0.06
WE08M1	103	19	1.5	<0.2	29	0.06	0.06
WE08M2	97	17	1.3	<0.2	37	0.08	0.06
WE08M3	82	14	1.2	<0.2	28	0.06	0.07
WE08MC	95	17	1.3	<0.2	30	0.08	0.06
WE09MC	147	32	4.6	0.5	39	0.08	0.05
WE10MC	178	40	5.7	0.6	42	0.06	0.06
WE11M1	233	53	3.8	0.8	60	0.08	0.05
WE11M2	229	55	7.4	0.7	48	0.08	0.05
WE11M3	245	59	4.0	<0.2	43	0.06	0.05
WE11MC	237	53	7.5	0.8	53	0.06	0.05
				North Traverse			
WN01MC	91	14	1.3	<0.2	32	0.04	0.07
WN01MX	97	16	1.3	<0.2	34	0.06	0.07
WN02MC	108	16	1.3	<0.2	32	0.06	0.07
WN03M1	95	23	3.3	<0.2	36	0.06	0.06
WN03M2	85	19	1.4	<0.2	29	0.06	0.06
WN03M3	86	18	1.4	<0.2	41	0.06	0.06
WN03MC	84	19	1.4	<0.2	33	0.06	0.06
WN04MC	133	35	4.7	0.5	42	0.06	0.08
WN05MC	125	33	4.5	<0.2	51	0.06	0.07
WN06M1	75	20	2.8	<0.2	47	0.08	0.06
WN06M2	84	22	3.0	0.3	37	0.06	0.06
WN06M3	79	20	2.9	0.3	34	0.06	0.06
WN06MC	87	23	1.6	0.3	41	0.08	0.06
WN07MC	114	32	4.3	<0.2	48	0.10	0.07
WN08MC	62	11	1.0	<0.2	35	0.08	0.06
WN09M1	42	7	0.7	<0.2	43	0.08	0.08
WN09M3	41	6	0.6	<0.2	30	0.06	0.08
WN09M3	46	6	0.7	<0.2	27	0.06	0.07
WN09MC	48	8	0.7	<0.2	38	0.06	0.07
WN10MC	61	9	0.9	<0.2	42	0.06	0.06
WN10MX	62	10	0.9	<0.2	44	0.04	0.07

Table A2.--*Hylocomium splendens* (feather moss) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Sr, ppm	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm	Total S, %
				South Traverse			
WS01MC	76	9	0.9	<0.2	32	0.04	0.07
WS01MX	74	9	0.9	<0.2	30	0.04	0.07
WS02MC	67	11	1.0	<0.2	30	0.06	0.07
WS03M1	82	9	0.9	<0.2	44	0.04	0.05
WS03M2	107	13	1.2	<0.2	52	0.04	0.06
WS03M3	66	10	0.9	<0.2	35	0.06	0.06
WS03MC	84	12	1.1	<0.2	43	0.04	0.05
WS04MC	111	25	3.6	<0.2	36	0.04	0.06
WS05MC	124	26	2.0	0.4	28	0.04	0.05
WS06M1	110	23	1.8	<0.2	37	0.10	0.06
WS06M2	124	26	2.0	0.4	53	0.08	0.06
WS06M3	108	22	1.7	<0.2	31	0.08	0.06
WS06MC	117	24	3.7	0.4	41	0.08	0.06
WS07MC	74	14	1.1	<0.2	24	0.08	0.06
WS08MC	73	12	1.1	<0.2	27	0.10	0.07
WS09M1	54	7	0.7	<0.2	26	0.10	0.08
WS09M2	56	8	0.8	<0.2	30	0.10	0.08
WS09M3	70	7	0.8	<0.2	25	0.06	0.06
WS09MC	58	7	0.7	<0.2	26	0.08	0.08
WS10MC	64	8	0.9	<0.2	36	0.12	0.08
WS11MC	48	7	0.7	<0.2	24	0.08	0.07
WS11MX	48	7	0.7	<0.2	24	0.08	0.07

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					East Traverse					
WE01LC	622330	1450700	5.36	6.91	3.14	10.6	2.43	1.73	2.75	0.23
WE01LX	622330	1450700	5.50	6.99	3.17	10.8	2.45	1.77	2.79	0.29
WE02L1	622318	1450648	5.07	6.55	2.92	12.9	2.38	1.55	3.40	0.26
WE02L2	622318	1450648	5.22	7.48	2.95	10.1	2.46	1.75	3.25	0.25
WE02L3	622318	1450648	5.57	6.65	3.27	11.4	2.41	1.71	2.53	0.24
WE02LC	622318	1450648	5.29	6.82	3.03	11.0	2.41	1.67	2.94	0.19
WE03LC	622248	1450554	6.91	6.11	3.98	6.9	2.33	2.11	1.36	0.29
WE04LC	622142	1450430	6.97	6.53	4.02	7.1	2.60	2.19	1.16	0.41
WE05L1	622218	1450342	7.00	6.35	4.01	6.9	2.46	2.19	1.08	0.32
WE05L2	622218	1450342	6.11	6.57	3.42	7.1	2.51	2.30	1.24	0.33
WE05L3	622218	1450342	6.83	6.21	4.01	8.2	2.53	2.10	1.58	0.41
WE05LC	622218	1450342	6.68	6.39	3.80	7.2	2.46	2.22	1.27	0.38
WE06LC	622054	1445948	7.38	6.05	4.08	6.6	2.21	2.28	1.40	0.36
WE07LC	622006	1445630	7.11	6.17	3.89	8.4	2.44	2.20	1.60	0.37
WE08L1	621936	1445318	6.48	6.38	3.51	9.4	2.74	2.11	1.75	0.34
WE08L2	621936	1445318	6.92	6.40	3.80	8.5	2.74	2.12	1.68	0.33
WE08L3	621936	1445318	6.76	6.60	3.70	9.6	2.66	2.08	1.59	0.30
WE08LC	621936	1445318	6.62	6.56	3.63	10.0	2.83	2.08	1.83	0.33
WE0PLC	621842	1445136	7.15	6.04	3.94	8.0	2.56	2.18	1.54	0.35
WE10LC	621830	1444918	7.33	6.04	4.11	7.6	2.73	2.25	1.48	0.22
WE11L1	621730	1444642	7.29	5.54	4.02	8.1	2.50	2.24	1.93	0.35
WE11L2	621730	1444642	8.00	5.61	4.48	6.4	2.57	2.46	1.34	0.42
WE11L3	621730	1444642	7.89	5.77	4.46	6.2	2.73	2.42	1.31	0.42
WE11LC	621730	1444642	7.86	5.66	4.42	6.5	2.59	2.42	1.47	0.43
					North Traverse					
WN01LC	622348	1450648	5.59	8.19	3.23	11.1	2.60	1.72	2.70	0.23
WN01LX	622348	1450648	5.47	8.05	3.19	10.9	2.56	1.68	2.68	0.29
WN02LC	622342	1450612	5.24	8.13	2.97	12.1	2.68	1.71	2.85	0.27
WN03L1	622424	1450542	5.93	7.00	3.51	10.8	2.87	1.82	1.72	0.34
WN03L2	622424	1450542	6.36	6.39	3.74	11.1	2.47	1.94	2.10	0.33
WN03L3	622424	1450542	5.87	6.77	3.43	11.8	2.62	1.78	2.09	0.24
WN03LC	622424	1450542	6.13	6.62	3.59	10.8	2.61	1.85	1.88	0.32
WN04LC	622512	1450512	6.79	6.69	3.97	7.4	2.62	2.07	1.61	0.42
WN05LC	622642	1445936	6.71	6.31	3.91	9.3	2.37	2.06	1.65	0.36
WN06L1	622448	1445242	6.64	6.38	4.13	9.6	2.58	1.99	1.94	0.35
WN06L2	622448	1445242	6.99	6.46	4.28	7.6	2.40	2.09	1.38	0.43
WN06L3	622448	1445242	6.65	6.35	4.13	9.0	2.48	2.00	1.55	0.33
WN06LC	622448	1445242	6.71	6.45	4.21	9.1	2.54	2.00	1.70	0.44
WN07LC	622618	1445130	6.85	6.28	4.38	8.3	2.52	2.05	1.35	0.32
WN08LC	622712	1444900	6.07	7.17	3.20	11.5	2.47	1.86	2.15	0.27
WN09L1	623518	1443142	5.98	7.40	3.17	11.3	2.87	1.83	2.09	0.27
WN09L2	623518	1443142	5.05	7.16	2.75	14.0	3.02	1.56	2.71	0.26
WN09L3	623518	1443142	5.50	6.91	2.95	12.7	3.01	1.70	2.76	0.23
WN09LC	623518	1443142	5.49	6.95	2.92	12.0	2.89	1.68	2.37	0.23
WN10LC	623730	1443030	5.83	8.71	3.19	10.8	2.71	1.78	2.03	0.25
WN10LX	623730	1443030	5.75	8.61	3.12	10.8	2.67	1.74	1.95	0.16

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					South Traverse					
WS01LC	622324	1450724	4.78	9.14	2.73	11.1	2.80	1.53	2.15	0.15
WS01LX	622324	1450724	4.89	9.30	2.83	11.3	2.88	1.55	2.21	0.27
WS02LC	622312	1450718	5.40	8.45	3.02	11.1	2.81	1.73	2.23	0.16
WS03L1	622248	1450712	5.22	7.65	2.94	10.4	2.58	1.72	2.97	0.24
WS03L2	622248	1450712	5.46	8.00	3.08	10.7	2.65	1.78	2.10	0.13
WS03L3	622248	1450712	5.52	7.31	3.16	11.6	2.44	1.70	2.64	0.26
WS03LC	622248	1450712	5.33	7.56	2.99	11.1	2.55	1.70	2.59	0.24
WS04LC	622118	1450630	7.60	6.30	4.36	6.7	2.53	2.34	1.11	0.47
WS05LC	621900	1450648	7.09	6.30	4.00	7.2	2.32	2.20	1.32	0.42
WS06L1	621300	1450436	6.82	7.54	3.88	7.4	2.46	2.08	1.41	0.39
WS06L2	621300	1450436	7.00	7.05	3.88	7.1	2.40	2.18	1.40	0.38
WS06L3	621300	1450436	6.62	7.22	3.79	7.6	2.39	2.03	1.45	0.38
WS06LC	621300	1450436	6.93	7.40	3.92	7.4	2.44	2.14	1.43	0.40
WS07LC	621206	1450412	6.47	7.11	3.57	9.5	2.38	2.01	1.96	0.32
WS08LC	621206	1450554	5.72	8.02	3.12	10.8	2.24	1.81	2.25	0.24
WS09L1	621100	1450354	5.32	8.69	3.10	11.4	2.81	1.60	2.45	0.30
WS09L2	621100	1450354	4.81	7.61	2.65	14.8	2.91	1.49	2.83	0.26
WS09L3	621100	1450354	5.65	6.76	2.87	12.8	2.13	1.76	2.79	0.24
WS09LC	621100	1450354	5.43	7.56	2.93	12.1	2.51	1.66	2.50	0.19
WS10LC	620730	1450318	5.14	7.40	2.91	13.4	2.50	1.56	3.39	0.26
WS11LC	620112	1445918	5.43	7.13	3.13	12.2	2.37	1.63	3.15	0.27
WS11LX	620112	1445918	5.46	7.18	3.15	12.3	2.39	1.63	3.17	0.27

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					East Traverse				
WE01LC	1240	<4	<20	<20	605	<2	<20	<4	26
WE01LX	1260	<4	<20	<20	609	<2	<20	<4	27
WE02L1	1810	<4	<20	<20	673	<2	<20	<4	24
WE02L2	850	<4	<20	<20	614	<2	<20	<4	25
WE02L3	1610	<4	<20	<20	742	<2	<20	<4	29
WE02LC	1360	<4	<20	<20	668	<2	<20	<4	25
WE03LC	1910	<4	<20	<20	621	<2	<20	<4	33
WE04LC	1960	<4	<20	<20	565	<2	<20	<4	30
WE05L1	1220	<4	<20	<20	578	<2	<20	<4	30
WE05L2	1000	<4	<20	<20	534	<2	<20	<4	27
WE05L3	1720	<4	<20	<20	574	<2	<20	<4	32
WE05LC	1270	<4	<20	<20	560	<2	<20	<4	31
WE06LC	1250	<4	<20	<20	574	<2	<20	<4	32
WE07LC	3030	<4	<20	<20	516	<2	<20	<4	30
WE08L1	2920	<4	<20	<20	453	<2	<20	<4	26
WE08L2	3610	<4	<20	<20	474	<2	<20	<4	31
WE08L3	4440	<4	<20	<20	479	<2	<20	<4	29
WE08LC	3880	<4	<20	<20	468	<2	<20	<4	33
WE0PLC	3940	<4	<20	<20	461	<2	<20	<4	31
WE10LC	3420	<4	<20	<20	453	<2	<20	<4	32
WE11L1	1950	<4	<20	<20	433	<2	<20	<4	38
WE11L2	2580	<4	<20	<20	475	<2	<20	<4	33
WE11L3	2820	<4	<20	<20	476	<2	<20	<4	35
WE11LC	2410	<4	<20	<20	466	<2	<20	<4	32
					North Traverse				
WN01LC	1420	<4	<20	<20	641	<2	<20	<4	26
WN01LX	1450	<4	<20	<20	632	<2	<20	<4	25
WN02LC	964	<4	<20	<20	628	<2	<20	<4	25
WN03L1	2400	<4	<20	<20	588	<2	<20	<4	30
WN03L2	2730	<4	<20	<20	624	<2	<20	<4	31
WN03L3	2970	<4	<20	<20	587	<2	<20	<4	31
WN03LC	2610	<4	<20	<20	591	<2	<20	<4	29
WN04LC	2520	<4	<20	<20	641	<2	<20	<4	32
WN05LC	2880	<4	<20	<20	616	<2	<20	<4	31
WN06L1	2850	<4	<20	<20	592	<2	<20	<4	33
WN06L2	2800	<4	<20	<20	654	<2	<20	<4	34
WN06L3	2800	<4	<20	<20	607	<2	<20	<4	36
WN06LC	2970	<4	<20	<20	624	<2	<20	<4	35
WN07LC	2840	<4	<20	<20	635	<2	<20	<4	42
WN08LC	4300	<4	<20	<20	569	<2	<20	<4	25
WN09L1	6130	<4	<20	<20	544	<2	<20	<4	25
WN09L2	6290	<4	<20	<20	511	<2	<20	<4	21
WN09L3	6580	<4	<20	<20	533	<2	<20	<4	27
WN09LC	5970	<4	<20	<20	521	<2	<20	<4	25
WN10LC	3530	<4	<20	<20	636	<2	<20	<4	29
WN10LX	3470	<4	<20	<20	634	<2	<20	<4	27

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					South Traverse				
WS01LC	1130	<4	<20	<20	580	<2	<20	<4	23
WS01LX	1140	<4	<20	<20	586	<2	<20	<4	22
WS02LC	2200	<4	<20	<20	650	<2	<20	<4	26
WS03L1	814	<4	<20	<20	717	<2	<20	<4	25
WS03L2	1180	<4	<20	<20	848	<2	<20	<4	26
WS03L3	2990	<4	<20	<20	688	<2	<20	<4	29
WS03LC	1600	<4	<20	<20	753	<2	<20	<4	27
WS04LC	2680	<4	<20	<20	604	<2	<20	<4	33
WS05LC	1850	<4	<20	<20	633	<2	<20	<4	31
WS06L1	2260	<4	<20	<20	612	<2	<20	<4	31
WS06L2	1910	<4	<20	<20	576	<2	<20	<4	35
WS06L3	1770	<4	<20	<20	606	<2	<20	<4	34
WS06LC	2020	<4	<20	<20	607	<2	<20	<4	33
WS07LC	1870	<4	<20	<20	603	<2	<20	<4	27
WS08LC	2200	<4	<20	<20	740	<2	<20	<4	27
WS09L1	5270	<4	<20	<20	614	<2	<20	<4	23
WS09L2	3260	<4	<20	<20	502	<2	<20	<4	22
WS09L3	2350	<4	<20	<20	759	<2	<20	<4	26
WS09LC	3460	<4	<20	<20	635	<2	<20	<4	27
WS10LC	4560	<4	<20	<20	710	<2	<20	<4	25
WS11LC	4940	<4	<20	<20	740	<2	<20	<4	29
WS11LX	4890	<4	<20	<20	743	<2	<20	<4	29

Table A3.--Peltigera apthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					East Traverse				
WE01LC	20	47	114	<4	12	<8	16	12	<4
WE01LX	18	62	111	<4	14	<8	17	11	<4
WE02L1	18	47	117	<4	12	<8	15	11	<4
WE02L2	17	42	96	<4	12	<8	15	11	6
WE02L3	21	58	112	<4	12	<8	18	11	<4
WE02LC	18	41	101	<4	11	<8	16	11	<4
WE03LC	24	51	120	<4	15	<8	21	13	<4
WE04LC	23	57	142	<4	15	<8	19	13	<4
WE05L1	23	51	109	<4	13	<8	19	13	<4
WE05L2	20	47	94	<4	13	<8	16	12	<4
WE05L3	23	69	121	<4	15	<8	21	13	<4
WE05LC	22	54	105	<4	15	<8	19	12	<4
WE06LC	24	55	100	<4	15	<8	21	13	<4
WE07LC	22	59	146	<4	16	<8	19	12	<4
WE08L1	22	49	154	<4	13	<8	17	12	<4
WE08L2	22	52	132	<4	15	<8	19	12	<4
WE08L3	25	48	143	<4	13	<8	19	12	<4
WE08LC	22	65	152	<4	16	<8	19	12	<4
WE0PLC	24	48	149	<4	15	<8	19	12	<4
WE10LC	26	49	141	<4	16	<8	20	12	<4
WE11L1	24	64	115	<4	17	<8	19	11	<4
WE11L2	27	76	121	<4	16	<8	21	12	<4
WE11L3	26	61	115	<4	17	<8	21	12	<4
WE11LC	26	63	117	<4	18	<8	20	12	<4
					North Traverse				
WN01LC	20	46	121	<4	11	<8	17	12	<4
WN01LX	19	65	121	<4	12	<8	17	11	<4
WN02LC	20	58	113	<4	12	<8	16	11	<4
WN03L1	21	64	165	<4	13	<8	17	12	<4
WN03L2	23	52	134	<4	15	<8	20	13	<4
WN03L3	22	43	155	<4	14	<8	18	12	<4
WN03LC	22	48	147	<4	13	<8	18	12	<4
WN04LC	23	72	134	<4	17	<8	19	13	<4
WN05LC	23	59	128	<4	15	<8	20	13	<4
WN06L1	26	56	139	<4	15	<8	22	14	<4
WN06L2	24	61	141	<4	14	<8	21	13	<4
WN06L3	25	54	147	<4	15	<8	22	13	<4
WN06LC	25	62	148	<4	13	<8	22	14	<4
WN07LC	27	56	152	<4	15	<8	24	14	<4
WN08LC	19	59	153	<4	15	<8	17	11	4
WN09L1	19	54	146	<4	14	<8	17	11	<4
WN09L2	17	42	165	<4	11	<8	15	9	9
WN09L3	21	47	152	<4	14	<8	16	11	9
WN09LC	20	41	149	<4	13	<8	16	10	5
WN10LC	20	44	146	<4	13	<8	18	11	<4
WN10LX	20	42	148	<4	12	<8	18	11	<4

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					South Traverse				
WS01LC	18	37	114	<4	11	<8	15	11	<4
WS01LX	19	39	127	<4	10	<8	16	11	<4
WS02LC	19	41	120	<4	12	<8	16	11	<4
WS03L1	17	41	96	<4	11	<8	16	11	14
WS03L2	18	41	107	<4	12	<8	16	11	<4
WS03L3	18	60	123	<4	13	<8	17	12	<4
WS03LC	16	59	112	<4	13	<8	17	11	8
WS04LC	26	59	122	<4	18	<8	20	14	<4
WS05LC	23	55	137	<4	16	<8	19	15	<4
WS06L1	26	69	138	<4	16	<8	20	14	<4
WS06L2	21	50	122	<4	16	<8	20	14	<4
WS06L3	24	67	147	<4	13	<8	21	14	<4
WS06LC	24	53	135	<4	15	<8	21	14	<4
WS07LC	21	61	141	<4	14	<8	19	13	<4
WS08LC	18	40	138	<4	12	<8	18	12	<4
WS09L1	18	40	188	<4	13	<8	17	11	<4
WS09L2	17	46	165	<4	12	<8	15	11	<4
WS09L3	18	39	118	<4	13	<8	16	12	<4
WS09LC	16	34	142	<4	12	<8	17	11	<4
WS10LC	19	38	125	<4	11	<8	17	12	<4
WS11LC	19	43	130	<4	14	<8	18	12	<4
WS11LX	19	37	128	<4	14	<8	19	12	<4

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					East Traverse					
WE01LC	<8	16	52	19	12	<20	512	<80	<8	<200
WE01LX	<8	15	49	19	12	<20	520	<80	<8	<200
WE02L1	<8	14	37	12	11	<20	507	<80	<8	<200
WE02L2	<8	14	35	15	11	<20	551	<80	<8	<200
WE02L3	<8	17	39	17	12	<20	532	<80	<8	<200
WE02LC	<8	15	38	11	11	<20	527	<80	<8	<200
WE03LC	<8	20	51	8	15	<20	526	<80	<8	<200
WE04LC	<8	19	58	10	15	<20	557	<80	<8	<200
WE05L1	<8	17	53	<8	15	<20	550	<80	<8	<200
WE05L2	<8	15	48	<8	13	<20	527	<80	<8	<200
WE05L3	<8	21	55	10	15	<20	505	<80	<8	<200
WE05LC	<8	19	47	<8	14	<20	533	<80	<8	<200
WE06LC	<8	21	56	<8	15	<20	568	<80	<8	<200
WE07LC	<8	20	50	<8	14	<20	551	<80	<8	<200
WE08L1	<8	16	57	9	12	<20	576	<80	<8	<200
WE08L2	<8	19	52	9	14	<20	606	<80	<8	<200
WE08L3	<8	15	55	8	13	<20	591	<80	<8	<200
WE08LC	<8	17	56	12	13	<20	596	<80	<8	<200
WE0PLC	<8	20	64	<8	14	<20	549	<80	<8	<200
WE10LC	<8	19	69	11	14	<20	560	<80	<8	<200
WE11L1	<8	18	56	<8	14	<20	544	<80	<8	<200
WE11L2	<8	21	77	<8	15	<20	566	<80	<8	<200
WE11L3	<8	23	71	9	16	<20	570	<80	<8	<200
WE11LC	<8	21	62	<8	16	<20	566	<80	<8	<200
					North Traverse					
WN01LC	<8	16	43	16	12	<20	569	<80	<8	<200
WN01LX	<8	15	44	17	12	<20	558	<80	<8	<200
WN02LC	<8	16	42	10	11	<20	599	<80	<8	<200
WN03L1	<8	17	48	15	13	<20	523	<80	<8	<200
WN03L2	<8	20	51	12	14	<20	507	<80	<8	<200
WN03L3	<8	20	49	15	13	<20	492	<80	<8	<200
WN03LC	<8	17	50	14	13	<20	505	<80	<8	<200
WN04LC	<8	19	58	11	15	<20	503	<80	<8	<200
WN05LC	<8	20	49	10	15	<20	497	<80	<8	<200
WN06L1	<8	21	57	12	15	<20	492	<80	<8	<200
WN06L2	<8	22	65	9	16	<20	522	<80	<8	<200
WN06L3	<8	19	60	10	15	<20	493	<80	<8	<200
WN06LC	<8	25	63	9	16	<20	502	<80	<8	<200
WN07LC	<8	26	63	10	16	<20	471	<80	8	<200
WN08LC	<8	17	51	9	11	<20	520	<80	<8	<200
WN09L1	<8	17	49	11	11	<20	541	<80	<8	<200
WN09L2	<8	11	46	10	10	<20	505	<80	<8	<200
WN09L3	<8	15	46	12	13	<20	498	<80	<8	<200
WN09LC	<8	14	47	11	11	<20	508	<80	<8	<200
WN10LC	<8	14	56	14	12	<20	554	<80	<8	<200
WN10LX	<8	14	53	13	11	<20	548	<80	<8	<200

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					South Traverse					
WS01LC	<8	15	45	17	10	<20	614	<80	<8	<200
WS01LX	<8	12	35	19	10	<20	620	<80	<8	<200
WS02LC	<8	14	42	12	11	<20	559	<80	<8	<200
WS03L1	<8	13	43	9	11	<20	592	<80	<8	<200
WS03L2	<8	17	41	12	12	<20	676	<80	<8	<200
WS03L3	<8	15	46	11	12	<20	503	<80	<8	<200
WS03LC	<8	14	41	12	11	<20	587	<80	<8	<200
WS04LC	<8	22	58	9	16	<20	559	<80	<8	<200
WS05LC	<8	18	51	<8	15	<20	543	<80	<8	<200
WS06L1	<8	20	50	11	15	<20	562	<80	<8	<200
WS06L2	<8	23	50	12	14	<20	544	<80	<8	<200
WS06L3	<8	20	52	12	14	<20	540	<80	<8	<200
WS06LC	<8	21	49	11	15	<20	557	<80	<8	<200
WS07LC	<8	18	54	10	13	<20	533	<80	<8	<200
WS08LC	<8	13	43	11	11	<20	580	<80	<8	<200
WS09L1	<8	19	38	13	11	<20	524	<80	<8	<200
WS09L2	<8	14	33	15	9	<20	485	<80	<8	<200
WS09L3	<8	16	24	12	10	<20	589	<80	<8	<200
WS09LC	<8	15	33	11	10	<20	540	<80	<8	<200
WS10LC	<8	15	31	12	10	<20	506	<80	<8	<200
WS11LC	<8	16	34	13	11	<20	498	<80	<8	<200
WS11LX	<8	16	36	12	11	<20	500	<80	<8	<200

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	Total S, %*	Ash, %*
				East Traverse			
WE01LC	96	12	<2	443	0.08	0.07	5.99
WE01LX	98	13	<2	445	0.07	0.07	5.96
WE02L1	90	11	<2	545	0.12	0.09	5.71
WE02L2	92	12	<2	497	0.11	0.07	5.85
WE02L3	101	13	<2	549	0.06	0.07	5.23
WE02LC	94	12	<2	465	0.11	0.07	5.68
WE03LC	123	16	<2	444	0.09	0.10	8.30
WE04LC	124	15	2	490	0.06	0.08	7.50
WE05L1	127	15	<2	342	0.06	0.08	8.65
WE05L2	107	13	<2	300	0.06	0.08	10.0
WE05L3	129	16	2	403	0.05	0.08	7.09
WE05LC	119	15	<2	335	0.06	0.08	8.98
WE06LC	130	17	<2	239	0.09	0.07	9.38
WE07LC	121	16	<2	569	0.06	0.09	6.97
WE08L1	106	14	<2	497	0.08	0.07	5.62
WE08L2	113	15	<2	751	0.10	0.09	6.67
WE08L3	111	15	<2	608	0.06	0.08	5.44
WE08LC	110	15	<2	658	0.09	0.08	5.46
WE0PLC	119	17	<2	509	0.07	0.08	6.62
WE10LC	122	17	<2	546	0.11	0.08	7.82
WE11L1	121	18	2	341	0.08	0.07	8.12
WE11L2	134	18	2	353	0.09	0.07	8.78
WE11L3	133	19	2	300	0.10	0.06	8.68
WE11LC	131	18	<2	321	0.11	0.07	9.21
				North Traverse			
WN01LC	100	12	<2	475	0.08	0.09	5.92
WN01LX	100	12	<2	514	0.07	0.09	6.00
WN02LC	92	12	<2	375	0.07	0.09	5.60
WN03L1	110	13	<2	531	0.07	0.09	5.73
WN03L2	118	15	<2	552	0.08	0.08	5.96
WN03L3	107	15	<2	521	0.04	0.08	4.66
WN03LC	112	14	<2	513	0.04	0.08	5.50
WN04LC	125	15	<2	533	0.09	0.09	7.84
WN05LC	123	16	<2	465	0.08	0.08	6.97
WN06L1	130	17	<2	570	0.11	0.09	5.35
WN06L2	134	16	<2	540	0.12	0.08	7.73
WN06L3	129	17	<2	508	0.06	0.08	6.21
WN06LC	132	17	<2	572	0.07	0.08	6.22
WN07LC	138	18	2	437	0.08	0.08	6.45
WN08LC	97	13	<2	717	0.11	0.08	4.63
WN09L1	96	12	<2	921	0.08	0.10	4.66
WN09L2	82	10	<2	1040	0.10	0.09	3.75
WN09L3	89	11	<2	957	0.09	0.09	3.99
WN09LC	89	12	<2	938	0.07	0.09	4.18
WN10LC	96	13	<2	1010	0.11	0.09	4.54
WN10LX	94	13	<2	962	0.11	0.09	4.56

Table A3.--Peltigera aphthosa (lichen) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	Total S, %*	Ash, %*
				South Traverse			
WS01LC	83	10	<2	491	0.06	0.09	5.69
WS01LX	87	10	<2	514	0.09	0.09	5.58
WS02LC	93	12	<2	514	0.07	0.08	5.82
WS03L1	89	12	<2	575	0.08	0.07	6.61
WS03L2	95	12	<2	554	0.09	0.07	7.10
WS03L3	96	12	<2	496	0.06	0.07	5.71
WS03LC	93	12	<2	576	0.08	0.07	6.19
WS04LC	134	16	<2	382	0.08	0.07	8.50
WS05LC	127	16	<2	290	0.08	0.08	7.88
WS06L1	123	17	<2	537	0.10	0.10	7.81
WS06L2	122	16	<2	459	0.09	0.07	7.38
WS06L3	120	16	2	500	0.12	0.09	6.78
WS06LC	123	16	<2	504	0.10	0.09	7.29
WS07LC	109	15	<2	454	0.11	0.08	5.90
WS08LC	93	13	<2	510	0.11	0.08	5.29
WS09L1	93	12	<2	788	0.12	0.11	4.42
WS09L2	77	11	<2	631	0.12	0.10	4.24
WS09L3	81	13	<2	400	0.10	0.08	5.36
WS09LC	84	12	<2	548	0.06	0.09	4.99
WS10LC	84	13	<2	638	0.12	0.08	4.36
WS11LC	91	14	<2	546	0.12	0.08	4.50
WS11LX	91	14	2	535	0.09	0.08	4.60

Table A4.--Peltigera aphthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	Ash, %
				East Traverse					
WE01LC	622330	1450700	0.321	0.414	0.188	0.635	0.146	0.104	5.99
WE01LX	622330	1450700	0.328	0.417	0.189	0.644	0.146	0.105	5.96
WE02L1	622318	1450648	0.289	0.374	0.167	0.737	0.136	0.089	5.71
WE02L2	622318	1450648	0.305	0.438	0.173	0.591	0.144	0.102	5.85
WE02L3	622318	1450648	0.291	0.348	0.171	0.596	0.126	0.089	5.23
WE02LC	622318	1450648	0.300	0.387	0.172	0.625	0.137	0.095	5.68
WE03LC	622248	1450554	0.574	0.507	0.330	0.573	0.193	0.175	8.30
WE04LC	622142	1450430	0.523	0.490	0.302	0.533	0.195	0.164	7.50
WE05L1	622218	1450342	0.606	0.549	0.347	0.597	0.213	0.189	8.65
WE05L2	622218	1450342	0.611	0.657	0.342	0.710	0.251	0.230	10.0
WE05L3	622218	1450342	0.484	0.440	0.284	0.581	0.179	0.149	7.09
WE05LC	622218	1450342	0.600	0.574	0.341	0.647	0.221	0.199	8.98
WE06LC	622054	1445948	0.692	0.567	0.383	0.619	0.207	0.214	9.38
WE07LC	622006	1445630	0.496	0.430	0.271	0.585	0.170	0.153	6.97
WE08L1	621936	1445318	0.364	0.359	0.197	0.528	0.154	0.119	5.62
WE08L2	621936	1445318	0.462	0.427	0.253	0.567	0.183	0.141	6.67
WE08L3	621936	1445318	0.368	0.359	0.201	0.522	0.145	0.113	5.44
WE08LC	621936	1445318	0.361	0.358	0.198	0.546	0.155	0.114	5.46
WE0PLC	621842	1445136	0.473	0.400	0.261	0.530	0.169	0.144	6.62
WE10LC	621830	1444918	0.573	0.472	0.321	0.594	0.213	0.176	7.82
WE11L1	621730	1444642	0.592	0.450	0.326	0.658	0.203	0.182	8.12
WE11L2	621730	1444642	0.702	0.493	0.393	0.562	0.226	0.216	8.78
WE11L3	621730	1444642	0.685	0.501	0.387	0.538	0.237	0.210	8.68
WE11LC	621730	1444642	0.724	0.521	0.407	0.599	0.239	0.223	9.21
				North Traverse					
WN01LC	622348	1450648	0.331	0.485	0.191	0.657	0.154	0.102	5.92
WN01LX	622348	1450648	0.328	0.483	0.191	0.654	0.154	0.101	6.00
WN02LC	622342	1450612	0.293	0.455	0.166	0.678	0.150	0.096	5.60
WN03L1	622424	1450542	0.340	0.401	0.201	0.619	0.164	0.104	5.73
WN03L2	622424	1450542	0.379	0.381	0.223	0.662	0.147	0.116	5.96
WN03L3	622424	1450542	0.274	0.315	0.160	0.550	0.122	0.083	4.66
WN03LC	622424	1450542	0.337	0.364	0.197	0.594	0.144	0.102	5.50
WN04LC	622512	1450512	0.532	0.524	0.311	0.580	0.205	0.162	7.84
WN05LC	622642	1445936	0.468	0.440	0.273	0.648	0.165	0.144	6.97
WN06L1	622448	1445242	0.355	0.341	0.221	0.514	0.138	0.106	5.35
WN06L2	622448	1445242	0.540	0.499	0.331	0.587	0.186	0.162	7.73
WN06L3	622448	1445242	0.413	0.394	0.256	0.559	0.154	0.124	6.21
WN06LC	622448	1445242	0.417	0.401	0.262	0.566	0.158	0.124	6.22
WN07LC	622618	1445130	0.442	0.405	0.283	0.535	0.163	0.132	6.45
WN08LC	622712	1444900	0.281	0.332	0.148	0.532	0.114	0.086	4.63
WN09L1	623518	1443142	0.279	0.345	0.148	0.527	0.134	0.085	4.66
WN09L2	623518	1443142	0.189	0.269	0.103	0.525	0.113	0.059	3.75
WN09L3	623518	1443142	0.219	0.276	0.118	0.507	0.120	0.068	3.99
WN09LC	623518	1443142	0.229	0.291	0.122	0.502	0.121	0.070	4.18
WN10LC	623730	1443030	0.265	0.395	0.145	0.490	0.123	0.081	4.54
WN10LX	623730	1443030	0.262	0.393	0.142	0.492	0.122	0.079	4.56

Table A4.--Peltigera aphthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Latitude	Longitude	Al, %	Ca,%	Fe, %	K, %	Mg, %	Na, %	Ash, %
					South Traverse				
WS01LC	622324	1450724	0.272	0.520	0.155	0.632	0.159	0.087	5.69
WS01LX	622324	1450724	0.273	0.519	0.158	0.631	0.161	0.086	5.58
WS02LC	622312	1450718	0.314	0.492	0.176	0.646	0.164	0.101	5.82
WS03L1	622248	1450712	0.345	0.506	0.194	0.687	0.171	0.114	6.61
WS03L2	622248	1450712	0.388	0.568	0.219	0.760	0.188	0.126	7.10
WS03L3	622248	1450712	0.315	0.417	0.180	0.662	0.139	0.097	5.71
WS03LC	622248	1450712	0.330	0.468	0.185	0.687	0.158	0.105	6.19
WS04LC	622118	1450630	0.646	0.536	0.371	0.570	0.215	0.199	8.50
WS05LC	621900	1450648	0.559	0.496	0.315	0.567	0.183	0.173	7.88
WS06L1	621300	1450436	0.533	0.589	0.303	0.578	0.192	0.162	7.81
WS06L2	621300	1450436	0.517	0.520	0.286	0.524	0.177	0.161	7.38
WS06L3	621300	1450436	0.449	0.490	0.257	0.515	0.162	0.138	6.78
WS06LC	621300	1450436	0.505	0.539	0.286	0.539	0.178	0.156	7.29
WS07LC	621206	1450412	0.382	0.419	0.211	0.561	0.140	0.119	5.90
WS08LC	621206	1450554	0.303	0.424	0.165	0.571	0.118	0.096	5.29
WS09L1	621100	1450354	0.235	0.384	0.137	0.504	0.124	0.071	4.42
WS09L2	621100	1450354	0.204	0.323	0.112	0.628	0.123	0.063	4.24
WS09L3	621100	1450354	0.303	0.362	0.154	0.686	0.114	0.094	5.36
WS09LC	621100	1450354	0.271	0.377	0.146	0.604	0.125	0.083	4.99
WS10LC	620730	1450318	0.224	0.323	0.127	0.584	0.109	0.068	4.36
WS11LC	620112	1445918	0.244	0.321	0.141	0.549	0.107	0.073	4.50
WS11LX	620112	1445918	0.251	0.330	0.145	0.566	0.110	0.075	4.60

Table A4.--Peltigera aphthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	P, %	Ti, %	Mn, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm
				East Traverse				
WE01LC	0.165	0.014	74	36	1.6	1.2	2.8	6.8
WE01LX	0.166	0.017	75	36	1.6	1.1	3.7	6.6
WE02L1	0.194	0.015	103	38	1.4	1.0	2.7	6.7
WE02L2	0.190	0.015	50	36	1.5	1.0	2.5	5.6
WE02L3	0.132	0.013	84	39	1.5	1.1	3.0	5.9
WE02LC	0.167	0.011	77	38	1.4	1.0	2.3	5.7
WE03LC	0.113	0.024	159	52	2.7	2.0	4.2	10
WE04LC	0.087	0.031	147	42	2.3	1.7	4.3	11
WE05L1	0.093	0.028	106	50	2.6	2.0	4.4	9.4
WE05L2	0.124	0.033	100	53	2.7	2.0	4.7	9.4
WE05L3	0.112	0.029	122	41	2.3	1.6	4.9	8.6
WE05LC	0.114	0.034	114	50	2.8	2.0	4.8	9.4
WE06LC	0.131	0.034	117	54	3.0	2.3	5.2	9.4
WE07LC	0.112	0.026	211	36	2.1	1.5	4.1	10
WE08L1	0.098	0.019	164	25	1.5	1.2	2.8	8.7
WE08L2	0.112	0.022	241	32	2.1	1.5	3.5	8.8
WE08L3	0.086	0.016	242	26	1.6	1.4	2.6	7.8
WE08LC	0.100	0.018	212	26	1.8	1.2	3.5	8.3
WE0PLC	0.102	0.023	261	31	2.1	1.6	3.2	9.9
WE10LC	0.116	0.017	267	35	2.5	2.0	3.8	11
WE11L1	0.157	0.028	158	35	3.1	1.9	5.2	9.3
WE11L2	0.118	0.037	227	42	2.9	2.4	6.7	11
WE11L3	0.114	0.036	245	41	3.0	2.3	5.3	10
WE11LC	0.135	0.040	222	43	2.9	2.4	5.8	11
				North Traverse				
WN01LC	0.160	0.014	84	38	1.5	1.2	2.7	7.2
WN01LX	0.161	0.017	87	38	1.5	1.1	3.9	7.3
WN02LC	0.160	0.015	54	35	1.4	1.1	3.2	6.3
WN03L1	0.099	0.019	138	34	1.7	1.2	3.7	9.5
WN03L2	0.125	0.020	163	37	1.8	1.4	3.1	8.0
WN03L3	0.097	0.011	138	27	1.4	1.0	2.0	7.2
WN03LC	0.103	0.018	144	33	1.6	1.2	2.6	8.1
WN04LC	0.126	0.033	198	50	2.5	1.8	5.6	11
WN05LC	0.115	0.025	201	43	2.2	1.6	4.1	8.9
WN06L1	0.104	0.019	152	32	1.8	1.4	3.0	7.4
WN06L2	0.107	0.033	216	51	2.6	1.9	4.7	11
WN06L3	0.096	0.020	174	38	2.2	1.6	3.4	9.1
WN06LC	0.106	0.027	185	39	2.2	1.6	3.9	9.2
WN07LC	0.087	0.021	183	41	2.7	1.7	3.6	9.8
WN08LC	0.100	0.013	199	26	1.2	0.9	2.7	7.1
WN09L1	0.097	0.013	286	25	1.2	0.9	2.5	6.8
WN09L2	0.102	0.010	236	19	0.8	0.6	1.6	6.2
WN09L3	0.110	0.009	263	21	1.1	0.8	1.9	6.1
WN09LC	0.099	0.010	250	22	1.0	0.8	1.7	6.2
WN10LC	0.092	0.011	160	29	1.3	0.9	2.0	6.6
WN10LX	0.089	0.007	158	29	1.2	0.9	1.9	6.7

Table A4.--Peltigera apthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	P, %	Ti, %	Mn, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm
				South Traverse				
WS01LC	0.122	0.009	64	33	1.3	1.0	2.1	6.5
WS01LX	0.123	0.015	64	33	1.2	1.1	2.2	7.1
WS02LC	0.130	0.009	128	38	1.5	1.1	2.4	7.0
WS03L1	0.196	0.016	54	47	1.7	1.1	2.7	6.3
WS03L2	0.149	0.009	84	60	1.8	1.3	2.9	7.6
WS03L3	0.151	0.015	171	39	1.7	1.0	3.4	7.0
WS03LC	0.160	0.015	99	47	1.7	1.0	3.7	6.9
WS04LC	0.094	0.040	228	51	2.8	2.2	5.0	10
WS05LC	0.104	0.033	146	50	2.4	1.8	4.3	11
WS06L1	0.110	0.030	177	48	2.4	2.0	5.4	11
WS06L2	0.103	0.028	141	43	2.6	1.5	3.7	9.0
WS06L3	0.098	0.026	120	41	2.3	1.6	4.5	10
WS06LC	0.104	0.029	147	44	2.4	1.7	3.9	9.8
WS07LC	0.116	0.019	110	36	1.6	1.2	3.6	8.3
WS08LC	0.119	0.013	116	39	1.4	1.0	2.1	7.3
WS09L1	0.108	0.013	233	27	1.0	0.8	1.8	8.3
WS09L2	0.120	0.011	138	21	0.9	0.7	2.0	7.0
WS09L3	0.150	0.013	126	41	1.4	1.0	2.1	6.3
WS09LC	0.125	0.009	173	32	1.3	0.8	1.7	7.1
WS10LC	0.148	0.011	199	31	1.1	0.8	1.7	5.5
WS11LC	0.142	0.012	222	33	1.3	0.9	1.9	5.9
WS11LX	0.146	0.012	225	34	1.3	0.9	1.7	5.9

Table A4.--Peltigera apthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ga, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm
				East Traverse				
WE01LC	0.7	1.0	0.7	<0.5	1.0	3.1	1.1	0.7
WE01LX	0.8	1.0	0.7	<0.5	0.9	2.9	1.1	0.7
WE02L1	0.7	0.9	0.6	<0.5	0.8	2.1	0.7	0.6
WE02L2	0.7	0.9	0.6	0.4	0.8	2.0	0.9	0.6
WE02L3	0.6	0.9	0.6	<0.5	0.9	2.0	0.9	0.6
WE02LC	0.6	0.9	0.6	<0.5	0.9	2.2	0.6	0.6
WE03LC	1.2	1.7	1.1	<0.5	1.7	4.2	0.7	1.2
WE04LC	1.1	1.4	1.0	<0.5	1.4	4.4	0.8	1.1
WE05L1	1.1	1.6	1.1	<0.5	1.5	4.6	<0.5	1.3
WE05L2	1.3	1.6	1.2	<0.5	1.5	4.8	<0.5	1.3
WE05L3	1.1	1.5	0.9	<0.5	1.5	3.9	0.7	1.1
WE05LC	1.3	1.7	1.1	<0.5	1.7	4.2	<0.5	1.3
WE06LC	1.4	2.0	1.2	<0.5	2.0	5.3	<0.5	1.4
WE07LC	1.1	1.3	0.8	<0.5	1.4	3.5	<0.5	1.0
WE08L1	0.7	1.0	0.7	<0.5	0.9	3.2	0.5	0.7
WE08L2	1.0	1.3	0.8	<0.5	1.3	3.5	0.6	0.9
WE08L3	0.7	1.0	0.7	<0.5	0.8	3.0	0.4	0.7
WE08LC	0.9	1.0	0.7	<0.5	0.9	3.1	0.7	0.7
WE0PLC	1.0	1.3	0.8	<0.5	1.3	4.2	<0.5	0.9
WE10LC	1.3	1.6	0.9	<0.5	1.5	5.4	0.9	1.1
WE11L1	1.4	1.5	0.9	<0.5	1.5	4.5	<0.5	1.1
WE11L2	1.4	1.8	1.1	<0.5	1.8	6.8	<0.5	1.3
WE11L3	1.5	1.8	1.0	<0.5	2.0	6.2	0.8	1.4
WE11LC	1.7	1.8	1.1	<0.5	1.9	5.7	<0.5	1.5
				North Traverse				
WN01LC	0.7	1.0	0.7	<0.5	0.9	2.5	0.9	0.7
WN01LX	0.7	1.0	0.7	<0.5	0.9	2.6	1.0	0.7
WN02LC	0.7	0.9	0.6	<0.5	0.9	2.4	0.6	0.6
WN03L1	0.7	1.0	0.7	<0.5	1.0	2.8	0.9	0.7
WN03L2	0.9	1.2	0.8	<0.5	1.2	3.0	0.7	0.8
WN03L3	0.7	0.8	0.6	<0.5	0.9	2.3	0.7	0.6
WN03LC	0.7	1.0	0.7	<0.5	0.9	2.8	0.8	0.7
WN04LC	1.3	1.5	1.0	<0.5	1.5	4.5	0.9	1.2
WN05LC	1.0	1.4	0.9	<0.5	1.4	3.4	0.7	1.0
WN06L1	0.8	1.2	0.7	<0.5	1.1	3.0	0.6	0.8
WN06L2	1.1	1.6	1.0	<0.5	1.7	5.0	0.7	1.2
WN06L3	0.9	1.4	0.8	<0.5	1.2	3.7	0.6	0.9
WN06LC	0.8	1.4	0.9	<0.5	1.6	3.9	0.6	1.0
WN07LC	1.0	1.5	0.9	<0.5	1.7	4.1	0.6	1.0
WN08LC	0.7	0.8	0.5	0.2	0.8	2.4	0.4	0.5
WN09L1	0.7	0.8	0.5	<0.5	0.8	2.3	0.5	0.5
WN09L2	0.4	0.6	0.3	0.3	0.4	1.7	0.4	0.4
WN09L3	0.6	0.6	0.4	0.4	0.6	1.8	0.5	0.5
WN09LC	0.5	0.7	0.4	0.2	0.6	2.0	0.5	0.5
WN10LC	0.6	0.8	0.5	<0.5	0.6	2.5	0.6	0.5
WN10LX	0.5	0.8	0.5	<0.5	0.6	2.4	0.6	0.5

Table A4.--Peltigera aphthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ga, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm
				South Traverse				
WS01LC	0.6	0.9	0.6	<0.5	0.9	2.6	1.0	0.6
WS01LX	0.6	0.9	0.6	<0.5	0.7	2.0	1.1	0.6
WS02LC	0.7	0.9	0.6	<0.5	0.8	2.4	0.7	0.6
WS03L1	0.7	1.1	0.7	0.9	0.9	2.8	0.6	0.7
WS03L2	0.9	1.1	0.8	<0.5	1.2	2.9	0.9	0.9
WS03L3	0.7	1.0	0.7	<0.5	0.9	2.6	0.6	0.7
WS03LC	0.8	1.1	0.7	0.5	0.9	2.5	0.7	0.7
WS04LC	1.5	1.7	1.2	<0.5	1.9	4.9	0.8	1.4
WS05LC	1.3	1.5	1.2	<0.5	1.4	4.0	<0.5	1.2
WS06L1	1.2	1.6	1.1	<0.5	1.6	3.9	0.9	1.2
WS06L2	1.2	1.5	1.0	<0.5	1.7	3.7	0.9	1.0
WS06L3	0.9	1.4	0.9	<0.5	1.4	3.5	0.8	0.9
WS06LC	1.1	1.5	1.0	<0.5	1.5	3.6	0.8	1.1
WS07LC	0.8	1.1	0.8	<0.5	1.1	3.2	0.6	0.8
WS08LC	0.6	1.0	0.6	<0.5	0.7	2.3	0.6	0.6
WS09L1	0.6	0.8	0.5	<0.5	0.8	1.7	0.6	0.5
WS09L2	0.5	0.6	0.5	<0.5	0.6	1.4	0.6	0.4
WS09L3	0.7	0.9	0.6	<0.5	0.9	1.3	0.6	0.5
WS09LC	0.6	0.8	0.5	<0.5	0.7	1.6	0.5	0.5
WS10LC	0.5	0.7	0.5	<0.5	0.7	1.4	0.5	0.4
WS11LC	0.6	0.8	0.5	<0.5	0.7	1.5	0.6	0.5
WS11LX	0.6	0.9	0.6	<0.5	0.7	1.7	0.6	0.5

Table A4.--Peltigera aphthosa lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Sr, ppm	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm	Total S, %
			East Traverse				
WE01LC	31	5.8	0.7	<0.1	27	0.08	0.07
WE01LX	31	5.8	0.8	<0.1	27	0.07	0.07
WE02L1	29	5.1	0.6	<0.1	31	0.12	0.09
WE02L2	32	5.4	0.7	<0.1	29	0.11	0.07
WE02L3	28	5.3	0.7	<0.1	29	0.06	0.07
WE02LC	30	5.3	0.7	<0.1	26	0.11	0.07
WE03LC	44	10	1.3	<0.1	37	0.09	0.10
WE04LC	42	9.3	1.1	0.2	37	0.06	0.08
WE05L1	48	11	1.3	<0.1	30	0.06	0.08
WE05L2	53	11	1.3	<0.1	30	0.06	0.08
WE05L3	36	9.1	1.1	0.1	29	0.05	0.08
WE05LC	48	11	1.3	<0.1	30	0.06	0.08
WE06LC	53	12	1.6	<0.1	22	0.09	0.07
WE07LC	38	8.4	1.1	<0.1	40	0.06	0.09
WE08L1	32	6.0	0.8	<0.1	28	0.08	0.07
WE08L2	40	7.5	1.0	<0.1	50	0.10	0.09
WE08L3	32	6.0	0.8	<0.1	33	0.06	0.08
WE08LC	33	6.0	0.8	<0.1	36	0.09	0.08
WE09LC	36	7.9	1.1	<0.1	34	0.07	0.08
WE10LC	44	9.5	1.3	<0.1	43	0.11	0.08
WE11L1	44	9.8	1.5	0.2	28	0.08	0.07
WE11L2	50	12	1.6	0.2	31	0.09	0.07
WE11L3	49	12	1.6	0.2	26	0.10	0.06
WE11LC	52	12	1.7	<0.1	30	0.11	0.07
			North Traverse				
WN01LC	34	5.9	0.7	<0.1	28	0.08	0.09
WN01LX	33	6.0	0.7	<0.1	31	0.07	0.09
WN02LC	34	5.2	0.7	<0.1	21	0.07	0.09
WN03L1	30	6.3	0.7	<0.1	30	0.07	0.09
WN03L2	30	7.0	0.9	<0.1	33	0.08	0.08
WN03L3	23	5.0	0.7	<0.1	24	0.04	0.08
WN03LC	28	6.2	0.8	<0.1	28	0.04	0.08
WN04LC	39	9.8	1.2	<0.1	42	0.09	0.09
WN05LC	35	8.6	1.1	<0.1	32	0.08	0.08
WN06L1	26	7.0	0.9	<0.1	30	0.11	0.09
WN06L2	40	10	1.2	<0.1	42	0.12	0.08
WN06L3	31	8.0	1.1	<0.1	32	0.06	0.08
WN06LC	31	8.2	1.1	<0.1	36	0.07	0.08
WN07LC	30	8.9	1.2	0.1	28	0.08	0.08
WN08LC	24	4.5	0.6	<0.1	33	0.11	0.08
WN09L1	25	4.5	0.6	<0.1	43	0.08	0.10
WN09L2	19	3.1	0.4	<0.1	39	0.10	0.09
WN09L3	20	3.6	0.4	<0.1	38	0.09	0.09
WN09LC	21	3.7	0.5	<0.1	39	0.07	0.09
WN10LC	25	4.4	0.6	<0.1	46	0.11	0.09
WN10LX	25	4.3	0.6	<0.1	44	0.11	0.09

Table A4.--*Peltigera aphthosa* lichen analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Sr, ppm	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm	Total S, %
				South Traverse			
WS01LC	35	4.7	0.6	<0.1	28	0.06	0.09
WS01LX	35	4.9	0.6	<0.1	29	0.09	0.09
WS02LC	33	5.4	0.7	<0.1	30	0.07	0.08
WS03L1	39	5.9	0.8	<0.1	38	0.08	0.07
WS03L2	48	6.7	0.9	<0.1	39	0.09	0.07
WS03L3	29	5.5	0.7	<0.1	28	0.06	0.07
WS03LC	36	5.8	0.7	<0.1	36	0.08	0.07
WS04LC	48	11	1.4	<0.1	32	0.08	0.07
WS05LC	43	10	1.3	<0.1	23	0.08	0.08
WS06L1	44	9.6	1.3	<0.1	42	0.10	0.10
WS06L2	40	9.0	1.2	<0.1	34	0.09	0.07
WS06L3	37	8.1	1.1	0.1	34	0.12	0.09
WS06LC	41	9.0	1.2	<0.1	37	0.10	0.09
WS07LC	31	6.4	0.9	<0.1	27	0.11	0.08
WS08LC	31	4.9	0.7	<0.1	27	0.11	0.08
WS09L1	23	4.1	0.5	<0.1	35	0.12	0.11
WS09L2	21	3.3	0.5	<0.1	27	0.12	0.10
WS09L3	32	4.3	0.7	<0.1	21	0.10	0.08
WS09LC	27	4.2	0.6	<0.1	27	0.06	0.09
WS10LC	22	3.7	0.6	<0.1	28	0.12	0.08
WS11LC	22	4.1	0.6	<0.1	25	0.12	0.08
WS11LX	23	4.2	0.6	0.1	25	0.09	0.08

Table A5.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					East Traverse					
WE01SP1	622330	1450700	0.79	17	0.55	11	2.1	0.28	2.6	0.05
WE01SP1X	622330	1450700	0.73	17	0.50	11	2.1	0.27	2.6	0.05
WE02SP	622318	1450648	0.64	18	0.40	11	1.7	0.22	2.3	0.04
WE03SP	622248	1450554	2.0	20	1.2	9.3	2.5	0.67	2.2	0.10
WE04SP	622142	1450430	0.85	20	0.58	14	3.5	0.35	2.5	0.05
WE05SP	622218	1450342	1.5	19	0.99	11	3.5	0.55	3.2	0.07
WE06SP	622054	1445948	2.5	18	1.5	9.1	2.3	0.87	2.5	0.20
WE07SP	622024	1445830	1.5	19	0.88	10	2.1	0.51	2.2	0.10
WE08SP	621936	1445318	1.2	21	0.80	9.6	2.5	0.46	2.4	0.07
WE09SP	621842	1445136	1.2	22	0.76	11	2.3	0.45	2.3	0.05
WE10SP	621830	1444918	1.5	20	0.92	9.3	2.2	0.55	2.1	0.10
WE10SP2	621830	1444918	0.94	18	0.60	6.8	1.9	0.33	1.4	0.07
WE11SP	621730	1444042	1.3	17	0.58	14	2.5	0.47	3.2	0.05
WE11SPX	621830	1444642	1.2	17	0.74	13	2.5	0.45	3.8	0.07
					North Traverse					
WN01SP	622348	1450648	0.83	18	0.53	15	2.4	0.31	3.4	0.05
WN01SPX	622348	1450648	0.81	17	0.55	15	2.3	0.30	3.4	0.05
WN02SP	622342	1450612	0.67	17	0.41	14	2.3	0.25	3.3	0.04
WN03SP	622424	1450542	1.5	20	1.0	10	3.4	0.53	2.5	0.10
WN04SP	622512	1450512	0.74	21	0.50	9.5	2.8	0.29	1.9	0.05
WN05SP	622642	1445936	1.7	19	1.1	11	2.5	0.58	2.3	0.10
WN06SP	622448	1445242	1.9	20	1.3	8.2	2.5	0.65	1.6	0.10
WN07SP	622618	1445130	1.5	19	1.0	8.6	2.4	0.52	2.1	0.10
WN08SP	622712	1444900	0.92	22	0.58	9.7	2.2	0.34	2.1	0.05
WN09SP	623518	1443142	0.72	18	0.52	16	2.6	0.27	2.8	0.05
WN10SP	623730	1443030	0.90	24	0.58	8.6	2.0	0.33	1.8	0.05
WN10SPX	623730	1443030	0.91	25	0.62	8.9	2.1	0.33	1.9	0.06
					South Traverse					
WS01SP	622324	1450724	0.61	19	0.46	14	2.0	0.22	2.8	0.04
WS01SPX	622324	1450724	0.61	19	0.45	14	2.0	0.22	2.7	0.04
WS02SP	621024	1450718	0.78	18	0.54	12	2.2	0.29	2.7	0.05
WS03SP	622248	1450712	0.69	17	0.48	13	2.3	0.26	3.3	0.05
WS04SP1	622118	1450630	1.8	19	1.1	10	2.0	0.63	2.0	0.10
WS04SP2	622118	1450630	1.1	18	0.75	12	2.3	0.39	2.2	0.06
WS04SP3	622118	1450630	1.0	21	0.67	9.5	2.1	0.37	1.8	0.05
WS06SP	621300	1450436	1.5	22	0.97	8.9	1.3	0.51	1.8	0.10
WS07SP	621206	1450412	0.91	20	0.64	13	2.4	0.33	3.2	0.06
WS08SP	621206	1450554	0.79	21	0.49	9.9	1.9	0.29	2.2	0.04
WS09SP	621100	1440354	0.46	21	0.20	15	2.6	0.20	1.7	0.02
WS10SP	620730	1450318	0.54	21	0.20	10	1.9	0.20	1.9	0.03

Table A5.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					East Traverse				
WE01SP1	3400	<4	<20	<20	1800	<2	<20	<4	<8
WE01SP1X	2800	<4	<20	<20	1800	<2	<20	<4	<8
WE02SP	2600	<4	<20	<20	2200	<2	<20	<4	<8
WE03SP	15000	<4	<20	<20	820	<2	<20	<4	9
WE04SP	19000	<4	<20	<20	1000	<2	<20	<4	<8
WE05SP	6500	<4	<20	<20	1300	<2	<20	<4	<8
WE06SP	14000	<4	<20	<20	1100	<2	<20	<4	10
WE07SP	29000	<4	<20	<20	470	<2	<20	<4	9
WE08SP	14000	<4	<20	<20	460	<2	<20	<4	<8
WE09SP	30000	<4	<20	<20	320	<2	<20	<4	<8
WE10SP	31000	<4	<20	<20	240	<2	<20	<4	<8
WE10SP2	6300	<4	<20	<20	140	<2	<20	<4	<8
WE11SP	14000	<4	<20	<20	240	<2	<20	<4	<8
WE11SPX	21000	<4	<20	<20	230	<2	<20	<4	<8
					North Traverse				
WN01SP	2800	<4	<20	<20	1400	<2	<20	<4	<8
WN01SPX	3800	<4	<20	<20	1400	<2	<20	<4	<8
WN02SP	1100	<4	<20	<20	2300	<2	<20	<4	<8
WN03SP	14000	<4	<20	<20	1000	<2	<20	<4	9
WN04SP	13000	<4	<20	<20	1100	<2	<20	<4	<8
WN05SP	26000	<4	<20	<20	730	<2	<20	<4	10
WN06SP	18000	<4	<20	<20	650	<2	<20	<4	10
WN07SP	23000	<4	<20	<20	810	<2	<20	<4	<8
WN08SP	27000	<4	<20	<20	650	<2	<20	<4	<8
WN09SP	30000	<4	<20	<20	500	<2	<20	<4	<8
WN10SP	15000	<4	<20	<20	1200	<2	<20	<4	<8
WN10SPX	16000	<4	<20	<20	1200	<2	<20	<4	<8
					South Traverse				
WS01SP	2500	<4	<20	<20	1400	<2	<20	<4	<8
WS01SPX	2200	<4	<20	<20	1400	<2	<20	<4	<8
WS02SP	2400	<4	<20	<20	1700	<2	<20	<4	<8
WS03SP	2100	<4	<20	<20	2700	<2	<20	<4	<8
WS04SP1	25000	<4	<20	<20	1400	<2	<20	<4	9
WS04SP2	24000	<4	<20	<20	920	<2	<20	<4	<8
WS04SP3	26000	<4	<20	<20	700	<2	<20	<4	<8
WS06SP	18000	<4	<20	<20	900	<2	<20	<4	<8
WS07SP	20000	<4	<20	<20	760	<2	<20	<4	<8
WS08SP	6000	<4	<20	<20	830	<2	<20	<4	<8
WS09SP	13000	<4	<20	<20	670	<2	<20	<4	<8
WS10SP	5300	<4	<20	<20	1200	<2	<20	<4	<8

Table A5.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co, ppm	Cr,ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					East Traverse				
WE01SP1	5	20	39	<4	<8	<8	<4	5	<4
WE01SP1X	5	20	40	<4	<8	<8	<4	5	<4
WE02SP	6	10	39	<4	<8	<8	<4	<4	<4
WE03SP	9	55	60	<4	22	<8	6	10	<4
WE04SP	5	27	73	<4	28	<8	4	10	<4
WE05SP	7	37	52	<4	10	<8	6	10	<4
WE06SP	9	66	65	<4	22	<8	8	9	<4
WE07SP	6	50	66	<4	36	<8	6	8	<4
WE08SP	5	35	56	<4	20	<8	5	7	<4
WE09SP	6	41	62	<4	36	<8	5	6	<4
WE10SP	6	51	62	<4	39	<8	5	7	<4
WE10SP2	5	22	43	<4	10	<8	<4	5	<4
WE11SP	7	26	69	<4	20	<8	4	5	<4
WE11SPX	7	34	73	<4	26	<8	4	6	4
					North Traverse				
WN01SP	6	21	63	<4	<8	<8	4	4	<4
WN01SPX	5	20	59	<4	<8	<8	<4	4	<4
WN02SP	5	20	53	<4	<8	<8	4	4	<4
WN03SP	7	42	67	<4	20	<8	5	10	<4
WN04SP	6	21	57	<4	20	<8	4	9	<4
WN05SP	9	49	69	<4	34	<8	6	10	<4
WN06SP	8	63	61	<4	23	<8	7	10	<4
WN07SP	7	50	55	<4	29	<8	6	20	<4
WN08SP	6	28	63	<4	34	<8	4	5	<4
WN09SP	4	24	63	<4	32	<8	<4	5	5
WN10SP	6	25	53	<4	20	<8	4	5	<4
WN10SPX	5	27	53	<4	25	<8	4	5	<4
					South Traverse				
WS01SP	6	20	59	<4	<8	<8	<4	4	<4
WS01SPX	5	20	57	<4	<8	<8	<4	4	<4
WS02SP	6	21	45	<4	<8	<8	<4	6	6
WS03SP	5	20	47	<4	<8	<8	<4	5	8
WS04SP1	7	48	68	<4	32	<8	6	10	<4
WS04SP2	7	30	61	<4	29	<8	5	8	<4
WS04SP3	6	30	50	<4	33	<8	4	10	<4
WS06SP	8	38	48	<4	25	<8	5	9	<4
WS07SP	5	28	59	<4	30	<8	5	6	<4
WS08SP	5	20	47	<4	10	<8	<4	5	<4
WS09SP	4	10	71	<4	10	<8	<4	<4	<4
WS10SP	5	10	51	<4	<8	<8	<4	<4	<4

Table A5.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					East Traverse					
WE01SP1	<8	<8	20	<8	<4	<10	1100	<80	<8	<200
WE01SP1X	<8	<8	20	<8	<4	<10	1100	<80	<8	<200
WE02SP	<8	<8	21	<8	<4	<10	1300	<80	<8	<200
WE03SP	<8	<8	39	<8	5	<10	580	<80	<8	<200
WE04SP	<8	<8	26	<8	<4	<10	1100	<80	<8	<200
WE05SP	<8	<8	29	<8	<4	<10	1200	<80	<8	<200
WE06SP	<8	9	46	<8	6	<10	900	<80	<8	<200
WE07SP	<8	<8	44	<8	<4	<10	750	<80	8	<200
WE08SP	<8	<8	51	<8	<4	<10	1700	<80	<8	<200
WE09SP	<8	<8	30	<8	<4	<10	970	<80	10	<200
WE10SP	<8	10	42	<8	<4	<10	930	<80	10	<200
WE10SP2	<8	<8	26	<8	<4	<10	950	<80	<8	<200
WE11SP	<8	<8	50	<8	<4	<10	710	<80	<8	<200
WE11SPX	<8	<8	48	<8	<4	<10	710	<80	<8	<200
					North Traverse					
WN01SP	<8	<8	20	<8	<4	<10	1200	<80	<8	<200
WN01SPX	<8	<8	20	<8	<4	<10	1200	<80	<8	<200
WN02SP	<8	<8	20	<8	<4	<10	1400	<80	<8	<200
WN03SP	<8	10	28	<8	<4	<10	930	<80	<8	<200
WN04SP	<8	<8	20	<8	<4	<10	730	<80	<8	<200
WN05SP	<8	<8	32	<8	4	<10	490	<80	10	<200
WN06SP	<8	10	41	<8	5	<10	530	<80	<8	<200
WN07SP	<8	<8	34	<8	<4	<10	530	<80	9	<200
WN08SP	<8	<8	20	<8	<4	<10	620	<80	<8	<200
WN09SP	<8	<8	20	<8	<4	<10	730	<80	10	<200
WN10SP	<8	<8	20	<8	<4	<10	940	<80	<8	<200
WN10SPX	<8	8	20	<8	<4	<10	960	<80	<8	<200
					South Traverse					
WS01SP	<8	<8	38	<8	<4	<10	1300	<80	<8	<200
WS01SPX	<8	<8	10	<8	<4	<10	1300	<80	<8	<200
WS02SP	<8	<8	21	<8	<4	<10	1300	<80	<8	<200
WS03SP	<8	<8	20	<8	<4	<10	1500	<80	<8	<200
WS04SP1	<8	<8	31	<8	<4	<10	820	<80	8	<200
WS04SP2	<8	<8	26	<8	<4	<10	730	<80	<8	<200
WS04SP3	<8	<8	23	<8	<4	<10	610	<80	<8	<200
WS06SP	<8	<8	23	<8	<4	<10	720	<80	<8	<200
WS07SP	<8	<8	21	<8	<4	<10	680	<80	<8	<200
WS08SP	<8	<8	20	<8	<4	<10	860	<80	<8	<200
WS09SP	<8	<8	10	<8	<4	<10	1100	<80	<8	<200
WS10SP	<8	<8	20	<8	<4	<10	1100	<80	<8	<200

Table A5.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	Total S, %*	Ash, %*
				East Traverse			
WE01SP1	20	<4	<2	970	0.04	0.06	4.94
WE01SP1X	10	<4	<2	970	0.02	0.06	4.83
WE02SP	10	<4	<2	940	0.07	0.06	5.12
WE03SP	39	4	<2	1700	0.03	0.05	4.15
WE04SP	20	<4	<2	2300	0.02	0.06	2.95
WE05SP	32	<4	<2	2000	0.03	0.05	3.60
WE06SP	51	6	<2	1200	0.02	0.05	3.96
WE07SP	26	4	<2	2100	0.02	0.06	3.70
WE08SP	22	<4	<2	1800	0.03	0.05	3.26
WE09SP	20	<4	<2	1600	0.03	0.05	3.77
WE10SP	26	4	<2	1900	0.02	0.05	3.31
WE10SP2	20	<4	<2	1200	0.02	0.07	5.41
WE11SP	20	<4	<2	1500	<0.01	0.06	3.18
WE11SPX	20	<4	<2	1500	0.02	0.07	3.21
				North Traverse			
WN01SP	10	<4	<2	1300	0.02	0.06	3.81
WN01SPX	20	<4	<2	1300	0.02	0.06	3.98
WN02SP	8	<4	<2	910	0.02	0.08	5.52
WN03SP	31	<4	<2	2200	0.02	<0.05	2.56
WN04SP	10	<4	<2	1900	0.02	0.06	3.73
WN05SP	32	4	<2	2000	0.02	0.06	3.82
WN06SP	39	5	<2	1700	0.03	0.05	3.84
WN07SP	32	4	<2	2100	0.02	0.07	3.93
WN08SP	20	<4	<2	2200	0.03	0.06	3.15
WN09SP	10	<4	<2	2700	0.02	0.06	2.48
WN10SP	20	<4	<2	2700	0.02	0.06	3.82
WN10SPX	20	<4	<2	2700	0.03	0.06	3.64
				South Traverse			
WS01SP	10	<4	<2	1000	0.02	0.07	4.42
WS01SPX	10	<4	<2	1000	0.05	0.07	4.20
WS02SP	10	<4	<2	1100	0.02	0.06	4.55
WS03SP	10	<4	<2	1400	0.02	0.06	4.46
WS04SP1	32	4	<2	1900	0.02	0.05	3.92
WS04SP2	21	<4	<2	1700	0.03	0.07	3.68
WS04SP3	20	<4	<2	1700	0.02	0.06	4.07
WS06SP	28	<4	<2	1900	0.03	0.05	4.82
WS07SP	20	<4	<2	1500	0.03	0.06	3.24
WS08SP	10	<4	<2	1600	0.02	0.05	3.84
WS09SP	7	<4	<2	2100	0.02	0.07	2.72
WS10SP	7	<4	<2	800	0.06	0.07	4.48

Table A6.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %
					East Traverse				
WE01SP1	622330	1450700	0.039	0.84	0.027	0.54	0.104	0.014	0.128
WE01SP1X	622330	1450700	0.035	0.82	0.024	0.53	0.101	0.013	0.126
WE02SP	622318	1450648	0.033	0.92	0.020	0.56	0.087	0.011	0.118
WE03SP	622248	1450554	0.083	0.83	0.050	0.39	0.104	0.028	0.091
WE04SP	622142	1450430	0.025	0.59	0.017	0.41	0.103	0.010	0.074
WE05SP	622218	1450342	0.054	0.68	0.036	0.40	0.126	0.020	0.115
WE06SP	622054	1445948	0.099	0.71	0.059	0.36	0.091	0.034	0.099
WE07SP	622024	1445830	0.056	0.70	0.033	0.37	0.078	0.019	0.081
WE08SP	621936	1445318	0.039	0.68	0.026	0.31	0.082	0.015	0.078
WE09SP	621842	1445136	0.045	0.83	0.029	0.41	0.087	0.017	0.087
WE10SP	621830	1444918	0.050	0.66	0.030	0.31	0.073	0.018	0.070
WE10SP2	621830	1444918	0.051	0.97	0.032	0.37	0.103	0.018	0.076
WE11SP	621730	1444042	0.041	0.54	0.018	0.45	0.080	0.015	0.102
WE11SPX	621830	1444642	0.039	0.55	0.024	0.42	0.080	0.014	0.122
					North Traverse				
WN01SP	622348	1450648	0.032	0.69	0.020	0.57	0.091	0.012	0.130
WN01SPX	622348	1450648	0.032	0.68	0.022	0.60	0.092	0.012	0.135
WN02SP	622342	1450612	0.037	0.94	0.023	0.77	0.127	0.014	0.182
WN03SP	622424	1450542	0.038	0.51	0.026	0.26	0.087	0.014	0.064
WN04SP	622512	1450512	0.028	0.78	0.019	0.35	0.104	0.011	0.071
WN05SP	622642	1445936	0.065	0.73	0.042	0.42	0.096	0.022	0.088
WN06SP	622448	1445242	0.073	0.77	0.050	0.31	0.096	0.025	0.061
WN07SP	622618	1445130	0.059	0.75	0.039	0.34	0.094	0.020	0.083
WN08SP	622712	1444900	0.029	0.59	0.018	0.31	0.069	0.011	0.066
WN09SP	623518	1443142	0.018	0.45	0.013	0.40	0.064	0.007	0.069
WN10SP	623730	1443030	0.034	0.92	0.022	0.33	0.076	0.013	0.069
WN10SPX	623730	1443030	0.033	0.91	0.023	0.32	0.076	0.012	0.069
					South Traverse				
WS01SP	622324	1450724	0.027	0.84	0.020	0.62	0.088	0.010	0.124
WS01SPX	622324	1450724	0.026	0.80	0.019	0.59	0.084	0.009	0.113
WS02SP	621024	1450718	0.035	0.82	0.025	0.55	0.100	0.013	0.123
WS03SP	622248	1450712	0.031	0.76	0.021	0.58	0.103	0.012	0.147
WS04SP1	622118	1450630	0.071	0.74	0.043	0.39	0.078	0.025	0.078
WS04SP2	622118	1450630	0.040	0.66	0.028	0.44	0.085	0.014	0.081
WS04SP3	622118	1450630	0.041	0.85	0.027	0.39	0.085	0.015	0.073
WS06SP	621300	1450436	0.072	1.06	0.047	0.43	0.063	0.025	0.087
WS07SP	621206	1450412	0.029	0.65	0.021	0.42	0.078	0.011	0.104
WS08SP	621206	1450554	0.030	0.81	0.019	0.38	0.073	0.011	0.084
WS09SP	621100	1440354	0.013	0.57	0.005	0.41	0.071	0.005	0.046
WS10SP	620730	1450318	0.024	0.94	0.009	0.45	0.085	0.009	0.085

Table A6.-- Picea glauca (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ti, %	Mn, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm
				East Traverse				
WE01SP1	0.002	168	89	<0.4	0.2	1.0	1.9	<0.4
WE01SP1X	0.002	135	87	<0.4	0.2	1.0	1.9	<0.4
WE02SP	0.002	133	113	<0.4	0.3	0.5	2.0	<0.4
WE03SP	0.004	623	34	0.4	0.4	2.3	2.5	0.9
WE04SP	0.001	561	30	<0.4	0.1	0.8	2.2	0.8
WE05SP	0.003	234	47	<0.4	0.3	1.3	1.9	0.4
WE06SP	0.008	554	44	0.4	0.4	2.6	2.6	0.9
WE07SP	0.004	1073	17	0.3	0.2	1.9	2.4	1.3
WE08SP	0.002	456	15	<0.4	0.2	1.1	1.8	0.7
WE09SP	0.002	1131	12	0.0	0.2	1.5	2.3	1.4
WE10SP	0.003	1026	8	<0.4	0.2	1.7	2.1	1.3
WE10SP2	0.004	341	8	<0.4	0.3	1.2	2.3	0.5
WE11SP	0.002	445	8	<0.4	0.2	0.8	2.2	0.6
WE11SPX	0.002	674	7	<0.4	0.2	1.1	2.3	0.8
				North Traverse				
WN01SP	0.002	107	53	<0.4	0.2	0.8	2.4	<0.4
WN01SPX	0.002	151	56	<0.4	0.2	0.8	2.3	<0.4
WN02SP	0.002	61	127	<0.4	0.3	1.1	2.9	<0.4
WN03SP	0.003	358	26	0.2	0.2	1.1	1.7	0.5
WN04SP	0.002	485	41	<0.4	0.2	0.8	2.1	0.7
WN05SP	0.004	993	28	0.4	0.3	1.9	2.6	1.3
WN06SP	0.004	691	25	0.4	0.3	2.4	2.3	0.9
WN07SP	0.004	904	32	<0.4	0.3	2.0	2.2	1.1
WN08SP	0.002	851	20	<0.4	0.2	0.9	2.0	1.1
WN09SP	0.001	744	12	<0.4	0.1	0.6	1.6	0.8
WN10SP	0.002	573	46	<0.4	0.2	1.0	2.0	0.8
WN10SPX	0.002	582	44	<0.4	0.2	1.0	1.9	0.9
				South Traverse				
WS01SP	0.002	111	62	<0.4	0.3	0.9	2.6	<0.4
WS01SPX	0.002	92	59	<0.4	0.2	0.8	2.4	<0.4
WS02SP	0.002	109	77	<0.4	0.3	1.0	2.0	<0.4
WS03SP	0.002	94	120	<0.4	0.2	0.9	2.1	<0.4
WS04SP1	0.004	980	55	0.4	0.3	1.9	2.7	1.3
WS04SP2	0.002	883	34	<0.4	0.3	1.1	2.2	1.1
WS04SP3	0.002	1058	28	<0.4	0.2	1.2	2.0	1.3
WS06SP	0.005	868	43	<0.4	0.4	1.8	2.3	1.2
WS07SP	0.002	648	25	<0.4	0.2	0.9	1.9	1.0
WS08SP	0.002	230	32	<0.4	0.2	0.8	1.8	0.4
WS09SP	0.001	354	18	<0.4	0.1	0.3	1.9	0.3
WS10SP	0.001	237	54	<0.4	0.2	0.4	2.3	<0.4

Table A6.-- *Picea glauca* (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm	Sc, ppm	Sr, ppm	Th, ppm
				East Traverse				
WE01SP1	<0.4	0.2	<0.4	<0.4	1.0	<0.4	54	<0.4
WE01SP1X	<0.4	0.2	<0.4	<0.4	1.0	<0.4	53	<0.4
WE02SP	<0.4	<0.4	<0.4	<0.4	1.1	<0.4	67	<0.4
WE03SP	0.2	0.4	<0.4	<0.4	1.6	0.2	24	<0.4
WE04SP	0.1	0.3	<0.4	<0.4	0.8	<0.4	32	<0.4
WE05SP	0.2	0.4	<0.4	<0.4	1.0	<0.4	43	<0.4
WE06SP	0.3	0.4	<0.4	0.4	1.8	0.2	36	<0.4
WE07SP	0.2	0.3	<0.4	<0.4	1.6	<0.4	28	0.3
WE08SP	0.2	0.2	<0.4	<0.4	1.7	<0.4	55	<0.4
WE09SP	0.2	0.2	<0.4	<0.4	1.1	<0.4	37	0.4
WE10SP	0.2	0.2	<0.4	0.3	1.4	<0.4	31	0.3
WE10SP2	<0.4	0.3	<0.4	<0.4	1.4	<0.4	51	<0.4
WE11SP	0.1	0.2	<0.4	<0.4	1.6	<0.4	23	<0.4
WE11SPX	0.1	0.2	0.1	<0.4	1.5	<0.4	23	<0.4
				North Traverse				
WN01SP	0.2	0.2	<0.4	<0.4	0.8	<0.4	46	<0.4
WN01SPX	<0.4	0.2	<0.4	<0.4	0.8	<0.4	48	<0.4
WN02SP	0.2	0.2	<0.4	<0.4	1.1	<0.4	77	<0.4
WN03SP	0.1	0.3	<0.4	0.3	0.7	<0.4	24	<0.4
WN04SP	0.1	0.3	<0.4	<0.4	0.7	<0.4	27	<0.4
WN05SP	0.2	0.4	<0.4	<0.4	1.2	0.2	19	0.4
WN06SP	0.3	0.4	<0.4	0.4	1.6	0.2	20	<0.4
WN07SP	0.2	0.8	<0.4	<0.4	1.3	<0.4	21	0.4
WN08SP	0.1	0.2	<0.4	<0.4	0.6	<0.4	20	<0.4
WN09SP	<0.4	0.1	0.1	<0.4	0.5	<0.4	18	0.2
WN10SP	0.2	0.2	<0.4	<0.4	0.8	<0.4	36	<0.4
WN10SPX	0.1	0.2	<0.4	0.3	0.7	<0.4	35	<0.4
				South Traverse				
WS01SP	<0.4	0.2	<0.4	<0.4	1.7	<0.4	57	<0.4
WS01SPX	<0.4	0.2	<0.4	<0.4	0.4	<0.4	55	<0.4
WS02SP	<0.4	0.3	0.3	<0.4	1.0	<0.4	59	<0.4
WS03SP	<0.4	0.2	0.4	<0.4	0.9	<0.4	67	<0.4
WS04SP1	0.2	0.4	<0.4	<0.4	1.2	<0.4	32	0.3
WS04SP2	0.2	0.3	<0.4	<0.4	1.0	<0.4	27	<0.4
WS04SP3	0.2	0.4	<0.4	<0.4	0.9	<0.4	25	<0.4
WS06SP	0.2	0.4	<0.4	<0.4	1.1	<0.4	35	<0.4
WS07SP	0.2	0.2	<0.4	<0.4	0.7	<0.4	22	<0.4
WS08SP	<0.4	0.2	<0.4	<0.4	0.8	<0.4	33	<0.4
WS09SP	<0.4	<0.4	<0.4	<0.4	0.3	<0.4	30	<0.4
WS10SP	<0.4	<0.4	<0.4	<0.4	0.9	<0.4	49	<0.4

Table A6.-- *Picea glauca* (white spruce), needles and twigs, analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	V, ppm	Y, ppm	Zn, ppm	Hg, ppm	Total S, %	Ash, %
			East Traverse			
WE01SP1	1.0	<0.4	48	0.04	0.06	4.94
WE01SP1X	0.5	<0.4	47	0.02	0.06	4.83
WE02SP	0.5	<0.4	48	0.07	0.06	5.12
WE03SP	1.6	0.2	71	0.03	0.05	4.15
WE04SP	0.6	<0.4	68	0.02	0.06	2.95
WE05SP	1.2	<0.4	72	0.03	0.05	3.60
WE06SP	2.0	0.2	48	0.02	0.05	3.96
WE07SP	1.0	0.1	78	0.02	0.06	3.70
WE08SP	0.7	<0.4	59	0.03	0.05	3.26
WE09SP	0.8	<0.4	60	0.03	0.05	3.77
WE10SP	0.9	0.1	63	0.02	0.05	3.31
WE10SP2	1.1	<0.4	65	0.02	0.07	5.41
WE11SP	0.6	<0.4	48	<0.01	0.06	3.18
WE11SPX	0.6	<0.4	48	0.02	0.07	3.21
			North Traverse			
WN01SP	0.4	<0.4	50	0.02	0.06	3.81
WN01SPX	0.8	<0.4	52	0.02	0.06	3.98
WN02SP	0.4	<0.4	50	0.02	0.08	5.52
WN03SP	0.8	<0.4	56	0.02	<0.05	2.56
WN04SP	0.4	<0.4	71	0.02	0.06	3.73
WN05SP	1.2	0.2	76	0.02	0.06	3.82
WN06SP	1.5	0.2	65	0.03	0.05	3.84
WN07SP	1.3	0.2	83	0.02	0.07	3.93
WN08SP	0.6	<0.4	69	0.03	0.06	3.15
WN09SP	0.2	<0.4	67	0.02	0.06	2.48
WN10SP	0.8	<0.4	103	0.02	0.06	3.82
WN10SPX	0.7	<0.4	98	0.03	0.06	3.64
			South Traverse			
WS01SP	0.4	<0.4	44	0.02	0.07	4.42
WS01SPX	0.4	<0.4	42	0.05	0.07	4.20
WS02SP	0.5	<0.4	50	0.02	0.06	4.55
WS03SP	0.4	<0.4	62	0.02	0.06	4.46
WS04SP1	1.3	0.2	74	0.02	0.05	3.92
WS04SP2	0.8	<0.4	63	0.03	0.07	3.68
WS04SP3	0.8	<0.4	69	0.02	0.06	4.07
WS06SP	1.3	<0.4	92	0.03	0.05	4.82
WS07SP	0.6	<0.4	49	0.03	0.06	3.24
WS08SP	0.4	<0.4	61	0.02	0.05	3.84
WS09SP	0.2	<0.4	57	0.02	0.07	2.72
WS10SP	0.3	<0.4	36	0.06	0.07	4.48

Table A7.--Cladina rangiferina and Usnea Spp. (lichens) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Cladina rangiferina					
D14-1	635200	1484500	4.6	12	2.1	7.7	3.3	2.1	3.2	0.19
D2	635200	1484500	6.1	8.1	3.2	4.8	2.2	1.4	2.1	0.24
D4-2	635200	1484500	6.4	7.7	2.9	5.4	2.5	4.3	2.4	0.18
S4-1	635200	1484500	4.3	15	2.4	2.6	2.2	1.0	1.2	0.16
S4-2	635200	1484500	4.9	12	2.7	3.7	2.8	1.4	1.7	0.17
S4-3	635200	1484500	4.8	12	2.7	3.7	2.7	1.6	1.8	0.16
S4-3X	635200	1484500	4.7	13	2.7	3.8	2.8	1.6	1.8	0.16
					Usnea Spp.					
USNEAS5-	635200	1484500	1.6	29	1.2	2.8	2.0	0.58	1.4	0.18

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					Cladina rangiferina				
D14-1	6600	<4	<20	<20	1300	<2	<20	8	27
D2	7400	<4	<20	<20	1200	<2	<20	4	58
D4-2	6600	<4	<20	<20	990	<2	<20	5	51
S4-1	2800	<4	<20	<20	1000	<2	<20	<4	51
S4-2	2000	<4	<20	<20	950	<2	<20	<4	53
S4-3	1900	<4	<20	<20	920	<2	<20	<4	42
S4-3X	2000	<4	<20	<20	970	<2	<20	<4	47
					Usnea Spp.				
USNEAS5-	1300	<4	22	<20	1600	<2	<20	8	69

Sample	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					Cladina rangiferina				
D14-1	12	40	150	<4	14	<8	19	18	13
D2	19	66	160	<4	18	<8	35	23	7
D4-2	18	48	140	<4	17	<8	31	23	<4
S4-1	14	54	180	<4	11	<8	31	18	5
S4-2	15	67	180	<4	14	<8	31	21	7
S4-3	15	62	220	<4	12	<8	27	21	8
S4-3X	15	56	220	<4	12	<8	29	21	9
					Usnea Spp.				
USNEAS5-	20	50	130	<4	<8	<8	39	10	8

Table A7.--Cladina rangiferina and Usnea Spp. (lichens) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					Cladina rangiferina					
D14-1	<8	19	29	74	8	<10	760	<80	<8	<200
D2	<8	28	40	62	12	<10	490	<80	11	<200
D4-2	<8	27	41	50	10	<10	520	<80	<8	<200
S4-1	<8	26	34	41	8	<10	850	<80	8	<200
S4-2	<8	25	35	48	9	<10	760	<80	<8	<200
S4-3	<8	24	37	49	9	<10	810	<80	<8	<200
S4-3X	<8	26	31	58	9	<10	870	<80	<8	<200
					Usnea Spp.					
USNEAS5-	<8	41	41	340	9	<10	1100	<80	<8	<200

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm	Ash, %	Total S, %
				Cladina rangiferina			
D14-1	59	11	<2	1200	0.06	1.59	<0.05
D2	87	15	<2	700	0.07	3.05	<0.05
D4-2	77	15	<2	690	0.05	2.29	<0.05
S4-1	58	11	<2	530	0.05	3.61	<0.05
S4-2	65	12	<2	530	0.04	2.63	<0.05
S4-3	64	13	<2	490	0.04	2.47	<0.05
S4-3X	62	13	<2	530	0.04	2.34	<0.05
				Usnea Spp.			
USNEAS5-	43	44	4	580	0.36	7.08	0.12

Table A8.--Cladina rangiferina and Usnea Spp. (lichens) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Total S, %
				Cladina rangiferina				
D14-1	635200	1484500	0.073	0.191	0.033	0.122	0.052	<0.05
D2	635200	1484500	0.186	0.247	0.098	0.146	0.067	<0.05
D4-2	635200	1484500	0.147	0.176	0.066	0.124	0.057	<0.05
S4-1	635200	1484500	0.155	0.542	0.087	0.094	0.079	<0.05
S4-2	635200	1484500	0.129	0.316	0.071	0.097	0.074	<0.05
S4-3	635200	1484500	0.119	0.296	0.067	0.091	0.067	<0.05
S4-3X	635200	1484500	0.110	0.304	0.063	0.089	0.066	<0.05
				Usnea Spp.				
USNEAS5-	635200	1484500	0.113	2.053	0.085	0.198	0.142	0.12

Sample	Na, %	P, %	Ti, %	Mn, ppm	Ba, ppm	Cd, ppm	Ce, ppm	Co, ppm
				Cladina rangiferina				
D14-1	0.033	0.051	0.003	105	21	0.1	0.4	0.2
D2	0.043	0.064	0.007	226	37	0.1	1.8	0.6
D4-2	0.098	0.055	0.004	151	23	0.1	1.2	0.4
S4-1	0.036	0.043	0.006	101	36	<0.1	1.8	0.5
S4-2	0.037	0.045	0.004	53	25	<0.1	1.4	0.4
S4-3	0.040	0.044	0.004	47	23	<0.1	1.0	0.4
S4-3X	0.037	0.042	0.004	47	23	<0.1	1.1	0.4
				Usnea Spp.				
USNEAS5-	0.041	0.099	0.013	92	113	0.6	4.9	1.4

Sample	Cr, ppm	Cu, pp,	Ga, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
				Cladina rangiferina				
D14-1	0.6	2.4	0.2	0.3	0.3	0.2	0.3	0.5
D2	2.0	4.9	0.5	1.1	0.7	0.2	0.9	1.2
D4-2	1.1	3.2	0.4	0.7	0.5	0.1	0.6	0.9
S4-1	1.9	6.5	0.4	1.1	0.6	<0.1	0.9	1.2
S4-2	1.8	4.7	0.4	0.8	0.6	0.2	0.7	0.9
S4-3	1.5	5.4	0.3	0.7	0.5	0.2	0.6	0.9
S4-3X	1.3	5.1	0.3	0.7	0.5	0.2	0.6	0.7
				Usnea Spp.				
USNEAS5-	3.5	9.2	<0.1	2.8	0.7	0.6	2.9	2.9

Table A8.--Cladina rangiferina and Usnea Spp. (lichens) analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Pb, ppm	Sc, ppm	Sr, ppm	V, ppm	Y, ppm	Zn, ppm	Hg, ppm	Ash, %
				Cladina rangiferina				
D14-1	1.2	0.1	12	0.9	0.2	19	0.06	1.59
D2	1.9	0.4	15	2.7	0.5	21	0.07	3.05
D4-2	1.1	0.2	12	1.8	0.3	16	0.05	2.29
S4-1	1.5	0.3	31	2.1	0.4	19	0.05	3.61
S4-2	1.3	0.2	20	1.7	0.3	14	0.04	2.63
S4-3	1.2	0.2	20	1.6	0.3	12	0.04	2.47
S4-3X	1.4	0.2	20	1.5	0.3	12	0.04	2.34
				Usnea Spp.				
USNEAS5-	24	0.6	78	3.0	3.1	41	0.36	7.08

Table A9.--02-horizon soil samples analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					East Traverse					
WE01S	622330	1450700	7.6	3.5	3.9	1.1	1.5	2.2	0.08	0.48
WE01SX	622330	1450700	7.7	3.3	3.8	1.1	1.5	2.3	0.07	0.48
WE02S	622318	1450648	6.6	3.5	3.2	0.97	1.4	2.0	0.10	0.40
WE03S	622248	1450554	5.1	2.6	2.5	0.76	1.2	1.7	0.08	0.31
WE04S	622142	1450430	5.5	3.6	3.0	0.80	1.3	1.8	0.11	0.34
WE05S	622218	1450342	7.0	3.7	3.5	0.98	1.6	2.2	0.09	0.42
WE06S	622054	1445948	8.4	3.5	3.4	1.3	1.6	2.7	0.07	0.48
WE07S	622006	1445630	7.2	3.2	3.3	1.0	1.4	2.1	0.10	0.38
WE08S	621936	1445318	6.8	3.4	3.2	0.97	1.4	2.3	0.11	0.37
WE09S	621842	1445136	8.4	3.4	3.4	1.3	1.6	2.8	0.07	0.49
WE10S	621830	1444918	8.4	3.7	3.5	1.2	1.7	2.8	0.08	0.49
WE11S	621730	1444642	8.0	4.0	3.9	1.1	1.9	2.6	0.09	0.49
					North Traverse					
WN01S	622348	1450648	5.3	3.7	2.3	0.79	1.2	1.7	0.10	0.30
WN01SX	622348	1450648	5.2	3.6	2.4	0.80	1.1	1.8	0.10	0.31
WN02S	622342	1450612	7.2	3.5	3.2	1.1	1.5	2.3	0.11	0.44
WN03S	622424	1450542	6.0	3.9	3.0	0.86	1.3	1.9	0.08	0.36
WN04S	622512	1450512	6.7	3.2	3.3	0.98	1.5	2.2	0.08	0.42
WN05S	622642	1445936	6.6	3.4	3.8	0.98	1.5	2.0	0.11	0.43
WN06S	622448	1445242	7.2	3.5	3.9	1.0	1.7	2.1	0.10	0.46
WN07S	622618	1445130	7.4	3.8	3.7	1.1	1.6	2.3	0.10	0.46
WN08S	622712	1444900	7.5	2.8	3.9	1.2	1.6	2.0	0.08	0.43
WN09S	623518	1443142	7.0	2.9	3.8	0.96	1.3	1.7	0.09	0.40
WN10S	623730	1443030	7.0	3.4	3.8	1.1	1.5	2.0	0.09	0.45
					South Traverse					
WS01S	622324	1450724	6.6	3.8	3.4	1.0	1.4	2.1	0.11	0.40
WS01SX	622324	1450724	6.4	3.5	3.0	0.98	1.3	2.1	0.10	0.38
WS02S	622312	1450718	6.2	3.2	3.0	0.89	1.3	1.9	0.08	0.39
WS03S	622248	1450712	7.6	3.8	3.8	1.2	1.6	2.4	0.11	0.48
WS04S	622118	1450630	6.4	3.3	3.1	0.90	1.4	2.0	0.08	0.38
WS06S	621300	1450436	5.7	3.4	2.7	0.85	1.3	1.9	0.08	0.33
WS07S	621206	1450412	5.9	4.2	2.9	0.91	1.4	2.0	0.09	0.35
WS08S	621206	1450554	5.8	3.6	2.7	0.92	1.1	1.9	0.11	0.34
WS09S	621100	1450354	4.1	3.4	1.8	0.59	0.84	1.3	0.09	0.23
WS10S	620730	1450318	7.5	3.2	3.6	1.1	1.4	2.2	0.12	0.46
WS11S	620112	1445918	7.8	3.1	3.4	1.1	1.5	2.3	0.08	0.43
					USGS Green River Shale Standard Reference Material					
SGR1			3.4	5.8	2.0	1.3	2.6	2.4	0.13	0.12

Table A9.--O2-horizon soil samples analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
					East Traverse				
WE01S	590	<2	10	<8	540	<1	<10	<2	26
WE01SX	570	<2	<10	<8	550	<1	<10	<2	26
WE02S	580	<2	10	<8	470	<1	<10	<2	25
WE03S	360	<2	<10	<8	390	<1	<10	<2	16
WE04S	660	<2	<10	<8	400	<1	<10	<2	20
WE05S	680	<2	<10	<8	480	<1	<10	<2	25
WE06S	540	<2	<10	<8	540	<1	<10	<2	29
WE07S	1200	<2	<10	<8	500	<1	<10	<2	22
WE08S	1700	<2	<10	<8	440	<1	<10	<2	21
WE09S	560	<2	10	<8	550	<1	<10	<2	23
WE10S	810	<2	10	<8	500	<1	<10	<2	24
WE11S	760	<2	<10	<8	470	<1	<10	<2	24
					North Traverse				
WN01S	680	<2	<10	<8	410	<1	<10	<2	17
WN01SX	710	<2	<10	<8	400	<1	<10	<2	17
WN02S	590	<2	<10	<8	550	<1	<10	<2	26
WN03S	540	<2	<10	<8	440	<1	<10	<2	22
WN04S	540	<2	10	<8	570	<1	<10	<2	22
WN05S	1200	<2	10	<8	540	<1	<10	<2	27
WN06S	720	<2	10	<8	590	<1	<10	<2	29
WN07S	600	<2	10	<8	520	<1	<10	<2	27
WN08S	720	<2	10	<8	570	<1	<10	<2	28
WN09S	600	<2	10	<8	520	<1	<10	<2	27
WN10S	790	<2	<10	<8	530	<1	<10	<2	27
					South Traverse				
WS01S	720	<2	10	<8	440	<1	<10	<2	23
WS01SX	670	<2	<10	<8	450	<1	<10	<2	22
WS02S	500	<2	10	<8	420	<1	<10	<2	23
WS03S	730	<2	<10	<8	570	<1	<10	<2	29
WS04S	490	<2	<10	<8	430	<1	<10	<2	23
WS06S	470	<2	<10	<8	370	<1	<10	<2	18
WS07S	790	<2	<10	<8	390	<1	<10	<2	20
WS08S	410	<2	<10	<8	380	<1	<10	<2	22
WS09S	290	<2	<10	<8	270	<1	<10	<2	15
WS10S	1000	<2	20	<8	510	<1	<10	<2	29
WS11S	540	<2	10	<8	480	<1	<10	<2	24
					USGS Green River Shale Standard Reference Material				
SGR1	240	<2	73	<8	290	<1	<10	<2	32

Table A9.--O2-horizon soil samples analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm
					East Traverse				
WE01S	17	77	50	<2	16	<4	15	18	<2
WE01SX	17	76	51	<2	17	<4	16	20	<2
WE02S	17	59	46	<2	13	<4	14	12	<2
WE03S	11	44	34	<2	10	<4	11	11	<2
WE04S	16	50	49	<2	11	<4	13	10	<2
WE05S	18	66	51	<2	14	<4	15	14	<2
WE06S	16	61	57	<2	17	<4	18	16	<2
WE07S	30	51	63	<2	15	<4	15	17	<2
WE08S	22	44	45	<2	15	<4	13	12	<2
WE09S	15	62	53	<2	17	<4	16	15	<2
WE10S	21	57	50	<2	17	<4	15	15	<2
WE11S	20	68	47	<2	17	<4	14	12	<2
					North Traverse				
WN01S	13	40	39	<2	11	<4	11	10	<2
WN01SX	13	40	40	<2	11	<4	10	11	<2
WN02S	16	61	59	<2	15	<4	15	15	<2
WN03S	16	52	44	<2	12	<4	13	12	<2
WN04S	16	68	46	<2	14	<4	14	16	<2
WN05S	23	75	58	<2	15	<4	16	13	<2
WN06S	20	78	50	<2	15	<4	16	17	<2
WN07S	18	66	54	<2	16	<4	15	14	<2
WN08S	21	75	63	<2	16	<4	15	24	<2
WN09S	17	66	67	<2	15	<4	16	19	<2
WN10S	20	74	50	<2	15	<4	14	21	<2
					South Traverse				
WS01S	18	58	52	<2	13	<4	14	13	<2
WS01SX	17	53	49	<2	13	<4	14	14	<2
WS02S	15	56	36	<2	13	<4	13	12	<2
WS03S	19	72	56	<2	16	<4	16	14	<2
WS04S	15	57	39	<2	13	<4	13	11	<2
WS06S	13	49	37	<2	12	<4	11	9	<2
WS07S	15	47	48	<2	13	<4	12	12	<2
WS08S	12	42	46	<2	13	<4	12	10	<2
WS09S	9	28	35	<2	8	<4	9	7	<2
WS10S	21	61	62	<2	16	<4	17	15	<2
WS11S	17	61	41	<2	16	<4	14	15	<2
					USGS Green River Shale Standard Reference Material				
SGR1	13	33	69	<2	8	<4	20	150	29

Table A9.--02-horizon soil samples analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm	Sr, ppm	Ta, ppm	Th, ppm	U, ppm
					East Traverse				
WE01S	14	41	<4	15	<5	440	<40	<4	<100
WE01SX	17	40	9	15	<5	450	<40	<4	<100
WE02S	15	34	<4	13	<5	410	<40	<4	<100
WE03S	13	23	8	11	<5	330	<40	<4	<100
WE04S	14	34	<4	11	<5	380	<40	<4	<100
WE05S	15	40	<4	14	<5	440	<40	<4	<100
WE06S	20	36	14	15	<5	520	<40	<4	<100
WE07S	17	36	11	13	<5	450	<40	<4	<100
WE08S	17	30	8	12	<5	490	<40	<4	<100
WE09S	17	37	13	14	<5	560	<40	<4	<100
WE10S	17	36	11	15	<5	560	<40	<4	<100
WE11S	16	46	<4	15	<5	540	<40	<4	<100
					North Traverse				
WN01S	12	25	10	10	<5	390	<40	<4	<100
WN01SX	11	24	9	10	<5	390	<40	<4	<100
WN02S	17	37	11	14	<5	470	<40	<4	<100
WN03S	14	32	<4	12	<5	410	<40	<4	<100
WN04S	17	33	12	15	<5	410	<40	<4	<100
WN05S	17	42	<4	15	<5	390	<40	<4	<100
WN06S	16	43	<4	16	<5	420	<40	<4	<100
WN07S	17	41	<4	14	<5	460	<40	<4	<100
WN08S	16	43	<4	14	<5	380	<40	<4	<100
WN09S	17	42	<4	14	<5	380	<40	<4	<100
WN10S	16	39	<4	14	<5	390	<40	<4	<100
					South Traverse				
WS01S	14	36	<4	12	<5	420	<40	<4	<100
WS01SX	16	32	10	12	<5	420	<40	<4	<100
WS02S	14	29	<4	12	<5	390	<40	<4	<100
WS03S	17	42	<4	15	<5	480	<40	<4	<100
WS04S	14	31	<4	12	<5	420	<40	<4	<100
WS06S	11	28	<4	10	<5	400	<40	<4	<100
WS07S	12	30	<4	10	<5	420	<40	<4	<100
WS08S	14	28	<4	10	<5	390	<40	<4	<100
WS09S	10	18	<4	7	<5	310	<40	<4	<100
WS10S	17	38	<4	14	<5	440	<40	<4	<100
WS11S	14	36	<4	13	<5	480	<40	<4	<100
					USGS Green River Shale Standard Reference Material				
SGR1	18	31	45	5	<5	400	<40	<4	<100

Table A9.--O2-horizon soil samples analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (ash-weight basis, unless noted with an *) (continued).

Sample	V, ppm	Y, ppm	Yb, ppm	Zn, ppm	Hg, ppm*	F, %*	Total S, %*	Ash, %*
				East Traverse				
WE01S	140	15	1	64	0.02	0.01	<0.05	86.8
WE01SX	130	14	1	60	0.04	0.01	<0.05	86.6
WE02S	110	14	1	73	0.04	0.01	<0.05	75.1
WE03S	85	10	1	42	0.06	0.01	0.09	57.4
WE04S	100	12	1	58	0.06	0.01	0.09	66.6
WE05S	120	14	1	54	0.04	0.01	<0.05	80.3
WE06S	120	17	2	48	0.04	0.01	<0.05	87.3
WE07S	120	14	1	48	0.08	0.01	0.08	72.6
WE08S	110	13	1	39	0.08	0.01	0.07	73.2
WE09S	120	14	1	46	0.04	0.01	<0.05	86.8
WE10S	120	15	1	51	0.04	<0.01	<0.05	84.0
WE11S	130	16	2	64	0.02	0.01	<0.05	88.6
				North Traverse				
WN01S	85	10	<1	44	0.04	0.01	0.09	60.9
WN01SX	87	10	1	46	0.04	0.01	0.09	59.8
WN02S	120	14	1	51	0.04	<0.01	<0.05	76.9
WN03S	100	13	1	39	0.06	0.01	0.09	71.6
WN04S	130	14	1	58	0.04	0.01	0.05	75.7
WN05S	130	16	2	67	0.06	0.01	0.06	75.6
WN06S	140	16	2	58	0.06	0.01	<0.05	84.0
WN07S	130	16	2	57	0.04	0.01	0.06	80.9
WN08S	130	16	1	69	0.10	0.02	<0.05	82.0
WN09S	130	17	2	52	0.10	0.01	0.07	73.6
WN10S	130	14	1	310	0.08	0.01	0.05	77.9
				South Traverse				
WS01S	120	14	1	54	0.06	0.01	0.07	72.3
WS01SX	110	13	1	44	0.06	0.01	0.07	70.9
WS02S	110	13	1	49	0.06	0.01	<0.05	75.3
WS03S	130	16	1	81	0.04	0.01	<0.05	88.6
WS04S	110	12	1	53	0.04	<0.01	0.05	74.0
WS06S	95	10	1	50	0.06	0.01	0.06	62.8
WS07S	98	12	1	41	0.04	0.01	0.07	66.5
WS08S	89	12	1	37	0.08	0.01	0.08	63.4
WS09S	61	9	<1	24	0.08	<0.01	0.15	52.4
WS10S	130	16	2	47	0.08	0.01	<0.05	83.6
WS11S	110	12	1	51	0.04	<0.01	<0.05	84.3
				USGS Green River Shale Standard Reference Material				
SGR1	120	9	<1	73	0.10	0.16	1.55	67.8

Table A10.--02-horizon soil analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis).

Sample	Latitude	Logitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %
					East Traverse				
WE01S	622330	1450700	6.60	3.04	3.39	0.95	1.30	1.91	0.069
WE01SX	622330	1450700	6.67	2.86	3.29	0.95	1.30	1.99	0.061
WE02S	622318	1450648	4.96	2.63	2.40	0.73	1.05	1.50	0.075
WE03S	622248	1450554	2.93	1.49	1.44	0.44	0.69	0.98	0.046
WE04S	622142	1450430	3.66	2.40	2.00	0.53	0.87	1.20	0.073
WE05S	622218	1450342	5.62	2.97	2.81	0.79	1.28	1.77	0.072
WE06S	622054	1445948	7.33	3.06	2.97	1.13	1.40	2.36	0.061
WE07S	622006	1445630	5.23	2.32	2.40	0.73	1.02	1.52	0.073
WE08S	621936	1445318	4.98	2.49	2.34	0.71	1.02	1.68	0.081
WE09S	621842	1445136	7.29	2.95	2.95	1.13	1.39	2.43	0.061
WE10S	621830	1444918	7.06	3.11	2.94	1.01	1.43	2.35	0.067
WE11S	621730	1444642	7.09	3.54	3.46	0.97	1.68	2.30	0.080
					North Traverse				
WN01S	622348	1450648	3.23	2.25	1.40	0.48	0.73	1.04	0.061
WN01SX	622348	1450648	3.11	2.15	1.44	0.48	0.66	1.08	0.060
WN02S	622342	1450612	5.54	2.69	2.46	0.85	1.15	1.77	0.085
WN03S	622424	1450542	4.30	2.79	2.15	0.62	0.93	1.36	0.057
WN04S	622512	1450512	5.07	2.42	2.50	0.74	1.14	1.67	0.061
WN05S	622642	1445936	4.99	2.57	2.87	0.74	1.13	1.51	0.083
WN06S	622448	1445242	6.05	2.94	3.28	0.84	1.43	1.76	0.084
WN07S	622618	1445130	5.99	3.07	2.99	0.89	1.29	1.86	0.081
WN08S	622712	1444900	6.15	2.30	3.20	0.98	1.31	1.64	0.066
WN09S	623518	1443142	5.15	2.13	2.80	0.71	0.96	1.25	0.066
WN10S	623730	1443030	5.45	2.65	2.96	0.86	1.17	1.56	0.070
					South Traverse				
WS01S	622324	1450724	4.77	2.75	2.46	0.72	1.01	1.52	0.080
WS01SX	622324	1450724	4.54	2.48	2.13	0.69	0.92	1.49	0.071
WS02S	622312	1450718	4.67	2.41	2.26	0.67	0.98	1.43	0.060
WS03S	622248	1450712	6.73	3.37	3.37	1.06	1.42	2.13	0.097
WS04S	622118	1450630	4.74	2.44	2.29	0.67	1.04	1.48	0.059
WS06S	621300	1450436	3.58	2.14	1.70	0.53	0.82	1.19	0.050
WS07S	621206	1450412	3.92	2.79	1.93	0.61	0.93	1.33	0.060
WS08S	621206	1450554	3.68	2.28	1.71	0.58	0.70	1.20	0.070
WS09S	621100	1450354	2.15	1.78	0.94	0.31	0.44	0.68	0.047
WS10S	620730	1450318	6.27	2.68	3.01	0.92	1.17	1.84	0.100
WS11S	620112	1445918	6.58	2.61	2.87	0.93	1.26	1.94	0.067
					USGS Green River Shale Standard Reference Material				
SGR1			2.31	3.93	1.36	0.88	1.76	1.63	0.088

Table A10.--02-horizon soil analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Ti, %	Mn, ppm	As, ppm	Ba, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm
				East Traverse					
WE01S	0.417	512	9	469	23	15	67	43	14
WE01SX	0.416	494	<10	476	23	15	66	44	15
WE02S	0.300	436	8	353	19	13	44	35	10
WE03S	0.178	207	<10	224	9	6	25	20	6
WE04S	0.226	440	<10	266	13	11	33	33	7
WE05S	0.337	546	<10	385	20	14	53	41	11
WE06S	0.419	471	<10	471	25	14	53	50	15
WE07S	0.276	871	<10	363	16	22	37	46	11
WE08S	0.271	1240	<10	322	15	16	32	33	11
WE09S	0.425	486	9	477	20	13	54	46	15
WE10S	0.412	680	8	420	20	18	48	42	14
WE11S	0.434	673	<10	416	21	18	60	42	15
				North Traverse					
WN01S	0.183	414	<10	250	10	8	24	24	7
WN01SX	0.185	425	<10	239	10	8	24	24	7
WN02S	0.338	454	<10	423	20	12	47	45	12
WN03S	0.258	387	<10	315	16	11	37	32	9
WN04S	0.318	409	8	431	17	12	51	35	11
WN05S	0.325	907	8	408	20	17	57	44	11
WN06S	0.386	605	8	496	24	17	66	42	13
WN07S	0.372	485	8	421	22	15	53	44	13
WN08S	0.353	590	8	467	23	17	62	52	13
WN09S	0.294	442	7	383	20	13	49	49	11
WN10S	0.351	615	<10	413	21	16	58	39	12
				South Traverse					
WS01S	0.289	521	7	318	17	13	42	38	9
WS01SX	0.269	475	<10	319	16	12	38	35	9
WS02S	0.294	377	8	316	17	11	42	27	10
WS03S	0.425	647	<10	505	26	17	64	50	14
WS04S	0.281	363	<10	318	17	11	42	29	10
WS06S	0.207	295	<10	232	11	8	31	23	8
WS07S	0.233	525	<10	259	13	10	31	32	9
WS08S	0.216	260	<10	241	14	8	27	29	8
WS09S	0.121	152	<10	141	8	5	15	18	4
WS10S	0.385	836	17	426	24	18	51	52	13
WS11S	0.362	455	8	405	20	14	51	35	13
				USGS Green River Shale Standard Reference Material					
SGR1	0.081	163	49	197	22	9	22	47	5

Table A10.--02-horizon soil analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	La, ppm	Li, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	V, ppm	Y, ppm
				East Traverse					
WE01S	13	16	12	36	<4	13	382	122	13
WE01SX	14	17	15	35	8	13	390	113	12
WE02S	11	9	11	26	<4	10	308	83	11
WE03S	6	6	7	13	5	6	189	49	6
WE04S	9	7	9	23	<4	7	253	67	8
WE05S	12	11	12	32	<4	11	353	96	11
WE06S	16	14	17	31	12	13	454	105	15
WE07S	11	12	12	26	8	9	327	87	10
WE08S	10	9	12	22	6	9	359	81	10
WE09S	14	13	15	32	11	12	486	104	12
WE10S	13	13	14	30	9	13	470	101	13
WE11S	12	11	14	41	<4	13	478	115	14
				North Traverse					
WN01S	7	6	7	15	6	6	238	52	6
WN01SX	6	7	7	14	5	6	233	52	6
WN02S	12	12	13	28	8	11	361	92	11
WN03S	9	9	10	23	<4	9	294	72	9
WN04S	11	12	13	25	9	11	310	98	11
WN05S	12	10	13	32	<4	11	295	98	12
WN06S	13	14	13	36	<4	13	353	118	13
WN07S	12	11	14	33	<4	11	372	105	13
WN08S	12	20	13	35	<4	11	312	107	13
WN09S	12	14	13	31	<4	10	280	96	13
WN10S	11	16	12	30	<4	11	304	101	11
				South Traverse					
WS01S	10	9	10	26	<4	9	304	87	10
WS01SX	10	10	11	23	7	9	298	78	9
WS02S	10	9	11	22	<4	9	294	83	10
WS03S	14	12	15	37	<4	13	425	115	14
WS04S	10	8	10	23	<4	9	311	81	9
WS06S	7	6	7	18	<4	6	251	60	6
WS07S	8	8	8	20	<4	7	279	65	8
WS08S	8	6	9	18	<4	6	247	56	8
WS09S	5	4	5	9	<4	4	162	32	5
WS10S	14	13	14	32	<4	12	368	109	13
WS11S	12	13	12	30	<4	11	405	93	10
				USGS Green River Shale Standard Reference Material					
SGR1	14	102	12	21	31	3	271	81	6

Table A10.--02-horizon soil analytical results for the Wrangell-Saint Elias National Park and Preserve study area, Alaska (converted to dry-weight basis) (continued).

Sample	Yb, ppm	Zn, ppm	Hg, ppm	F, %	Total S, %	Ash, %
				East Traverse		
WE01S	0.9	56	0.02	0.01	<0.05	86.8
WE01SX	0.9	52	0.04	0.01	<0.05	86.6
WE02S	0.8	55	0.04	0.01	<0.05	75.1
WE03S	0.6	24	0.06	0.01	0.09	57.4
WE04S	0.7	39	0.06	0.01	0.09	66.6
WE05S	0.8	43	0.04	0.01	<0.05	80.3
WE06S	1.7	42	0.04	<0.01	<0.05	87.3
WE07S	0.7	35	0.08	0.01	0.08	72.6
WE08S	0.7	29	0.08	0.01	0.07	73.2
WE09S	0.9	40	0.04	0.01	<0.05	86.8
WE10S	0.8	43	0.04	<0.01	<0.05	84.0
WE11S	1.8	57	0.02	0.01	<0.05	88.6
				North Traverse		
WN01S	<1.0	27	0.04	0.01	0.09	60.9
WN01SX	0.6	28	0.04	0.01	0.09	59.8
WN02S	0.8	39	0.04	<0.01	<0.05	76.9
WN03S	0.7	28	0.06	0.01	0.09	71.6
WN04S	0.8	44	0.04	0.01	0.05	75.7
WN05S	1.5	51	0.06	0.01	0.06	75.6
WN06S	1.7	49	0.06	0.01	<0.05	84.0
WN07S	1.6	46	0.04	0.01	0.06	80.9
WN08S	0.8	57	0.10	0.02	<0.05	82.0
WN09S	1.5	38	0.10	0.01	0.07	73.6
WN10S	0.8	241	0.08	0.01	0.05	77.9
				South Traverse		
WS01S	0.7	39	0.06	0.01	0.07	72.3
WS01SX	0.7	31	0.06	0.01	0.07	70.9
WS02S	0.8	37	0.06	0.01	<0.05	75.3
WS03S	0.9	72	0.04	0.01	<0.05	88.6
WS04S	0.7	39	0.04	<0.01	0.05	74.0
WS06S	0.6	31	0.06	0.01	0.06	62.8
WS07S	0.7	27	0.04	0.01	0.07	66.5
WS08S	0.6	23	0.08	0.01	0.08	63.4
WS09S	<1.0	13	0.08	<0.01	0.15	52.4
WS10S	1.7	39	0.08	0.01	<0.05	83.6
WS11S	0.8	43	0.04	<0.01	<0.05	84.3
				USGS Green River Shale Standard Reference Material		
SGR1	<1.0	49	0.10	0.16	1.55	67.8