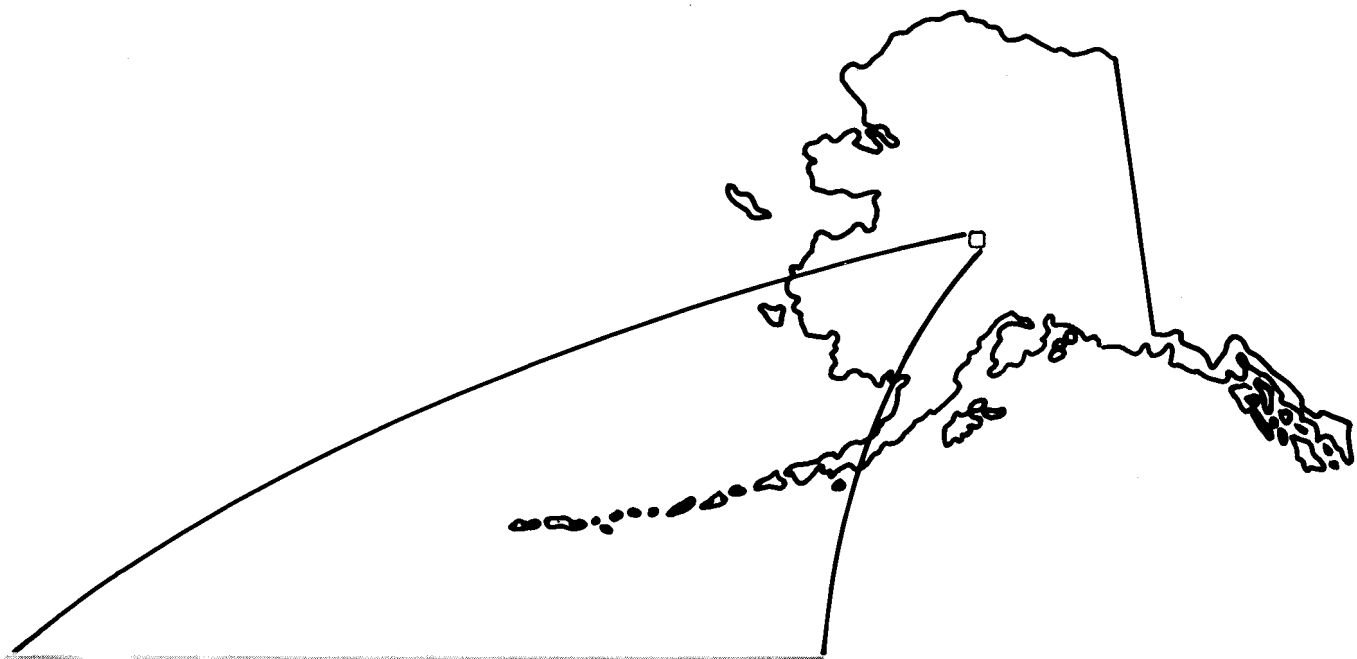
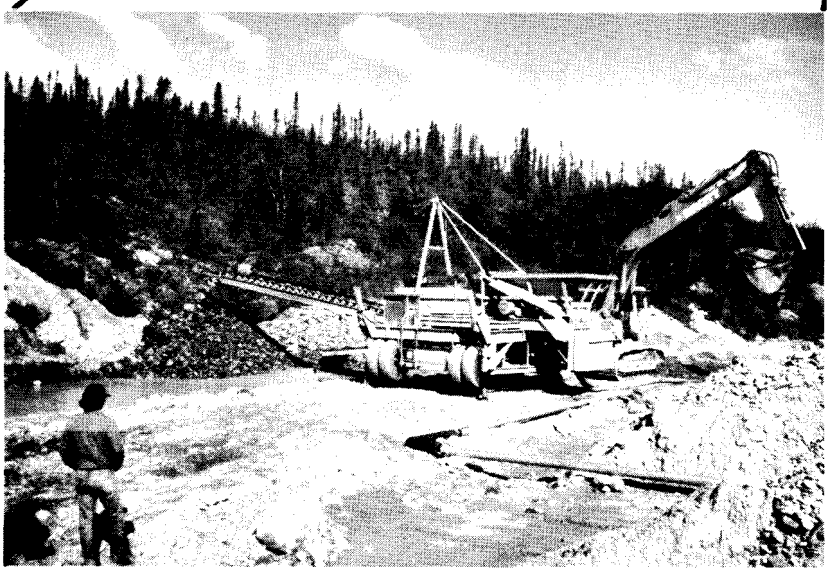
Distribution, Analysis, and Recovery of Gold from Kantishna Placers, Alaska

by Steven A. Fechner and Robert B. Hoekzema





UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
T. S. Horton, Director

OFR 1-86

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

dwt	pennyweight
ft	feet
in.	inch
lb	pound
mi	mile
%	percent
yd^3	cubic yard

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By Steven A. Fechner[1/] and Robert B. Hoekzema[2/]

ABSTRACT

In 1983, the U.S. Bureau of Mines, using contractors and conducting independent studies, evaluated the mineral resources of the Kantishna Hills area of Denali National Park and Preserve, southcentral Alaska. Geological and engineering studies addressed types and abundance of mineralization, mineral development potential, and acquisition costs of mineral claims. The Bureau of Mines collected reconnaissance and site specific bulk placer samples to evaluate the mineral development potential of twenty-seven drainages and analyze the size distribution of gravel and gold on five streams in the Kantishna Hills study area. Sizing studies conducted on five streams suggest that over 99% of the gold ranges from -6 to +70 mesh with the biggest percentage being +40 mesh in size. Recommended placer recovery plants on these streams should be designed to recover +70 mesh gold and classify gravel to -1 mesh in size prior to processing through a recovery device. Ten streams were rated as having high mineral development potential. Five of these streams lack current mining activity.

INTRODUCTION

Section 202(3)(b) of the Alaska National Interest Lands Conservation Act (ANILCA, P. L. 96-487), passed by Congress on December 2, 1980, mandated the Alaska Land Use Council (ALUC) to conduct resource studies of the Kantishna Hills study area in the newly established Denali National Park and Preserve, southcentral Alaska (fig. 1). In addition to other resource studies, the ALUC was directed specifically to: (1) evaluate mineral resources and compile information related to "mineral potential"; (2) estimate the cost of acquiring mineral properties; and (3) assess the consequences of further mineral development. In accordance with this mandate, in 1983, the U.S. Bureau of Mines (Bureau) conducted mineral evaluations and mining property studies in the Kantishna Hills area of Denali National Park and Preserve.

The mineral resource study was contracted to Salisbury and Dietz, Inc. of Spokane, Washington. The acquisition cost study was contracted to DOWL Engineers/PLANgraphics, Inc. Field work in the Kantishna Hills study area included geologic mapping at reconnaissance to site specific levels, rock and geochemical sampling, core drilling, placer evaluations, geophysical surveys, and land surveying. Results of the work completed by Salisbury and Dietz, Inc. has been published

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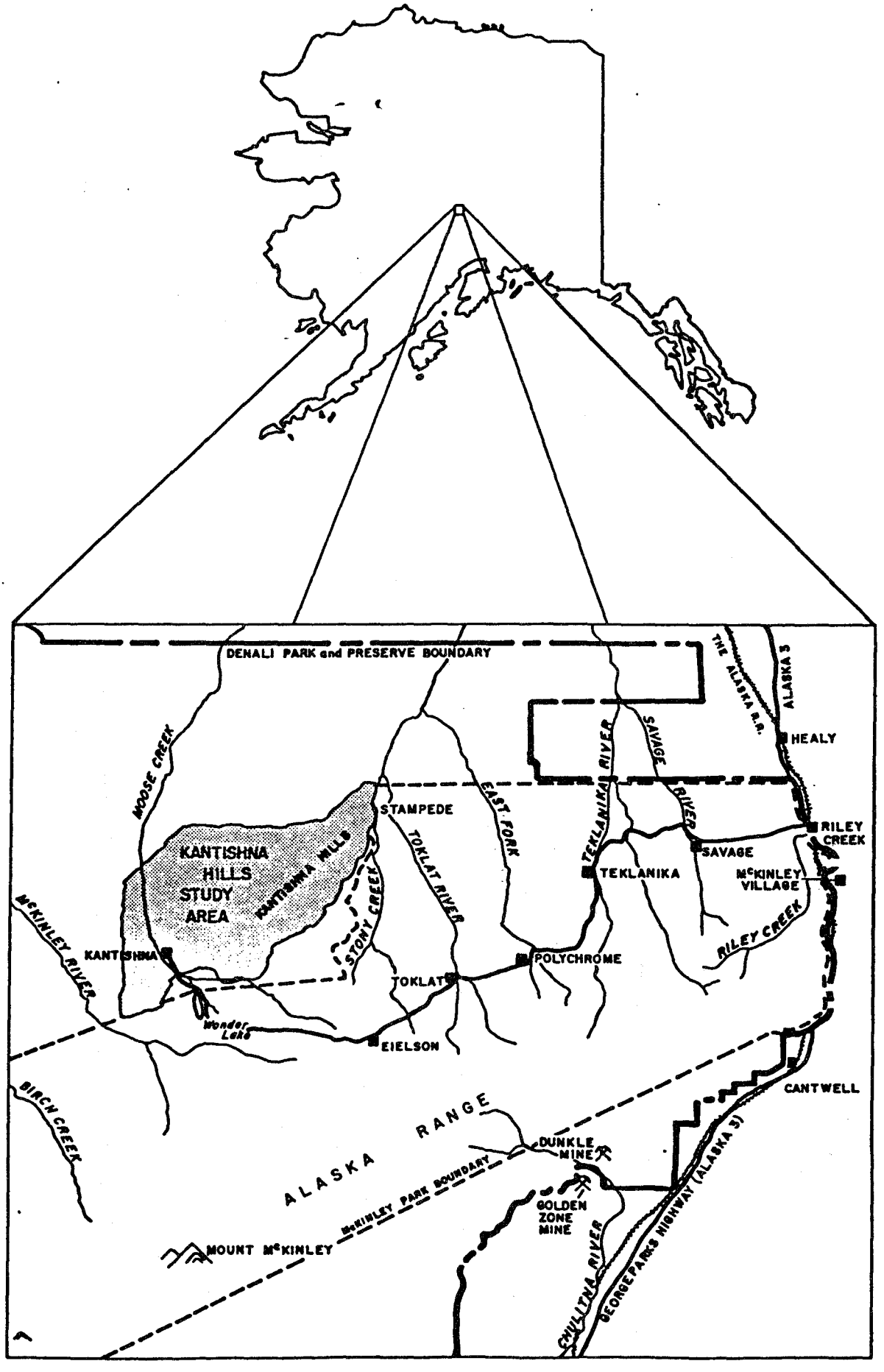


FIGURE 1. Index map of Alaska showing Kantishna Hills study area.

as Bureau OFR 129-84(11)[3/]. The cost acquisition study was published as Bureau OFR 128-84(5).

In 1983, a regional reconnaissance and site specific bulk placer sampling program was undertaken in the Kantishna Hills area by the Bureau to supplement the data obtained by Salisbury and Dietz, Inc. Reconnaissance sampling was concentrated along drainages which lacked sufficient sample data and recent placer mining activity. Site specific bulk sampling was conducted in order to ascertain the size distribution of gravel and gold in five recently mined drainages in the district. This report summarizes the results of the reconnaissance and bulk placer sampling studies.

ACKNOWLEDGEMENTS

The authors would like to thank the following miners in the Kantishna Mining District for their direct help during the Bureau part of the study: the Wieler brothers on Glen Creek, Dan Ashbrook at Kantishna, and Arley Taylor on Eureka Creek.

STUDY AREA

The Kantishna Hills study area is located in Denali National Park and Preserve, Alaska and encompasses approximately 300 square mi of land (fig. 1). It is in part adjacent to, and northwest of, the original McKinley Park boundary. Land access is provided by one road, the McKinley National Park road (originally the Kantishna Mine road). Landing strips are present at Stampede and Kantishna. The study area is currently closed to mineral entry but contains 185 unpatented placer, 5 unpatented lode, and 34 patented lode claims.

PREVIOUS STUDIES

The placer deposits of the Kantishna Hills study area have previously been described by Capps (3), Bundtzen (1, 2), DOWL Engineers/PLANgraphics (5), and Salisbury & Dietz, Inc. (11). Jeske (6) studied the abundance and distribution of critical and strategic minerals using the geochemical results from the reconnaissance placer samples collected in the district during 1983.

In 1983, Salisbury & Dietz, Inc. (11) estimated that there are 43 million yd^3 of minable stream and terrace gravels containing 688,000 oz of recoverable gold. Of this total, 18 million yd^3 of material, which contain an estimated 288,000 oz of gold are covered by existing claims. At 1983 mining rates, approximately 35 years would be required to process the indicated reserves on existing claims.

Jeske's analysis of the geochemical results from the regional placer sampling indicated 10 anomalous areas of strategic and critical minerals in the study area (6). They include: (1) Eldorado Creek drainage for cobalt, nickel, niobium, tantalum, tin, titanium, and tungsten; (2) lower Moose Creek drainage for niobium, tantalum, tin, titanium, and tungsten; (3) Rainy Creek to Glen Creek area for niobium, tantalum, tin, titanium, and tungsten; (4) Myrtle Creek drainage for tin and tungsten; (5) Moonlight Creek drainage for cobalt

3/Underlined numbers in parentheses refer to items in the list of references preceding the appendix.

and nickel; (6) Clearwater Fork drainage for niobium, tantalum, and titanium; (7) Canyon Creek drainage for tin and tungsten; (8) two Bearpaw River tributaries for tin and tungsten; (9) a tributary to lower Stampede Creek for cobalt, nickel, and tungsten; and (10) the northern part of the study area for germanium.

MINING HISTORY

The Kantishna Hills study area has produced gold from placer and lode sources; and silver, lead, zinc, and antimony from high-grade veins. Placer gold was discovered in the Kantishna Hills area in 1903 by Judge James Wickersham. A small gold rush, involving several thousand people, followed the discovery. By 1906, most of the people had left because the high grade pay streaks had either been mined out or staked. Lode deposits, mainly silver, gold, and antimony were found after 1905.

The Kantishna Hills area is one of 37 producing placer gold districts in Alaska. The area has produced approximately 80,000 oz of placer gold through 1984. Estimated production by drainage is listed on Table 1. More than 90% of the gold has been produced by small to medium scale placer mines (5 yd^3 to 1,500 yd^3/day) operating 4-5 months during the summer season.

Precious metal vein deposits have produced a total of 265,000 oz silver, over 5,000 oz gold, 504,000 lb of by-product lead, and an unknown quantity of zinc. The Stampede Mine and smaller deposits have produced 4,600,000 lb of antimony.

GEOLOGY

Bedrock in the Kantishna Hills study area consists of four regionally metamorphosed rock units ranging from Precambrian to Late Paleozoic in age, which are intruded by Tertiary dike swarms and are unconformably overlain by Tertiary and Quaternary sediments.

METAMORPHIC ROCKS

The metamorphic rocks in the study area are a small part of the Yukon Crystalline Terrane complex that extends from the Alaska Range to the Yukon Territory of Canada. The oldest rock unit is the polymetamorphic Birch Creek Schist, which underlies about 85% of the Kantishna Hills area and consists of variable amounts of quartzite, quartz-mica schist, marble, and greenstone (fig. 2). This unit is favorable for stratiform base metal mineralization but is apparently not a source of significant quantities of placer gold. The Birch Creek Schist also hosts most of the known antimony deposits in the Kantishna Hills area.

The second oldest unit is the Spruce Creek Sequence which is composed of chlorite and graphitic schist, marble, and metavolcanic rocks. The unit is mainly exposed in a tectonic window from Eldorado Creek to Moonlight Creek (fig. 2). According to Bundtzen (1), a large majority of the structurally controlled ore deposits in the study area are hosted in the Spruce Creek Sequence. Geochemical, geologic, and petrologic evidence suggest that the sequence, constitutes a "source

TABLE 1. - Mineral development potential and estimated gold production (through 1984) of drainages in the Kantishna Hills study area

Drainage	Mineral development potential				Estimated Production (oz)
	High	Moderate	Low	Unknown	
Bear Creek			X		0
Bearpaw River			X		0
Beauty Creek				X	0
Canyon Creek,					
Main Fork			X		0
North Fork			X		0
Canyon Creek (Moose Creek Trib.)				X	0
Caribou Creek,					
Lower	X				100
Upper	X				18,000
Caribou Creek, unnamed					
northern tributary			X		0
Clearwater Fork				X	100
Crevice Creek	X				700
Eldorado Creek,					
Lower	X				200
Upper (Slate Creek)			X		0
Eureka Creek	X				12,000
Flat Creek		X			0
Friday Creek	X				6,000
Glacier Creek	X				8,000
Glen Creek	X				11,500
Last Chance Creek				X	700
Little Moose Creek	X				2,500
Moonlight Creek			X		0
Moose Creek,					
Below upper canyon	X				16,000
Above upper canyon	X	X			200
Myrtle Creek		X			100
Rainy Creek		X			500
Rock Creek			X		0
Snowshoe Creek				X	0
Spruce Creek		X			2,200
Stampede Creek	X				600
Willow Creek			X		0
Yellow Creek				X	600
Total					80,000

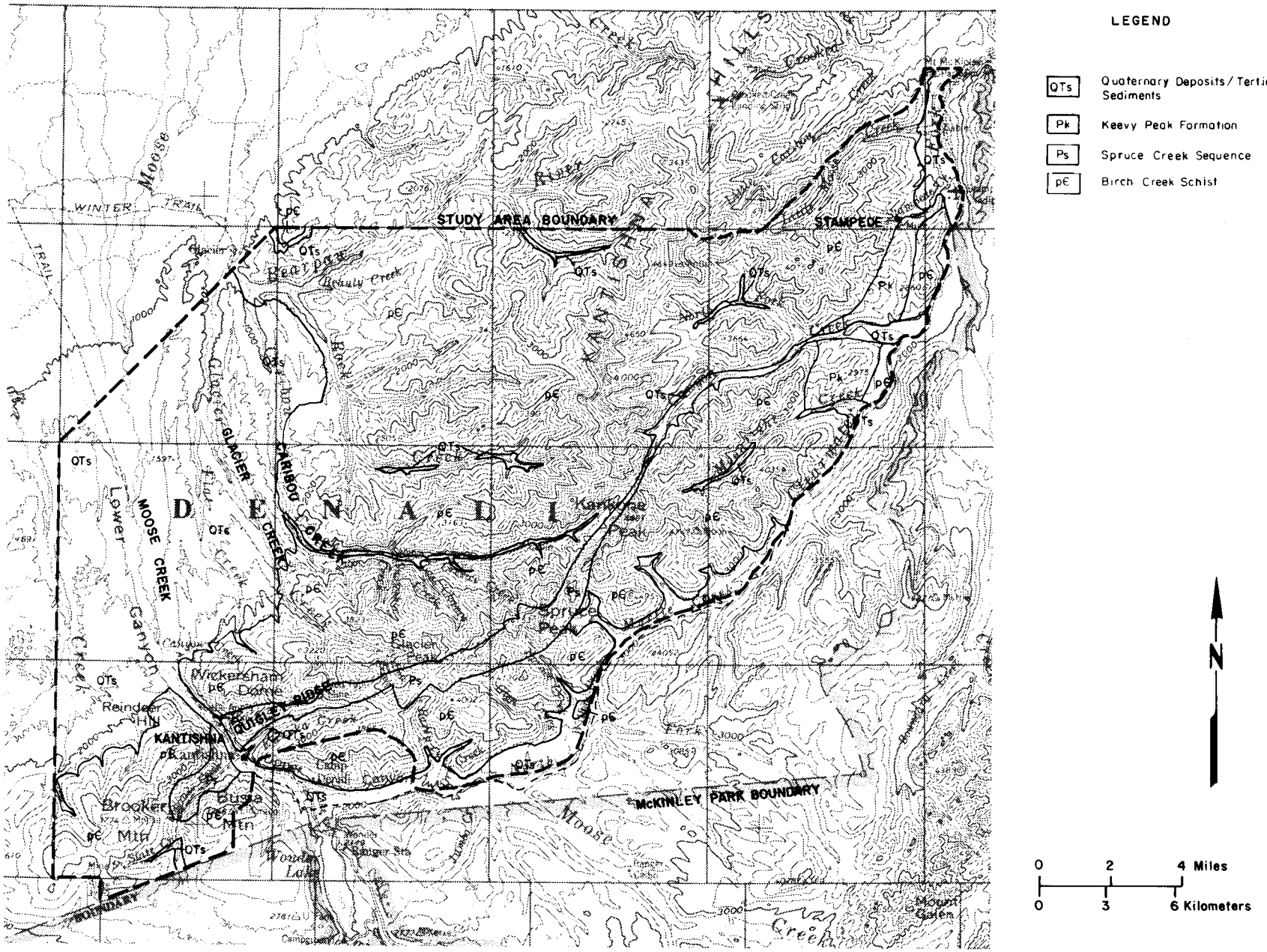


FIGURE 2. Geologic Map, Kantishna Hills Study Area, Alaska

bed" for much of the Kantishna Hills mineral deposits including the placer deposits.

The youngest metamorphic rocks in the Kantishna Hills area are metasedimentary and metavolcanic rocks of the Keevy Peak Formation (fig.2) and Totatlanika Schist, which are from Late Devonian to Mississippian age. Although the Totatlanika Schist is not known to be exposed in the study area, geologic relationships suggest that it may occur in the Stampede Mine area. The Keevy Peak Formation contains large volumes of pyritiferous black shale which is considered to be a favorable host rock for stratiform base metal sulfide mineralization. The potential of this unit as a source of placer gold remains unknown.

Undeformed mafic to felsic dike swarms and stocks of early Tertiary age intrude the older metamorphic rocks preferentially along the crest of a major fold structure, the Kantishna Anticline, that parallels the Spruce Creek Sequence. These rocks are spacially associated with metalliferous skarns containing minor amounts of base metal sulfides.

SEDIMENTS

Middle to Late Tertiary coal-bearing conglomerate, sandstone and mudstone overlie older lithologies, often in structural grabens. The layered rocks have been successively deformed by isoclinal to open folds and thrust- and high-angle faults. The region has been uplifted with the Alaska Range since mid-Tertiary. Shallow gravel thicknesses, well developed locally auriferous bench deposits, and steep bedrock canyons indicate that the region is still undergoing uplift. Modern stream alluvium, some of it gold-bearing, is being deposited in many streams.

Although at least four ages of Late Pleistocene till and outwash blanket much of the southern portion of the study area, most of the rugged upland was not glaciated during Wisconsin time.

Auriferous Sediments

The gold-bearing sediments of the Kantishna Hills study area have been divided into three categories: tributary stream, lowland alluvial, and glacial/alluvial deposits.

Tributary Stream Deposits

The tributary stream deposits consist of colluvium and alluvium in steep gradient drainages. The deposits average 10-ft-deep and 150-ft-wide. The deposits are poorly sorted and contain coarse, angular to subrounded material. Boulder content is usually less than 2 or 3% by volume or weight. A considerable amount of sand and silt, present as interstitial filling between pebbles and cobbles, form irregular beds and lenses. Gold is usually concentrated in the lower 2 ft of the deposits or on and within cracked and weathered bedrock. Gold is usually found disseminated laterally in the gravels because most of the concentrated paystreaks have been mined out.

Lowland Alluvial Deposits

The lowland alluvial deposits consist of recent stream and bench gravels. The lowland stream deposits are similar to the tributary

stream gravels, but the clasts are more rounded. The bench deposits are covered by variable thicknesses of frozen muck, and the underlying gravels contain discontinuous frozen lenses. Gold has been found on false bedrock clay layers, which are from 10 to 20 ft below the surface. Gravel thicknesses in the main valleys are unknown, but are thought to be greater than 100 ft at many locations.

Glacial/Alluvial Deposits

The glacial/alluvial deposits consist of a mixture of poorly washed glacial drift and alluvial gravels occurring as terrace deposits along the major stream drainages like Moose Creek. The deposits are composed mostly of subrounded material and usually contain gold which is fine-grained and sparsely disseminated. Higher gold concentrations may occur where these gravels lie unconformably on the Tertiary gravels, such as at Myrtle Creek.

BUREAU OF MINES INVESTIGATION

In 1983, the Bureau took 148 reconnaissance and 6 site specific bulk placer samples. Most of the streams in the study area were sampled, with at least one sample taken from each drainage. Site specific samples were taken from Spruce Creek, East Fork of Glen Creek, Arley Taylor's bench claim on Eureka Creek, Moose Creek and Eldorado Creek.

The procedure for reconnaissance bulk placer sampling consisted of processing 0.1 yd^3 of gravel through a portable aluminum mini-sluice box, hydraulic concentrator or suction dredge. The concentrates were saved and the gold recovered from them using a spiral concentrating wheel, pan, and amalgamation.

The procedures for taking site specific bulk samples were to wet screen, using a 1 mesh screen, six hundred to sixteen hundred lb of gravel in the field. The +1 mesh fraction was weighed and discarded, and the -1 mesh fraction was bagged and shipped to the Bureau's processing lab in Anchorage, Alaska. The samples were then dried and screened to +4, +6, +10, +14, +20, +30, +40, +50, +60, +70, +80, +100, +200, and -200 mesh sizes. Magnetic minerals were removed from the +4 through +70 mesh fractions and visually inspected for gold. No gold was noted with the magnetic minerals. The remaining non-magnetic heavy minerals in these fractions were separated by using a sluice, gold wheel, and pan. A pan was used to separate the free gold from the heavy mineral concentrates.

The +80 through -200 mesh fractions were geochemically analyzed for gold because the high clay content in these fractions prevented the use of gravity or amalgamation separation techniques.

RESULTS

Results obtained from 148 reconnaissance bulk placer samples and 6 site specific bulk placer samples are described below.

RECONNAISSANCE PLACER SAMPLING

The results of the reconnaissance placer sampling are summarized in appendix A by sample number and appendix B by stream drainage. The locations of the sample sites are shown on figure 3.

Each stream was given a mineral development potential rating for placer gold using one of four levels: "high", "moderate", "low", and "unknown". Table 1 shows development potential ratings and estimated production for 25 streams in the Kantishna Hills area. These ratings are estimates based on an evaluation of grades and extent of mineralization as well as geologic and geochemical factors. The criteria used to assess these potentials are listed in table 2.

Five drainages or portions of drainages lacking either recent mining activity or current mining claims were found to have high mineral development potential. These include: lowermost Caribou Creek, which includes the Bearpaw River immediately below Caribou Creek, Crevice Creek, upper 3 miles of Little Moose Creek, lower and upper Moose Creek, and Stampede Creek. Additional drainages found to have high mineral development potential which are currently staked include upper Caribou, Eldorado, Eureka, Friday, Glacier, and Glen Creeks.

SITE SPECIFIC PLACER SAMPLING

Six site specific bulk placer samples (B-1-6) were collected from five recently mined streams in the area for purposes of analyzing gravel and gold particle sizes. The streams were: Spruce Creek, East Fork of Glen Creek, Eureka Creek, Moose Creek, and Eldorado Creek. The weights of the gravel and gold in the various mesh sizes are listed on table 3. The grade of the site specific samples taken on the various creeks correlate with the grade of the backhoe-pit samples taken near the sample locations by Salisbury and Deitz, Inc. (11). Histograms of the percentages of gravel and gold in the mesh sizes are shown on figures 4-11.

A 900 lb sample (B-1) was taken from Spruce Creek (fig. 3). The sample was taken from 8.5 ft of tributary stream alluvium overlying Birch Creek Schist bedrock. Approximately 90% of the sample did not contain any gold and 90% of the gold was found in the -14 to +50 mesh portion of the sample (fig. 4). The sample contained 0.007 oz gold/yd^3 (table 3).

A 626 lb sample (B-2) was taken from the East Fork of Glen Creek (fig. 3). The sample was taken from tributary stream alluvium 3 ft deep overlying Birch Creek Schist bedrock. Approximately 80% of the sample did not contain any gold (fig. 5). Gold was found in the -10 to +70 mesh portions of the sample with the majority of the gold in the -20/+30 mesh fraction (fig. 5). The sample contained 0.016 oz gold/yd^3 (table 3).

A 1,013 lb sample (B-3) was taken from an alluvial fan on the north side of Eureka Creek (fig. 3). The alluvial fan consisted of colluvium and alluvium 30-40 ft deep. The top 11 ft of the material was sampled. The sample contained 55% +10 mesh and 18% -70 mesh material, none of which contained detectable gold (table 3, fig. 6). Over 90% of the gold was found in the -10 to +50 mesh fractions of the sample (fig. 6). The sample contained 0.008 oz gold/yd^3 (table 3).

Two samples (B-4 and 5) were taken from Moose Creek near the airstrip (fig. 3). The samples were taken from lowland alluvium. Permafrost was encountered at a depth of 6 ft at both locations.

TABLE 2. - Criteria used to assess placer gold mineral development potential of the Kantishna Hills Study Area, Alaska

Development Potential	Grade 1/, 2/	Reserves 2/	Study Recommendations
High	Highly anomalous samples collected and/or current production indicates a high probability that minable grades exist.	Established, or sampling indicates geologic conditions offer a high probability of establishing reserves to supply a mine of given size.	Site specific evaluation including: drilling and/or pit sampling is strongly recommended. Excellent chance for identifying a minable reserve.
Moderate	A single highly anomalous sample and/or anomalous samples indicate possibility that minable grades exist.	No established reserves. Geologic conditions are conducive for establishing enough reserves to supply mine of given size.	Additional reconnaissance and/or site specific evaluation recommended. Reasonable chance for identifying a minable reserve.
Low	Anomalous samples not obtained. Indications that minable grades are present were not identified.	No established reserves. Geologic conditions are poorly suited for establishing reserves to supply a mine of given size.	Additional reconnaissance has little possibility of identifying a minable reserve.
Undetermined	No sample results or available sample results are inconclusive. Additional reconnaissance is recommended before development potential is determined.		

1/ Highly anomalous: recovered values exceed 0.005 oz gold/yd^3
Anomalous : recovered values range from 0.0005-0.005 oz gold/yd^3
Background : recovered values less than 0.0005 oz gold/yd^3

2/ Mine Size/Grade Assumptions used for Resource Assessment

Size of Mine	Cubic yards processed	Grade
Small	<500 yd^3/d	>0.015 oz gold/yd^3
Medium	500-2000 yd^3/d	>0.010 oz gold/yd^3
Large	>2000 yd^3/d	>0.007 oz gold/yd^3

TABLE 3. - Results of site specific bulk placer sampling in the Kantishna Hills study area

Sieve Size (mesh)	Spruce Creek (B-1)		Glen Creek (B-2)		Eureka Creek (B-3)		Kantishna Airstrip(B-4)		Kantishna Airstrip(B-5)		Eldorado Creek (B-6)	
	Gravel weight(lb)	Gold weight grams	Gravel weight (lb)	Gold weight grams	Gravel weight(lb)	Gold weight grams	Gravel weight(lb)	Gold weight grams	Gravel weight(lb)	Gold weight grams	Gravel weight(lb)	Gold weight grams
+ 1	486	0	265	0	436	0	978	0	296	0	unknown	0
+ 4	135	0	73	0	94	0	171.5	0	53	0	69	0
+ 6	40.5	0	27	0	32	0	56.5	0	24.5	0	30.25	0
+ 10	74.25	0	53.25	0	70.5	0	126.75	0	24.5	0	63.50	0.0433
+ 14	28.5	0	25.75	0.0104	38	0.0168	61.25	0	17.25	0.0218	29	0.0415
+ 20	25.5	0.0158	24.75	0.0085	39.75	0.0153	62.5	0	27.25	0.0158	27.5	0.0397
+ 30	21.5	0.0136	22.75	0.0441	37.25	0.013	50.5	0	21	0.0353	24	0.0579
+ 40	18	0.0168	19.75	0.018	30.75	0.0208	33.5	0.0071	24.5	0.031	19.5	0.0385
+ 50	13.75	0.0132	15.75	0.0143	26.75	0.0122	22.5	0.0092	30.25	0	15.25	0.016
+ 60	6	0.0038	9.25	0.0069	16	0.0028	7.5	0.004	14	0	7	0.0018
+ 70	4.5	0.003	6	0.004	12	0.0033	4.75	0.0016	11.5	0	5	0.002
+ 80	4.25	0	6	0	11.75	0	4	0	12	0	4.5	0
+100	5.5	0	7.5	0	14.75	0	4.25	0	13	0	5.25	0
+200	17.25	0	27.25	0	56	0	8.5	0	30.5	0	16.25	0
-200	28.5	0	43	0	97.75	0	8.25	0	15.75	0	26	0
Total	909	0.0662	626	0.1062	1013.25	0.0842	1600.25	0.0219	615	0.1039	342 +	0.2407
oz gold/ yd^3		0.0070		0.0163		0.0080		0.0013		0.0163		ND

ND Not determined.

Figure 4. Histogram of Sample B—1,

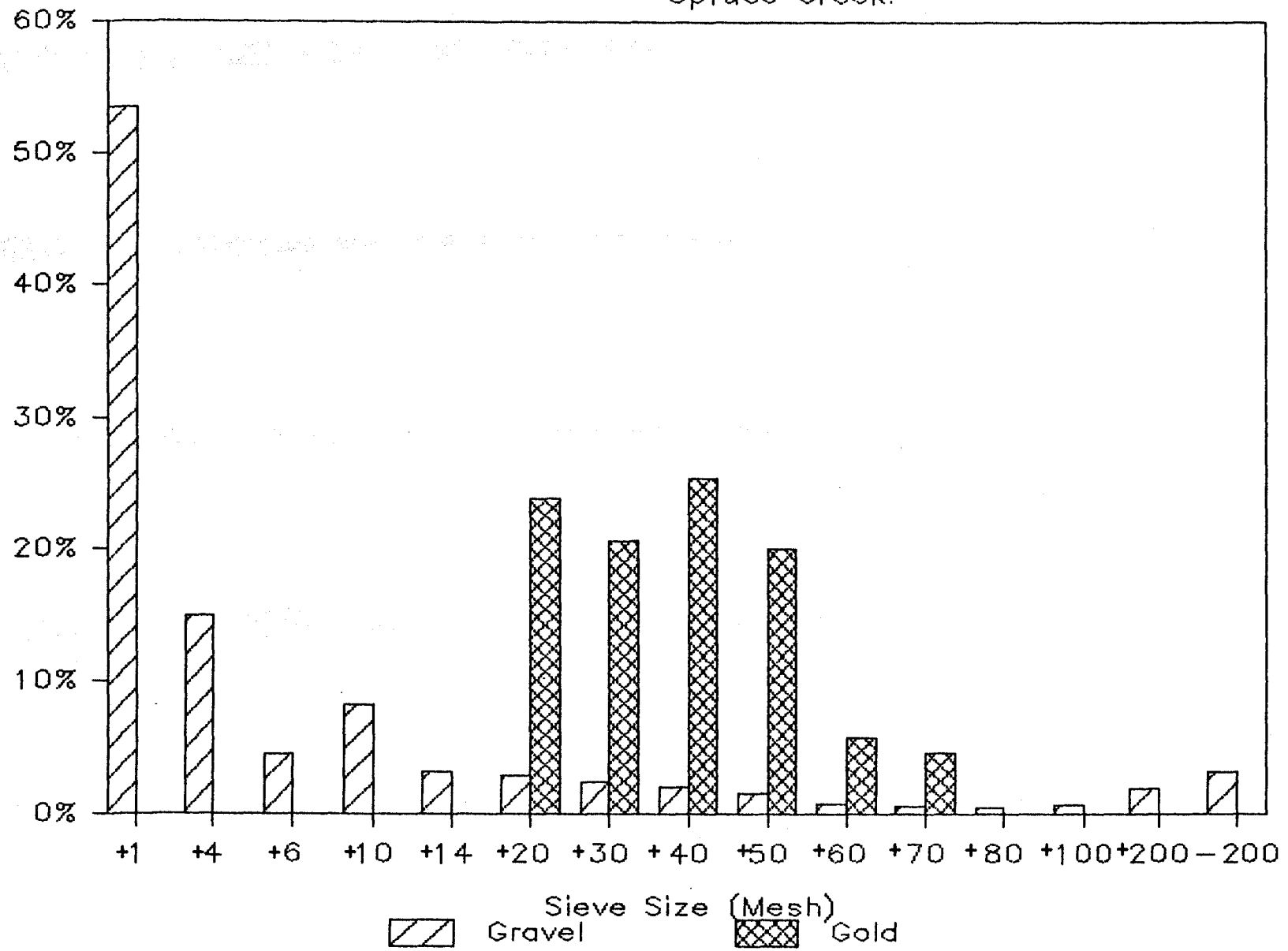


Figure 5. Histogram of Sample B-2,

East Fork of Glen Creek.

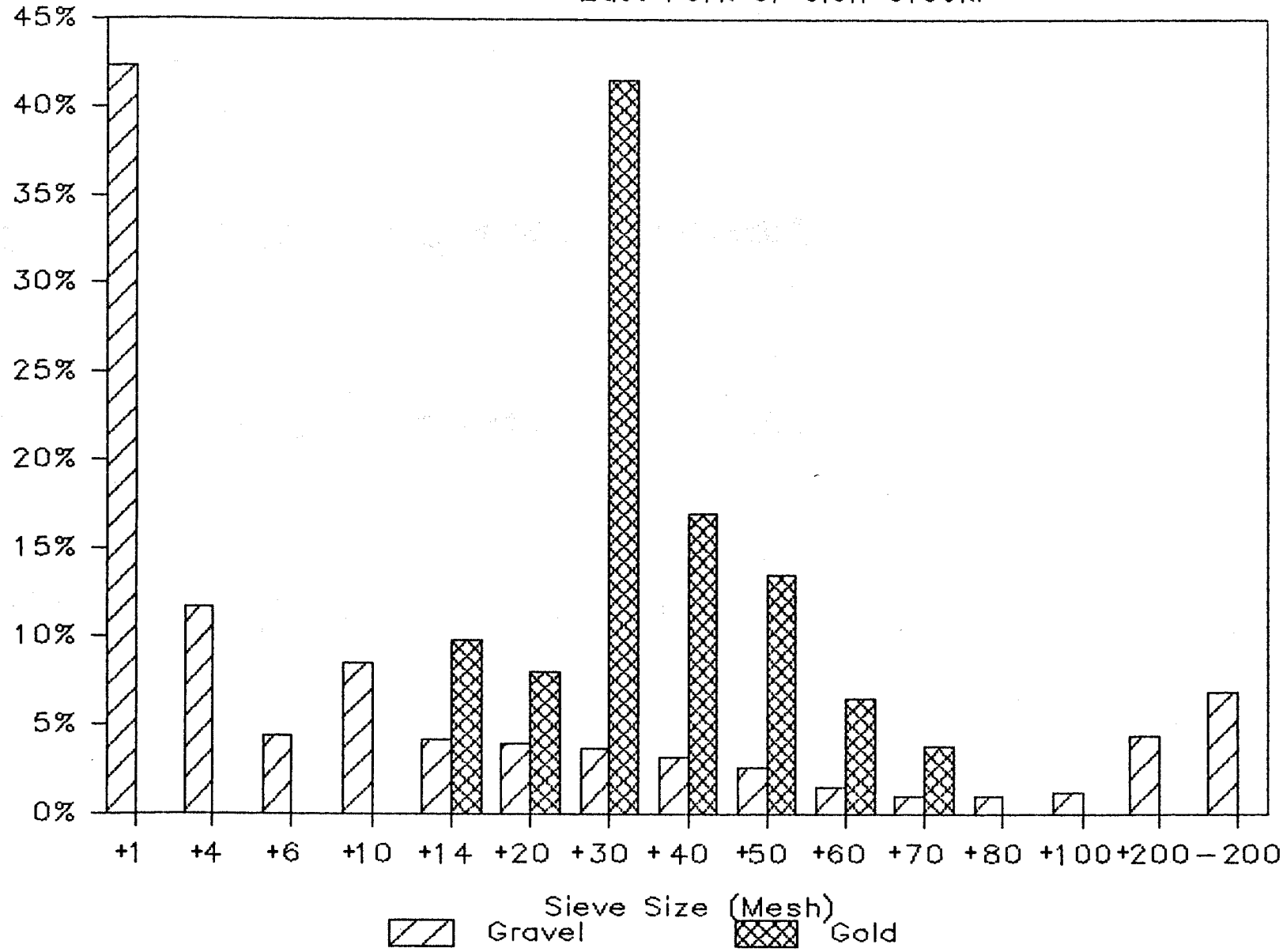
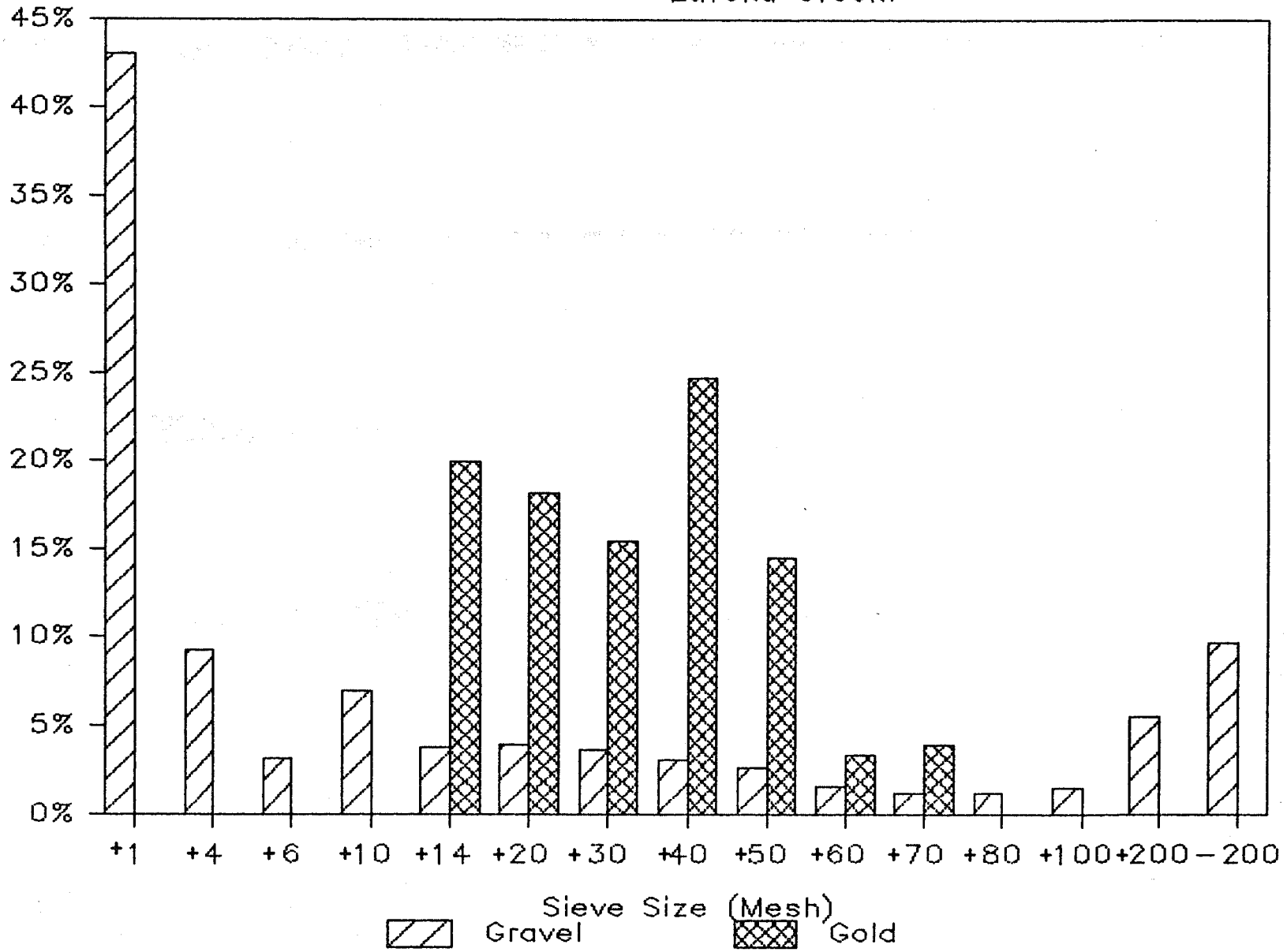


Figure 6. Histogram of Sample B-3, Eureka Creek.



Approximately 95% of the material in the 1,600 lb sample (B-4) contained no gold (fig. 7). Gold was only found in the -30 to +70 mesh portion of the sample (fig. 7). The sample contained 0.001 oz gold/yd^3 (table 3). Approximately 85% of the material in the 615 lb sample (B-5) contained no gold (fig. 8). Gold was recovered only from the -10 to +40 mesh portion of the sample (fig. 8). The sample contained 0.016 oz gold/yd^3 (table 3).

Figure 9 summarizes the gold sizes found in both samples from Moose Creek. The highest percentage of gold is -30/+40 mesh in size and 98% of the gold ranges from -10 to +50 mesh in size.

One sample (B-6) was taken from Eldorado Creek (fig. 3). The sample was taken from tributary stream alluvium 3 ft deep overlying Spruce Creek schist. The weight measurement of the +1 mesh size fraction of the gravel was lost; therefore, a size distribution graph of the gravel was not possible. It can be assumed that the size distribution would be similar to that of the other samples. Over 97% of the gold was in the -6 to +50 mesh size fractions (fig. 10).

Figure 11 is a graph of the cumulative results for all five bulk samples. The graph indicates that approximately 90% of the gold is coarser than 50 mesh; and the majority of the gravel is coarser than 4 mesh.

SUMMARY

The Bureau conducted reconnaissance and site specific bulk placer sampling in the Kantishna Hills study area in 1983. The results of reconnaissance sampling indicated that several drainages or portions of drainages lacking either recent mining activity or current mining claims have high mineral development potentials for placer gold.

Site specific sampling indicates that 99+% of the gold occurring on five recently mined drainages in the Kantishna Hills study area is between -6 and +70 mesh in size.

Gravel coarser than 6 mesh and finer than 70 mesh was found to contain very little gold. These size fractions represent over 75% of the total gravel volume. The size fractionation study indicates that although large nuggets may be an important constituent of the gravels of these streams and nugget traps should be installed on most recovery plants, the recovery portion of the plant should be designed to process -1 mesh gravel sizes and recover gold coarser than 70 mesh.

Figure 7. Histogram of Sample B-4,

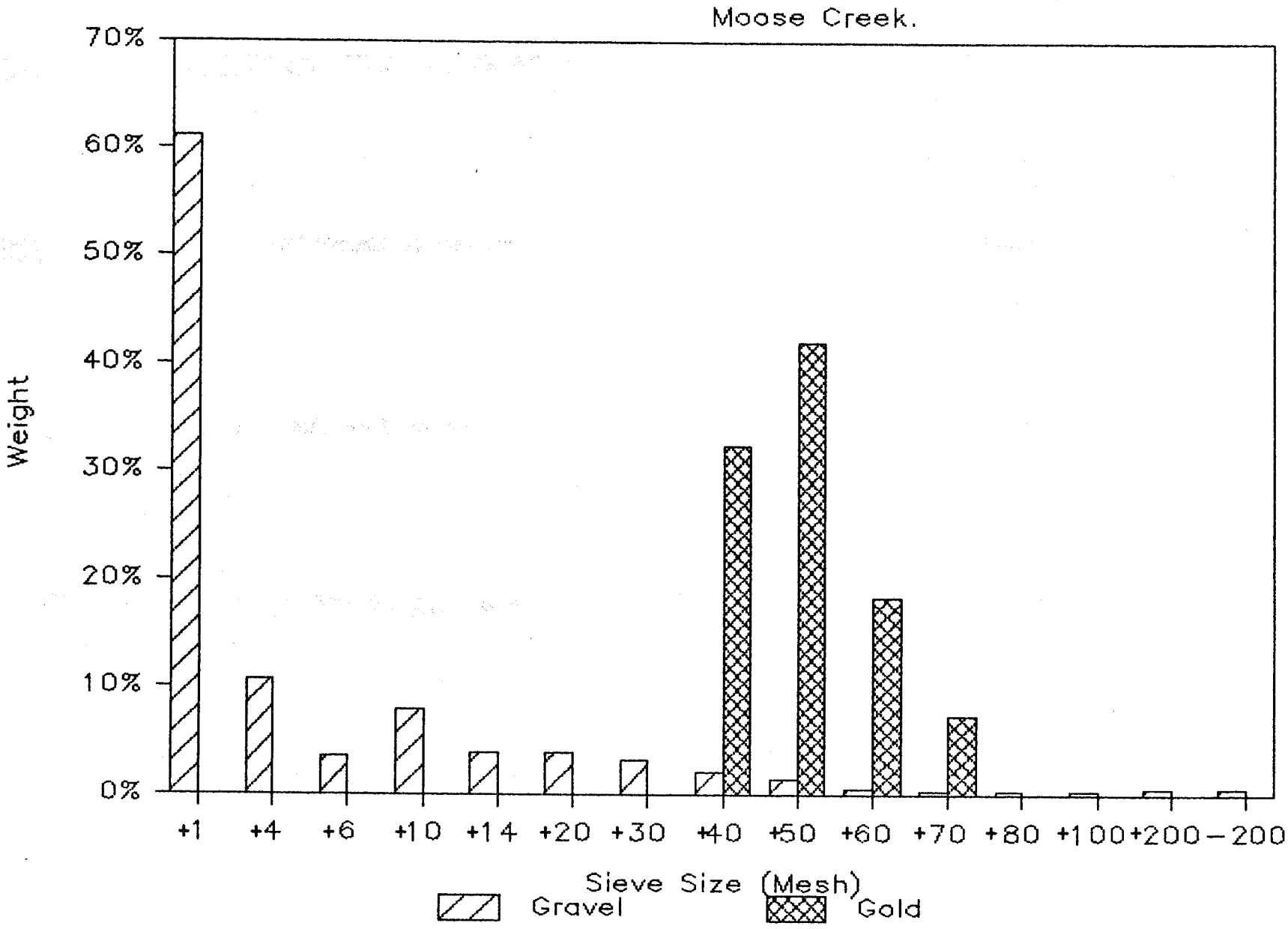


Figure 8. Histogram of Sample B-5, Moose Creek.

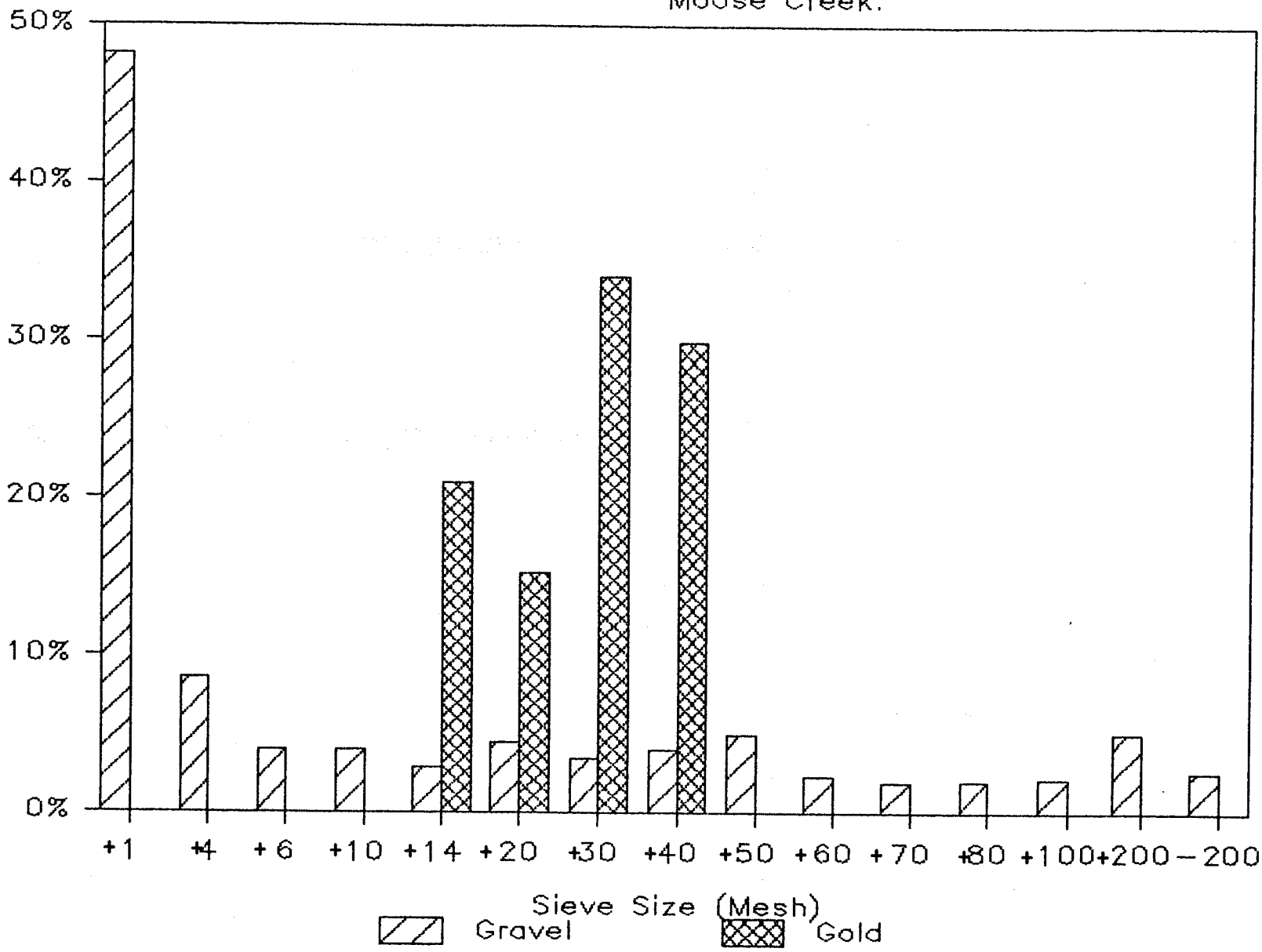


Figure 9. Cumulative Histogram of Samples B-4 and 5.

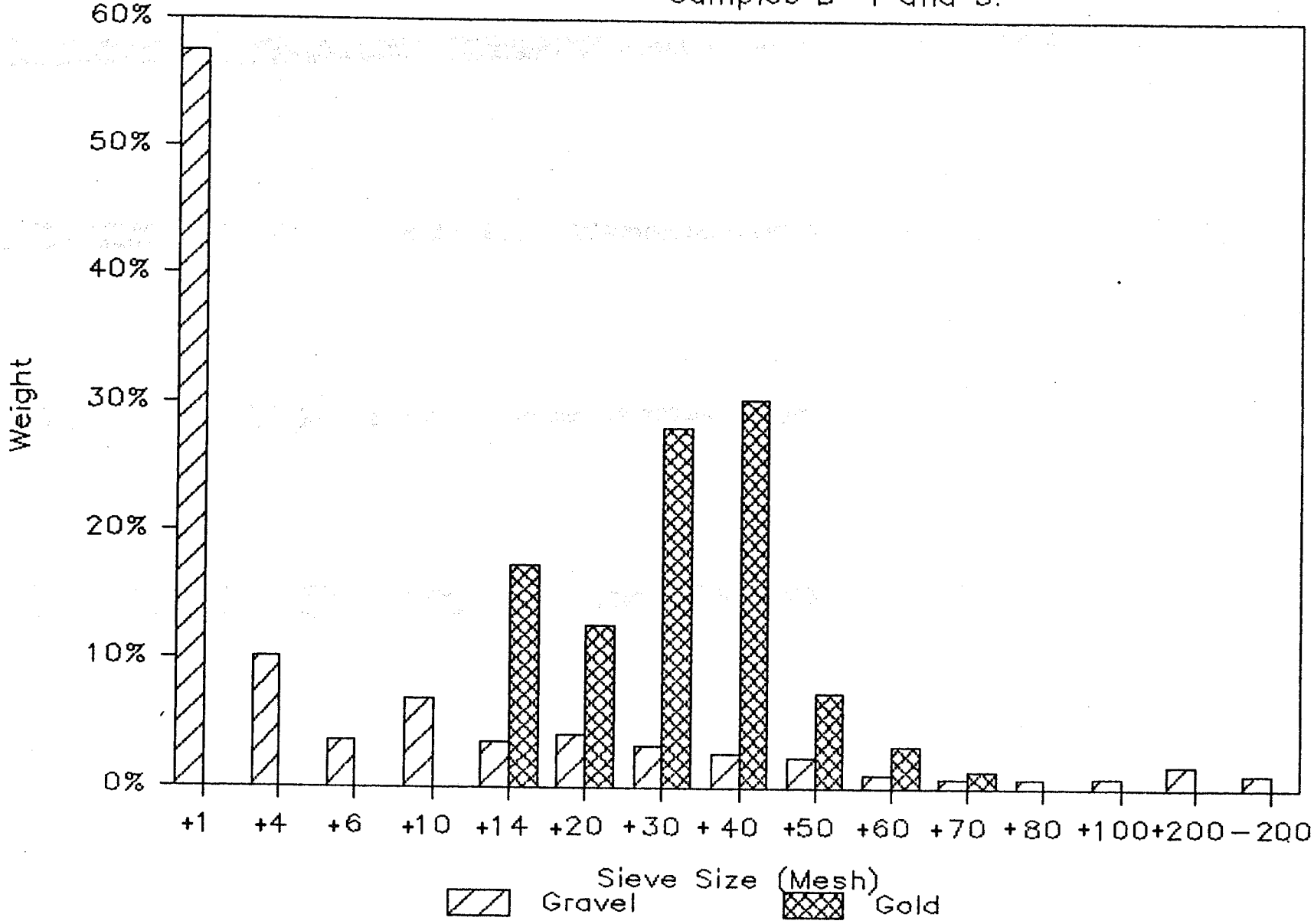


Figure 10. Histogram of Sample B-6

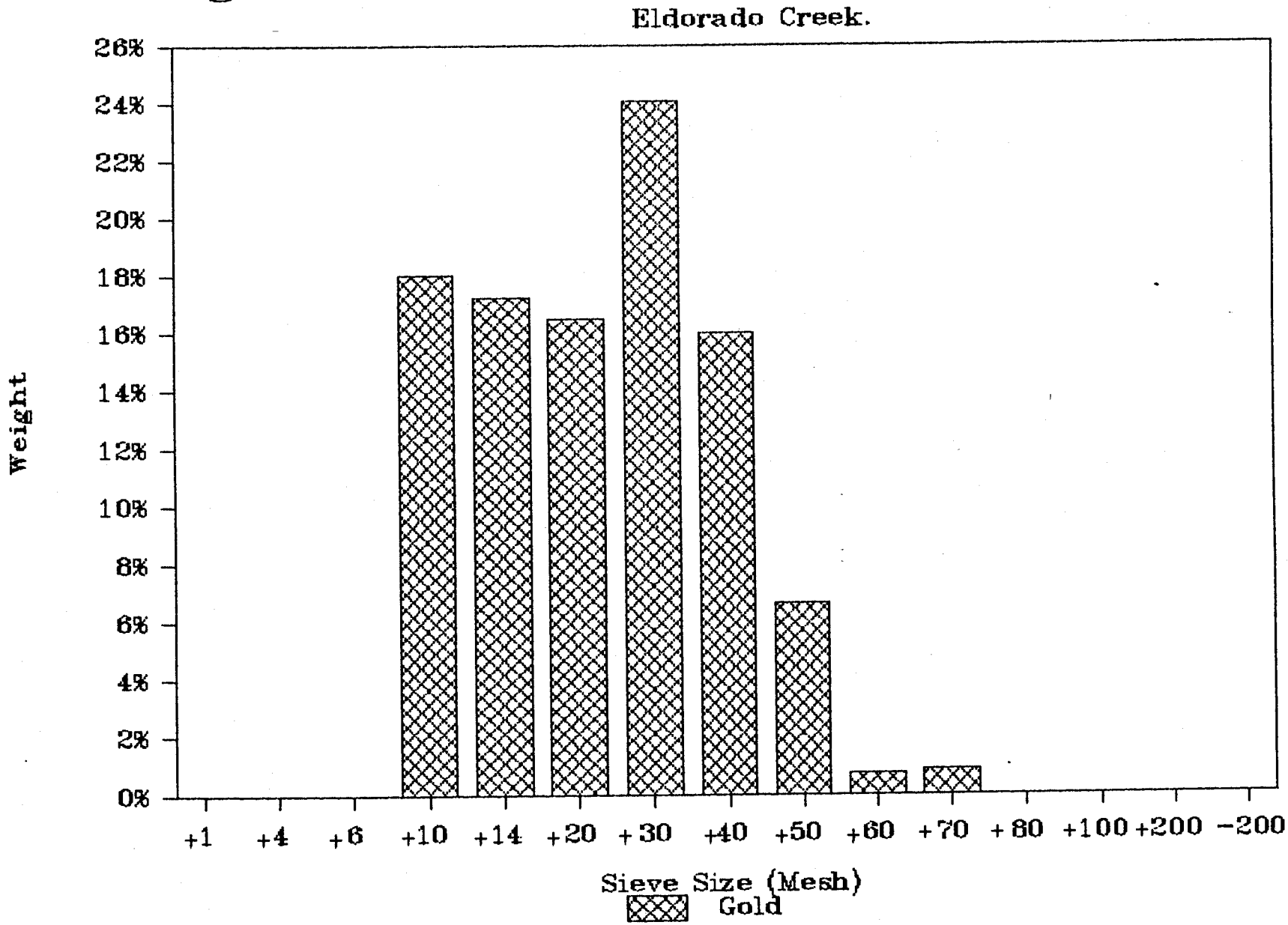
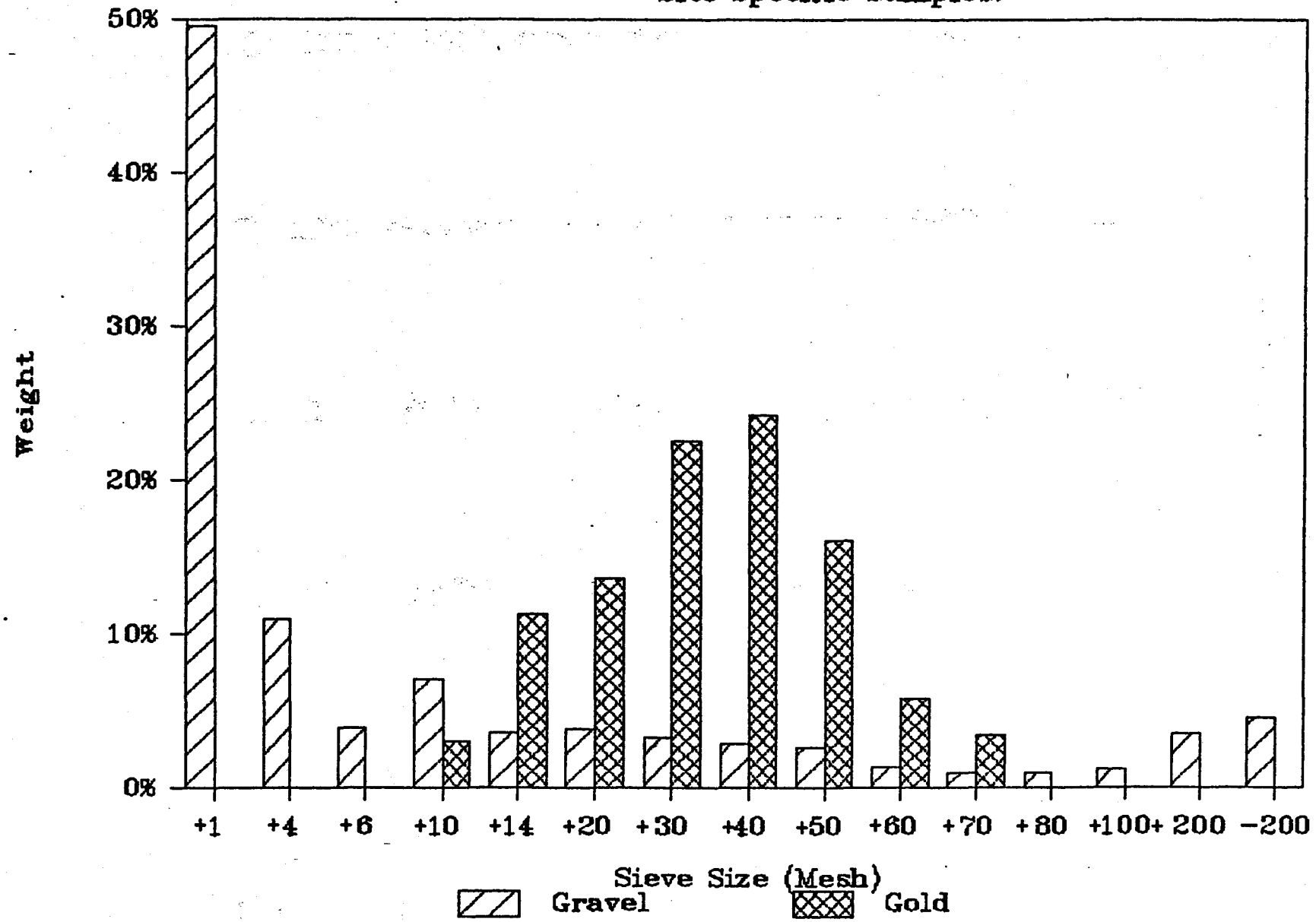


Figure 11. Cumulative Histogram of Site Specific Samples.



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APPENDIX A. - RESULTS OF RECONNAISSANCE PLACER SAMPLING IN THE KANTISHNA HILLS STUDY AREA

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
1	Little Moose	Sluice	0.1	ND	NA	Sandy alluvial gravel. Poor sample location.
2	do	do	0.1	0.0066	537	Alluvial gravel and 4 ft^2 bedrock worked. Good sample location.
3	Stampede	do	0.1	0.2925	532	6 to 8 ft^2 of bedrock worked in previously disturbed area. Excellent sample location.
4	Little Moose	do	0.1	0.0597	579	Bedrock sampled, previously mined area. Excellent sample location.
5	do	do	0.1	0.0002	NA	Alluvial gravel. Fair sample location.
6	do	do	0.1	0.0058	NA	Mixed colluvial and alluvial gravel. Poor sample location.
7	Stampede	do	0.1	0.0418	NA	Angular bedrock fragments and rounded boulders to 3 ft on bedrock. Fair sample location.
8	Tributary to Stampede	do	0.1	0.0003	NA	Angular to subangular bedrock fragments, with smaller and less numerous quartz boulders. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
9.....	Tributary to Stampede.....	Sluice...	0.1	0.0013	NA	Angular graphitic schist fragments with numerous quartz boulders to 4 ft across. Abundant pyrite recovered. Poor sample location.
10.....	Bearpaw.....	...do.....	0.1	trace 2/	NA	Alluvial gravel. Poor sample location.
11.....	.....do.....	...do.....	0.1	do.	NA	Alluvial gravel. Poor sample location.
12.....	.....do.....	...do.....	0.1	ND	NA	Alluvial gravel. Poor sample location.
13.....	.....do.....	...do.....	0.1	trace	NA	Alluvial gravel. Poor sample location.
14.....	Bearpaw tributary..	...do.....	0.1	do.	NA	Alluvial gravel. Poor sample location.
15.....	.....do.....	...do.....	0.1	do.	NA	Alluvial gravel bar. Poor sample location.
16.....	Bearpaw.....	...do.....	0.1	0.0004	NA	Surface of alluvial gravel bar. Fair sample location.
17.....	.....do.....	...do.....	0.1	ND	NA	Alluvial gravel bar. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
18.....	Bearpaw.....	Sluice...	0.1	0.0021	759	Alluvial gravel bar. Fair sample location.
19.....	.....do.....	...do.....	0.1	0.0029	623	Alluvial gravel bar. Boulders up to 16 in. in diameter common. Poor sample location.
20.....	.....do.....	...do.....	0.1	0.0002	NA	Alluvial gravel bar. Clasts less than 12 in. Poor sample location.
21.....	Caribou.....	...do.....	0.1	0.0261	660	Surface sample near head of alluvial gravel bar. Boulders up to 2 ft in diameter present. Fair sample location.
22.....	Bearpaw Tributary..	...do.....	0.1	trace	NA	Coarse alluvial gravel on bedrock. Fair sample location.
23.....	Rock.....	...do.....	0.1	0.0018	801	Head of alluvial gravel bar. Fair sample location.
24.....	Bearpaw.....	...do.....	0.1	trace	NA	Alluvial bench. 6-ft long channel. Sandy gravel on top with boulders at the bottom. Fair sample location.
25.....	Beauty.....	...do.....	0.1	trace	NA	Mixed colluvial/alluvial gravels near bedrock. Fair sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
26.....	North Fork Canyon..	Sluice...	0.1	0.0002	NA	Alluvial gravels. Poor sample location.
27.....	Clearwater Tributary.....	....do....	0.1	0.0005	NA	Alluvial/colluvial gravel. Poor sample location.
28.....	North Fork Canyon Tributary.....	....do....	0.1	0.0001	NA	Alluvial gravel on bedrock. Good sample location.
29.....	North Fork Canyon..	....do....	0.1	0.0001	NA	Alluvial gravel. Fair sample location.
30.....	.....do.....	....do....	0.1	0.0006	NA	Alluvial gravel on bedrock. Good sample location.
31.....	.....do.....	....do....	0.1	ND	NA	Alluvial gravel on bedrock. Good sample location.
32.....	Caribou.....	....do....	0.1	0.0057	NA	Surface sample near head of alluvial gravel bar. Boulders up to 1.5 ft in diameter. Fair sample location.
33.....	.....do.....	....do....	0.1	0.3045	NA	Surface sample near head of alluvial gravel bar. Boulders up to 1.5 ft in diameter. Fair sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
34.....	Rock Tributary.....	Sluice...	0.1	trace	NA	Colluvium on bedrock. Large boulders present. Fair sample location.
35.....	Rock.....	....do....	0.1	0.0001	NA	Sandy alluvium with large boulders. Poor sample location.
36.....	Canyon Tributary...	....do....	0.1	0.0003	NA	Alluvium on bedrock. Good sample location. Coarse scheelite recovered.
37.....	.....do.....	....do....	0.1	0.0002	NA	Alluvium. Poor sample location.
38.....	.....do.....	....do....	0.1	0.0005	NA	Alluvium. Poor sample location.
39.....	Canyon.....	....do....	0.1	0.0002	NA	Alluvium on bedrock. Good sample location.
40.....	.....do.....	....do....	0.1	trace	NA	Alluvium on bedrock. Fair sample location.
41.....	.....do.....	....do....	0.1	0.0001	NA	Alluvium on bedrock. Good sample location.
42.....	Clearwater Fork....	....do....	0.1	0.0004	NA	Alluvium on bedrock. Fair sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
43	Moonlight	Sluice	0.1	trace	NA	Sandy alluvium. Poor sample location.
44	Canyon	do	0.1	trace	NA	Alluvium. Poor sample location.
45	do	do	0.1	0.0001	NA	Alluvium. Fair sample location.
46	Rock	do	0.1	trace	NA	Alluvium on bedrock. Fair sample location.
47	Rock	do	0.1	do	NA	Alluvial gravel bar. Poor sample location.
48	do	do	0.1	do	NA	Alluvial gravel bar. Poor sample location.
49	Rock Tributary	do	0.1	do	NA	Alluvial gravel bar. Poor sample location.
50	do	do	0.1	0.0012	831	Alluvial gravel bar. Boulders greater than 2 ft in diameter. Poor sample location.
51	Rock	do	0.1	0.0001	NA	Sandy alluvium. Poor sample location.
52	Canyon Tributary	do	0.1	trace	NA	Alluvium. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
53.....	Canyon.....	Sluice...	0.1	0.0002	NA	Alluvium. Fair sample location.
54.....	Moonlight.....	...do.....	0.1	ND	NA	Alluvium/colluvium on bedrock. Good sample location.
55.....	Canyon.....	...do.....	0.1	0.0002	NA	Alluvium. Poor sample location.
56.....	Rock.....	...do.....	0.1	trace	NA	Alluvium. Poor sample location.
57.....	.....do.....	...do.....	0.1	.....do.....	NA	Alluvium on bedrock. Fair sample location.
58.....	.....do.....	...do.....	0.1	ND	NA	Alluvium near bedrock. Fair sample location.
59.....	.....do.....	...do.....	0.1	trace	NA	Alluvium/colluvium. Poor sample location.
60.....	.....do.....	...do.....	0.1	.....do.....	NA	Sandy alluvium on bedrock. Good sample location.
61.....	.....do.....	...do.....	0.1	.....do.....	NA	Alluvium. Fair sample location.
62.....	.....do.....	...do.....	0.1	.....do.....	NA	Sandy alluvium. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
63.....	Rock Tributary.....	Sluice	0.1	trace	NA	Alluvium with boulders 3 ft in diameter. Fair sample location.
64.....	Caribou Tributary..	...do.....	0.1	.....do.....	NA	Sandy alluvium on bedrock. Fair sample location.
65.....	Caribou.....	...do.....	0.1	0.0005	NA	Alluvium/colluvium. Poor sample location.
66.....	Clearwater Tributary.....	...do.....	0.1	trace	NA	Alluvium/colluvium. Poor sample location.
67.....	Caribou.....	...do.....	0.1	0.0077	654	Alluvium on bedrock. Fair sample location.
68.....	.....do.....	...do.....	0.1	0.0012	NA	Alluvium on bedrock. Fair sample location.
69.....	Caribou Tributary..	...do.....	0.1	0.0004	NA	Alluvium/colluvium. Poor sample location.
70.....	.....do.....	...do.....	0.1	0.0003	NA	Alluvium with boulders up to 4 ft in diameter. Poor sample location.
71.....	Caribou.....	...do....	0.1	0.0193	NA	Surface sample of mid channel bar. Boulders up to 3 ft in diameter. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance of placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
72.....	Snowshoe.....	Sluice...	0.1	trace	NA	Alluvium/colluvium with boulders up to 16 in. in diameter. Poor sample location.
73.....	Last Chance.....	...do.....	0.1	0.0003	NA	Alluvium/colluvium on bedrock. Fair sample location.
74.....	.....do.....	...do.....	0.1	0.0003	NA	Sandy alluvium with boulders up to 14 in. in diameter. Poor sample location.
75.....	Crevice.....	...do.....	0.1	0.0022	613	Alluvial gravel bar. Fair sample location.
76.....	.....do.....	...do.....	0.1	0.0018	631	Alluvial gravel bar. Fair sample location.
77.....	.....do.....	...do.....	0.1	0.0107 plus 0.0114 oz nugget	NA	Alluvium on bedrock. Excellent sample location.
78.....	Myrtle.....	...do.....	0.1	trace	NA	Alluvium/colluvium on bedrock. Poor sample location.
79.....	.....do.....	...do.....	0.1	0.0005	NA	Thin alluvium on bedrock. Good sample location.
80.....	.....do.....	...do.....	0.1	0.0121	827	Thin alluvium on bedrock. Excellent sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
81.....	Clearwater Tributary.....	Sluice...	0.1	0.0002	NA	Alluvium/colluvium. Poor sample location.
82.....	Myrtle.....	...do.....	0.1	0.0011	768	Alluvium on bedrock. Fair sample location.
83.....	.....do.....	...do.....	0.1	0.0001	NA	Colluvium on bedrock. Fair sample location.
84.....	.....do.....	...do.....	0.1	trace	NA	Sandy gravel from bench. Fair sample location.
85.....	.....do.....	Hydraulic concentrator	0.1	0.0004	NA	Alluvium from upper section of 24 ft tall bench. Good sample location.
86.....	.....do.....	...do.....	0.1	0.0050	735	Alluvium from 24 ft tall gravel bench. Good sample location.
87 & 88.	.....do.....	...do.....	0.2	0.0001	NA	Hematite-stained fine gravel from mid-section of 24 ft tall bench. Good sample location.
89.....	.....do.....	Sluice...	0.1	0.0002	NA	Alluvium from 6 ft tall bench. Poor sample location.
90.....	.....do.....	...do.....	0.1	.....do.....	NA	Alluvium/colluvium. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
91	Mrytle	Sluice	0.1	0.0003	NA	Alluvium/colluvium. Poor sample location.
92	do	do	0.1	0.0021	614	Alluvium/colluvium. Poor sample location.
93	Last Chance	do	0.1	0.0006	NA	Alluvium/colluvium. Poor sample location.
94	Flat	do	0.1	0.0036	NA	Alluvial gravel bar. Fair sample location.
95	do	do	0.1	trace	NA	Alluvial gravel on bedrock. Fair sample location. Sample lost, trace amounts of gold noted in concentrate.
96	Moose	Hydraulic concentrator	0.2	trace	NA	Sample of slough at bottom of a 40-ft tall gravel bench. Poor sample location.
97	do	Sluice	0.1	0.0092	630	Sandy alluvial gravel bar. Poor sample location.
98	do	Hydraulic concentrator	0.2	0.0080	760	Alluvial bench gravel. Channel sample taken from bedrock to 4 ft above bedrock. Good sample location.
99	do	do	0.2	0.0167	724	15-ft tall alluvial bench. Channel sample taken from bedrock to 7.25 ft above bedrock. Good sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
100.....	Moose.....	Hydraulic concentrator	0.1	0.0010	NA	Alluvial bench gravel. Sampled slough from upper 18 ft. Fair sample location.
101.....	.....do.....	3-in. suction dredge	Approximately 0.3	0.5100	713	Alluvium covering 20 ft^2 of bedrock was sampled. Dredge worked for 1 hour and recovered 0.1519 ounces. Excellent sample location.
102.....	.....do.....	Sluice	0.1	0.0150	NA	Alluvial gravel bar. Fair sample location.
103.....	.....do.....	...do.....	0.1	0.0002	NA	Alluvial bench gravel. Fair sample location.
104.....	Canyon.....	...do.....	0.1	NA	NA	Colluvium on bedrock. Fair sample location. Sample lost, no gold noted in concentrate.
105.....	Willow.....	...do.....	0.1	0.0002	NA	Alluvium/colluvium. Poor sample location.
106.....	.....do.....	...do.....	0.1	.....do.....	NA	Alluvial gravel on bedrock in cutbank. Fair sample location.
107.....	East Fork Glen.....	...do.....	0.1	0.0004	NA	Alluvium/colluvium bench deposit. Fair sample location.
108.....	Moose.....	...do.....	0.1	0.0025	738	Alluvium. Fair sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
109.....	Moose.....	Sluice...	0.1	0.0058	NA	Alluvial bench gravel. Good sample location.
110.....	.....do.....	...do.....	0.1	0.0050	NA	Alluvium. Good sample location.
111.....	Moose-Rainy Junction.....	...do.....	0.1	0.0074	NA	Alluvium on bedrock. Excellent sample location.
112.....	.....do.....	...do.....	0.1	0.0028	NA	Alluvial bench gravel. Channel sample taken from bedrock to 7 ft above bedrock. Good sample location.
113.....	Dry.....	...do.....	0.1	trace	NA	Colluvium on bedrock. Poor sample location.
114.....	Rainy.....	...do.....	0.1	0.0104	743	Alluvium/colluvium on bedrock. Good sample location.
115.....	.....do.....	...do.....	0.1	0.0003	NA	Colluvium. Poor sample location.
116.....	Lucky Gulch.....	...do.....	0.1	0.0064	NA	Colluvium taken below Banjo gold mine. Poor sample location.
117.....	Banjo Dump.....	...do.....	0.1	0.1639	635	Quartz from the Banjo mine dump. Excellent sample location.
118.....	Friday.....	...do.....	0.1	0.0086	NA	Colluvium. Poor sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments[1/]
119.....	Moose.....	Sluice...	0.1	0.0013	717	Alluvium. Fair sample location.
120.....	.....do.....	...do.....	0.1	0.0193	NA	Alluvium. Good sample location.
121.....	.....do.....	Hydraulic concentrator...	0.2	0.0013	NA	Sandy alluvial gravel on false clay bedrock. Fair sample location.
122.....	.....do.....	Pan.....	0.1	0.0739	NA	Alluvium on clay bedrock. Excellent sample location.
123.....	Moose Tributary....	Sluice...	0.1	trace	NA	Alluvium/colluvium. Poor sample location.
124.....	Eldorado.....	...do.....	0.1	0.0159	787	Bedrock sampled. Good sample location.
125.....	.....do.....	Hydraulic concentrator...	0.1	NA	NA	Alluvium. Good sample location. Sample lost.
126.....	.....do.....	...do.....	0.1	NA	NA	Alluvium. Good sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
127.....	Eldorado.....	Sluice...	0.1	0.0706	NA	Sandy alluvium on bedrock. Excellent sample location.
128.....	.....do.....	...do.....	0.1	0.0177	NA	Alluvium/colluvium on bedrock. Good sample location.
129.....	.....do.....	...do.....	0.1	0.0182	829	Alluvium on bedrock. Excellent sample location.
130.....	Reinhart.....	...do.....	0.1	trace	NA	Alluvium/colluvium. Poor sample location.
131.....	Eldorado.....	...do.....	0.1	.....do.....	NA	Slough from bench alluvium. Good sample location.
132.....	.....do.....	...do.....	0.1	0.0012	NA	Alluvium/colluvium. Good sample location.
133.....	Eldorado Tributary.....	...do.....	0.1	0.0019	952	Alluvium/colluvium on bedrock. Good sample location.
134.....	Slate.....	...do.....	0.1	0.0004	NA	Alluvium/colluvium on bedrock. Fair sample location.

See footnotes at end of appendix.

APPENDIX A. - Results of reconnaissance placer sampling in the Kantishna Hills study area - Continued

Sample no.	Drainage	Sample type	Sample size (yd^3)	Grade (oz gold/yd^3)	Fineness	Comments 1/
135.....	Slate.....	Sluice...	0.1	0.0003	NA	Alluvium/colluvium. Fair sample location.
136.....	Bear Tributary.....	...do.....	0.1	ND	NA	Alluvium/colluvium. Poor sample location.
137.....	.....do.....	...do.....	0.1	trace	NA	Alluvium/colluvium. Poor sample location.
138.....	Bear.....	...do.....	0.1	0.0004	NA	Alluvium/colluvium. Fair sample location.
139.....	.....do.....	...do.....	0.1	ND	NA	Alluvium/colluvium. Poor sample location.
140.....	.....do.....	...do.....	0.1	0.0002	NA	Alluvium/colluvium. Fair sample location.

NA Not analyzed.
ND Not detected.
1/Comments include a description of the geology of the sample site and an evaluation of the site based on the following criteria.

Excellent: Bedrock reached, little water in hole. Good location for gold to accumulate. Likely high graded sample in excess of average value of gravels in immediate area.

Good: Bedrock reached, may have water in hole, fair to good area for gold to accumulate. Likely representative of value of gravels in immediate area.

Fair: Bedrock not reached and/or poor location for gold to accumulate. May underestimate value of gravels in immediate area.

Poor: Bedrock not reached and water in hole. Bad location for gold to accumulate. Likely underestimates value of gold.

2/Trace - less than 0.0001 oz gold/yd^3 recovered.

APPENDIX B. - SUMMARY OF STREAM DRAINAGES IN THE KANTISHNA HILLS STUDY AREA - ALPHABETICALLY LISTED

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed

Drainage/location	Summary of deposits	Workings and production	Sample data
Bear Creek Mt. McKinley B2/B3 Quads. T15-16S, R18W	The upper portions of Bear Creek occupy steep narrow colluvial filled valleys with little accumulation of alluvium. Average gradients are about 500 ft/mi. The middle portion of Bear Creek occupies a wider alluvial filled valley having a gradient of about 100 ft/mi. Bedrock appears to be deep along much of the drainage.	No workings were identified on upper Bear Creek.	Five placer samples (136-140) were collected from the upper portions of Bear Creek. Two contained no detectable gold. The other three contained from a trace to 0.0004 oz gold/yd^3.
Bearpaw River (above Caribou Creek) Mt. McKinley C2, D2 Quads. T13-14S, R16-17W	The Bearpaw River drains a large basin and occupies steep, narrow tributary valleys and an occasionally wider main valley containing significant alluvial deposits. The average gradient is about 120 ft/mi.	Evidence of minor prospecting is present. No evidence of mining is present.	Ten 0.1 yd^3 placer samples (10-17, 22, 24) recovered from 0 to 0.0004 oz gold/yd^3. One sample (18) contained 0.0021 oz gold/yd^3. Fineness values were 623 and 759. An extensive gravel resource occurs on the Bearpaw River but little evidence of valuable placer gold mineralization was found.
Beauty Creek Mt. McKinley C2 Quad. T14S, R17W	Beauty Creek occupies a relatively wide valley narrowing to a bedrock walled canyon about 1/2 mi above its junction with the Bearpaw River. The average gradient is about 125 ft/mi.	Evidence of prospecting and/or mining was not found. No reported production.	One 0.1 yd^3 placer sample (25) recovered a trace of gold. This drainage was not walked as were most of the others.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Canyon Creek, Main Fork Mt. McKinley C1-C2 Quads. T14S, R15-16W	Canyon Creek occupies narrow bedrock walled canyons alternating with broader alluvial filled sections. The average gradient is about 75 ft/mi.	Evidence of placer prospecting or mining was not identified.	Eleven 0.1 yd^3 samples (36-41, 44, 45, 52, 53, 55) contained from a trace to 0.0005 oz gold/yd^3. One sample (36) recovered anomalous quantities of coarse (0.4 in.) scheelite.
Canyon Creek, North Fork Mt. McKinley C1-C2 Quads. T14S, R15-16W	The North Fork of Canyon Creek occupies steep narrow bedrock canyons with alternating wider sections containing large quantities of alluvial gravels. The average gradient is about 200 ft/mi but is highly variable. The upper portions drain sulfide-bearing schist and graphitic phyllite.	Minor prospecting activity is indicated by the presence of several small trenches and pits and cut timbers near the junction of the two main forks of the creek. No recorded production.	Four 0.1 yd^3 samples (26, 28-30) contained from 0.0001 to 0.0006 oz gold/yd^3. One sample (31) contained no detectable gold.
Canyon Creek (tributary to Moose Creek) Mt. McKinley C2 Quad. T15S, R18W	Canyon Creek drains the north side of Wickersham Dome. The upper 1.5 mi of the creek occupies a steep narrow valley with a gradient of 700 ft/mi. Colluvium occupies much of the valley. The lower 1 mi of the creek cuts the bench deposits of Moose Creek.	No evidence of prospecting or mining is present. No reported production.	A 0.1 yd^3 sample (104) contained no gold.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Caribou Creek, Lower (below claim block) and including the Bearpaw River between Caribou and Glacier Creeks.) Mt. McKinley C2 Quad. T14S, R18W	Lower Caribou Creek occupies a narrow bedrock walled canyon with occasional short flood plains developed. The Bearpaw has well developed flood plain deposits below Caribou Creek. The average gradient of this section is 70 ft/mi. Gold is reported to be fine grained and flat with a limited percentage qualifying as jewelers grade (greater than 14 mesh).	Some evidence of testing is present. Significant mining has not occurred because of the narrow bedrock canyons and difficult access for heavy equipment.	Five 0.1 yd^3 samples (19-21, 32, 33) recovered from 0.0002 oz gold/yd^3 (surface sample on the Bearpaw River) to 0.3045 oz gold/yd^3. Fineness for one sample was 660. Approximately 250,000 yd^3 of recent alluvial gravel occur on Lower Caribou Creek with an additional 750,000 yd^3 of gravel along the Bearpaw River between Caribou and Glacier Creeks.
Caribou Creek, Upper Mt. McKinley C2 Quad. T15S, R16-17W	Upper Caribou Creek occupies a terraced valley with narrow bedrock walled portions alternating with wider alluvial filled sections and has an average gradient of 250 ft/mi. Gold is reported (unpublished Bureau of Mines records) to have a high silver content and to include a significant nugget fraction. Grades are estimated to exceed 0.015 oz gold/yd^3 based upon production records.	Portions of Upper Caribou Creek were worked by the Carrington Company in the late 1940's. Evidence of more recent mining by hand, suction dredging, and using small heavy equipment is also present. A production of 4,547 oz gold and 2,196 oz silver is reported (unpublished Bureau of Mines production records) for Caribou Mines between 1946 and 1948. This is believed to have come from Upper Caribou Creek. Total estimated gold production based upon workings present is 18,000 oz. A backhoe-fed washing plant began operating in early September, 1983. An airfield and road were constructed to provide adequate access.	Four 0.1 yd^3 samples (65, 67, 68, 71) recovered from 0.0005 to 0.0193 oz gold/yd^3. One sample (69) collected from a southern tributary contained 0.0004 oz gold/yd^3. Fineness for one sample was 654. An estimated 1,500,000 yd^3 of recent alluvial gravels occur on upper Caribou Creek. Up to 500,000 yd^3 have been previously mined. Large volumes of unevaluated bench gravels are also present.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Caribou Creek, Unnamed Northern Tributary Mt. McKinley C2 Quad. T15S, R17W	This tributary occupies a steep but relatively wide valley along much of its length prior to entering a very steep narrow bedrock walled canyon just prior to its junction with Caribou Creek. The average gradient is about 300 ft/mi.	A few very small prospect pits occur. No evidence of mining was located.	Two 0.1 yd^3 samples (64, 70) recovered a trace and 0.0003 oz gold/yd^3 respectively. An estimated 700,000 yd^3 of recent alluvial gravels occur in this valley above the lower canyon. However, there is no evidence of significant gold values.
Clearwater Fork Mt. McKinley C1-C2, D2 Quads. T13-16S, R14-16W	The Clearwater Fork of the Toklat River drains a large area, much of which lies outside the study area. Bedrock is exposed along some sections of the stream but most of it occupies a broad alluvium filled valley with terraces of Tertiary gravels exposed along one or both sides. The average gradient is about 70 ft/mi.	The Clearwater Fork has been prospected in the past. Old prospect pits and trenches still exist but no evidence of significant mining was identified during this study. No reported production.	Three samples (27, 66, 81) from small unnamed tributaries to the Clearwater Fork contained from a trace to 0.0005 oz gold/yd^3. One sample (42) collected from Clearwater Fork below Moonlight Creek contained 0.0004 oz gold/yd^3. Capps (3) reports that numerous coarse colors were found on the benches of Clearwater Fork. Additional evaluation is necessary due to the large area drained and extensive gravels associated with the Clearwater Fork.
Crevice Creek Mt. McKinley C2 Quad T15S, R16-17W	Crevice Creek occupies a very steep narrow bedrock walled valley with an average gradient of greater than 500 ft/mi. Gold is reported to be relatively coarse.	Evidence of hand mining is present along much of the creek. Estimated production is 700 oz. A production of 660 oz of gold and 57 oz of silver was reported in 1946 and 1947 from First Chance Creek. This may be an earlier name for Crevice Creek.	Three 0.1 yd^3 samples (75-77) contained from 0.0018 to 0.1249 oz gold/yd^3. A 0.011 oz nugget was recovered. Fineness values were 613 and 631. Approximately 100,000 yd^3 of recent alluvial gravels are estimated to occur in Crevice Creek. About 1/3 have been previously mined.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Eldorado Creek - Slate Creek Mt. McKinley C2-C3, B2-B3 Quads. T16S, R18W	Eldorado Creek occupies a relatively narrow bedrock walled valley with open sections containing flood plain deposits developed between 1/2 and 2 1/2 mi above its junction with Moose Creek. Bedrock is usually less than 8-ft-deep. The average gradient between Slate Creek and Moose Creek is about 150 ft/mi. A bulk sample contained gold from -6 to +70 mesh in size; with the majority being -6 to +50 mesh.	A short section extending for about 1/4 mi above and including the lowermost canyon was mined using heavy equipment during 1980 (?). Test pits have been dug along most of the creek below Slate Creek. Minor amounts of suction dredging and hand mining have also occurred. No recorded production. Estimated production 200 oz.	Ten placer samples (124-133) collected from Eldorado Creek contained from a trace to 0.0706 oz gold/yd^3. Four of these (124, 127-129) contained in excess of 0.015 oz gold/yd^3. Fineness values ranged from 787 to 952. Greater than 300,000 yd^3 of recent alluvial gravels are estimated to occur between Slate Creek and the lower canyon of Eldorado Creek. This section has high potential for supporting a small to medium sized commercial placer operation. Two samples (134, 135) collected from Slate Creek contained 0.0004 and 0.0003 oz gold/yd^3 respectively.
Eureka Creek Mt. McKinley C-2 Quad. T16S, R17, 18W	The creek is a deeply entrenched 4-mi-long drainage. The average gradient is 250 ft/mi. Gravel deposits in the upper 3 mi are from 50- to 250-ft-wide and 4- to 5-ft deep. Some gravels extend underneath slideslope colluvium. The lower 1 mi of the creek is through a canyon. Terrace gravel deposits line the canyon sidehills along the lower 2,000 ft of the creek. Gold was reported in the terrace.	40% of the upper segment of the drainage has been heavily mined with mechanized equipment. The lower 1 mi of the drainage has been mined several times. Production as of 1968 was 5,000 oz, with an estimated 7,000 oz produced since then.	A 1,013 lb bulk sample (B-3) taken from a bench on the north side of Eureka Creek contained 0.008 oz gold/yd^3. One sample (116) from Lucky Gulch contained 0.0064 oz gold/yd^3. A sample (117) from the Banjo dump contained 0.1639 oz gold/yd^3. Greater than 1.3 million yd^3 of gravel is estimated in the drainage; however, much of it has been mined one or more times.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Eureka Creek - Cont.	Gold recovered from Eureka Creek is rough-to-well-worn occasionally crystalline and frequently coated with oxides. Nuggets up to 30 oz in weight have been taken from the creek. A gold-bearing alluvial fan is located at the junction with Lucky Gulch. Bureau sampling showed that over 90% of the gold was found in -10 to +50 mesh material, which comprised only 17% of the sample by weight.		
Flat Creek Mt. McKinley C-2/C-3 Quads. T14-15S, R18W	Upper Flat Creek occupies a steep narrow valley with bedrock walls and has a gradient of 300-400 ft/mi. The stream gravels consist in part of alluvial sediments. Alluvial bench (Tertiary in part ?) gravels also occur along much of the drainage. Below the Glacier Creek Road the gradient of Flat Creek decreases to 100-150 ft/mi and the valley widens.	Little evidence of prospecting or mining activity is present. No reported production.	A sample (94) of recent alluvial gravels contained 0.0036 oz gold/yd^3. A sample (95) of bench gravels contained trace amounts of gold; the gold in the sample was not weighed. 2.6 million yd^3 of gravel is estimated to occur in the drainage.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Friday Creek Mt. McKinley C2 Quad. T16S, R18W	The creek is deeply incised into Quigley Ridge and is a tributary to Moose Creek. The drainage is 2-mi-long and has a gradient of 400 ft/mi. In the upper 1.5 mi the gravels average 3- to 6-ft-deep and 10- to 75-ft-wide. Gold is reported to be concentrated in the lower 2 ft of gravel and to a depth of 2 ft into the fractured bedrock. The lower 0.5 mi of the stream flows into Moose Creek valley, where it has cut through its alluvial fan and Moose Creek terrace deposits. The fan gravels are unsorted, subangular, and contain up to 1% boulders. The terrace deposits are well-washed, glaciofluvial gravels. The terrace gravels are underlain by a clay false bedrock. The gravels above the bedrock are usually stained red, and gold is concentrated in this horizon. Galena, magnetite, pyrite, scheelite, and stibnite are recovered in the placer concentrates.	The upper canyon was mined by hand and booming techniques. The lower 0.5 mi of the creek have been mined by heavy equipment. As of 1983, an estimated 8,000 oz of gold has been produced.	A 0.1 yd^3 sample (118) taken near the head of Friday Creek contained 0.0086 oz gold/yd^3. An estimated 2.24 million yd^3 of inferred reserves are present in Friday Creek and its alluvial fan. Approximately 1/3 of this resource has been mined.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Glen Creek Mt. McKinley C-2 Quad. T15, 16S, R16, 17W	Glen Creek forks approximately 1 mi from the head of the creek. Stream gradient is 400 ft/mi. Gravel deposits in the upper sections of the creek are from 30- to 200-ft-wide and 3- to 5-ft deep. Terrace deposits approximately 25-ft-deep composed of coarse, unsorted alluvium are exposed north of the junction of the two forks. A bulk sample from the East Fork consisted of over 65% +10 mesh and 13% -70 mesh gravel. Gold ranged from -10 to +70 mesh in size, with the majority being in the +30 mesh fraction. At the junction of the two forks is a large basin filled with up to 35 ft of gravel. Downstream of the junction, the creek occupies a 20- to 150-ft-wide canyon. The last mile of the drainage is located in the Moose Creek valley and is deeply incised into a large alluvial fan.	Glen Creek has been mined along its entire length. Approximately 48 acres and 590,000 yd^3 of gravels have been mined. By 1968, 2,250 oz of gold had been produced. An estimated 9,250 additional oz may have been produced since that time.	The Bureau took a 626 lb bulk sample (B-1) from East Fork. The sample contained 0.0163 oz gold/yd^3. A 0.1 yd^3 sample (107) contained 0.0004 oz gold/yd^3. Approximately 4 million yd^3 of gravel is estimated to occur in the drainage. Most of this consists of largely untested bench gravels along the lower mile of the drainage.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Glen Creek - cont.	The gold is rough and nuggety. Nuggets are common with some up to 7 oz in weight recovered in the past. Large nuggets often contain attached quartz.		
Last Chance Creek Mt. McKinley C2 Quad. T15S, R17W	Last Chance Creek occupies a steep narrow bedrock walled colluvial filled valley. The gradient is approximately 500 ft/mi.	Evidence of mining occurs near sample location. Minor prospecting has occurred near the mouth of the creek. Recorded production is 665 oz.	Three 0.1 yd^3 samples (73, 74, 93) contained from 0.0003 to 0.0006 oz gold/yd^3. Sample locations were generally poor due to high water and may not reflect values present in the creek. Additional sampling may be warranted since previous mining occurred. Most of the creek is too steep for gravel accumulation. A 1,500 ft partially mined section located near sample location contains about 50,000 yd^3. An additional 50,000 yd^3 occurs near the mouth of the creek.
Little Moose Creek Mt. McKinley C1, D1 Quads. T13S, R15W	The upper 3 mi of Little Moose Creek mostly occupies a narrow (50 to 200-ft-wide) bedrock walled valley having a gradient of about 200 ft/mi. Bedrock is reported to range from 8-10 ft deep though some of the portions appear to be shallower (3). Capps (3) also reports that	Sections of Little Moose were worked using booming techniques and by hand mostly between 1906 and 1942. Several cabins and tailings attest to a moderate level of mining activity. Minor prospecting has occurred more recently. Reported production is 1,948 oz gold.	Three placer samples (2, 4, 6) collected from upper Little Moose Creek contained from 0.0058-0.0597 oz gold/yd^3. One sample (5) contained 0.0002 oz gold/yd^3 and another (1) from lower Little Moose Creek contained no detectable gold. Fineness values were 537 and 579. Greater than 500,000 yd3 of

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Little Moose Creek - Cont.	the gold is coarse and of low fineness. Small native silver nuggets were found in cleanups by the early miners. The lower 1 1/2 mi to the junction with the Clearwater Fork occupies a wider valley containing considerable gravel and has an average gradient of 150 ft/mi.		gravel are estimated to occupy the upper 3 mi section of the creek. Significant quantities (greater than 750,000 yd^3) of gravels are estimated to occur in the lower 1 1/2 mi section of Little Moose Creek. These gravels are unevaluated due to greater depth to bedrock. However, surface indications of a valuable placer resource are lacking.
Moonlight Creek Mt. McKinley C1/C2 Quads. T14-15S, R15-16W	Upper Moonlight Creek occupies relatively steep narrow bedrock walled canyons alternating with short, less steep sections containing alluvial deposits. A wider valley containing large volumes of alluvium has developed along its lower portions. The average stream gradient is about 200 ft/mi.	Evidence of significant prospecting or mining was not seen. A few small hand dug pits were tentatively identified. No recorded production.	Two placer samples (43, 54) contained trace and nondetectable amounts of gold, respectively.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Moose Creek, above upper canyon (between junction with Spruce and Rainy Creeks) Mt. McKinley C2 Quad. T16S, R16-17W	This section of Moose Creek occupies a relatively broad terraced valley with portions occupying relatively narrow bedrock walled canyons. An extensive flood plain is developed along much of the stream. Large terraces and alluvial fans associated with northern auriferous tributaries fill in much of the valley. The stream gradient averages about 60 ft/mi along this section. Gold recovered in samples was relatively fine (less than 20 mesh).	Extensive prospecting has occurred especially near the juctions with Rainy and Glen Creeks. Sustained mining has apparently not taken place. No recorded production.	Five placer samples (108-112) collected from just below Jumbo to just below Rainy Creek junctions contained from 0.0025-0.0074 oz gold/yd^3. One fineness value was 738. Greater than 3,000,000 yd^3 of recent alluvial deposits occur along the 4 1/2 mi stretch of creek between Spruce and Rainy. This section of Moose Creek has moderate placer potential for small to medium and high potential for large placer mining operations. Up to 90 million yd^3 occur in the large benches and alluvial fan deposits associated with Rainy, Glen, and Spruce Creeks.
Moose Creek, Lower (below upper canyon of Moose Creek) Mt. McKinley C2/C3 Quads. T15-16S, R18W	Lower Moose Creek mostly occupies a wide valley with a well developed flood plain and several terraces. A short section passes through a narrow bedrock walled canyon. In bulk samples gold was found in the -10 to +70 mesh fractions, with the majority of gold between -20 and +50 mesh; though nuggets up to 1 1/2 dwt are common. The average stream gradient for	Extensive sampling has occurred along Moose Creek between Friday Creek and the lower end of the canyon section. Hydraulic and hand methods were used to mine creek gravels and the lowermost bench gravels exposed in the canyon section. Mechanized methods were used to mine Moose Creek between Eureka and Friday Creek. Estimated production is 16,000 oz.	Six 0.1 yd^3 samples (97, 102, 119-122) of recent gravel deposits contained from trace to 0.0739 oz gold/yd^3. A one hour run suction dredge sample (101) recovered 0.1519 oz gold. Five 0.1 yd^3 samples (96, 98-99, 100, 123) of bench deposits ranging from 10 ft to 60 ft above the current creek level contained from a trace to 0.0167 oz gold/yd^3. Two bulk samples (B-4, 5) contained 0.0013 and 0.0163 oz gold/yd^3. Fineness values ranged from 630 to 760.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Moose Creek, Lower - Cont.	this portion of the creek is 50 ft/mi. Stream bars locally contain high concentrations of gold on the surface. Bedrock exposed in the canyon pans well with recovery estimated to be 0.05 oz gold/yd^2.		Greater than 3.2 million yd^3 of recent alluvial gravels with high mineral development potential are estimated to occur between Friday Creek and sample location 96 (fig. 3). An estimated 137 million yd^3 of gravel with undetermined potential occur in remaining benches and stream channels of lower Moose Creek.
Myrtle Creek Mt. McKinley C2 Quad T15S, R15-16W	The tributary draining Spruce Peak occupies a broad colluvial filled valley with a gradient of 125 ft/mi. Bedrock is not exposed. The tributary draining Kankone Peak occupies a narrow, bedrock walled valley having a gradient of 200 ft/mi. Sections up to 500 ft wide contain alluvial deposits with bedrock estimated to average less than 5-ft-deep. The main valley of Myrtle Creek has well developed terraces 20-30 ft or more high consisting of Tertiary gravels locally overlain by up to 10 ft of coarser Quaternary alluvial deposits. Much of the	The Spruce Peak tributary has been mined about 1 mi east of Spruce Peak. Evidence of prospecting was found in a few other locations. No recorded production. Estimated production 100 oz gold.	Ten 0.1 yd^3 samples (78, 79, 83-85, 87-91) contained from a trace to 0.0005 oz gold/yd^3. Four samples (80, 82, 86, 92) contained from 0.0011 to 0.0121 oz gold/yd^3. Fineness values ranged from 614 to 827. An estimated 40,000 yd^3 of gravel occur in the upper portion of Spruce Peak tributary and an additional 200,000 yd^3 of gravel occur on the tributary draining Kankone Peak. Bench deposits along Mrytle Creek, especially those exposed between the above mentioned tributaries deserve additional evaluation due to the anomalous gold found in the sample (86) collected at the interface between exposed Tertiary and Quaternary gravels.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Myrtle Creek - Cont.	stream occupies bedrock walled canyons with limited alluvial deposits. The average gradient of the main stream is about 110 ft/mi.		
Rainy Creek Mt. McKinley C-2 Quad. T16S, R17W	Rainy Creek is from 15- to 50-ft-wide with a gradient of 400 ft/mi. The lower 1 mi of the drainage is incised into a large, inactive alluvial fan.	Evidence of hand mining exists in the upper stream section. An area at the mouth of the canyon on the creek has been worked.	The Bureau took two samples (114, 115) from the upper portion of Rainy Creek. They contained 0.0003 and 0.0104 oz gold/yd^3. Fineness was 743. Over 1 million yd^3 of gravel is estimated to occur in the drainage.
Rock Creek Mt. McKinley C2 Quad. T14-15S, R16-17W	Rock Creek drains a large basin and occupies steep narrow tributary valleys with intermittent relatively wide alluvial filled sections along the main stream. The average gradient is about 130 ft/mi.	Some evidence of prospecting was identified. No evidence of mining was found.	Seventeen samples were collected on Rock Creek. Of these, thirteen (34, 46-49, 56-63) contained trace amounts of gold. Two (35, 51) contained 0.0001 oz gold/yd^3. One sample (50) collected from an unnamed tributary contained 0.0012 oz gold/yd^3 and a second (23) collected near the mouth of Rock Creek contained 0.0018 oz gold/yd^3. Fineness values were 801 and 831. These two areas may deserve additional evaluation. collected near the mouth of Rock
Snowshoe Creek Mt. McKinley C2 Quad. T15S, R17W	Snowshoe Creek occupies a narrow colluvium filled bedrock walled valley with an average gradient of over 600 ft/mi.	Evidence of prospecting activity exists near the mouth of the creek. No reported production.	One 0.1 yd^3 sample (72) recovered a trace of gold.

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Spruce Creek Mt. McKinley C-2 Quad. T15, 16S, R16W	Gravels in the upper 2 mi of the drainage are from 10- to 100-ft-wide. The average stream gradient is 350 ft/mi. The lower 2 mi lie in the Moose Creek valley. The stream gradient is 150 ft/mi. The stream is incised into a large alluvial fan complex which overlies glacial outwash terrace deposits of Moose Creek. The gravels are from 3- to 20-ft deep. 84% of the gravel is +14 mesh. The gold is very bright and ranges from -14 to +70 mesh in size.	Evidence of hand working in the upper section of the drainage. A few large and small mining cuts are present in the lower section of the creek. 1,183 oz were produced by 1968, with an estimated 1,000 oz produced since then.	A 909 lb bulk sample (B-1) was taken by the Bureau. The sample contained 0.007 oz gold/yd^3. An estimated 2.5 million yd^3 of gravel is in the drainage.
Stampede Creek Mt. McKinley, C1/D1 Quads. T13S, R14-15W.	Stampede Creek occupies a narrow valley (50-200 ft wide) for most of its 3 mi length. The gradient averages about 200 ft/mi. Bedrock is shallow (less than 6 ft) along most of the upper section of the stream but is likely considerably deeper near its junction with the Clearwater Fork of the Toklat River. Gold tends to be relatively rough, fine-grained, and of very low fineness.	Sections of Stampede Creek above the Stampede Mine were worked by hand methods in the 1940's. Lower Stampede Creek has been disturbed by equipment for construction purposes. Portions have been mined. Reported production is 183 oz. Estimated production is 600 oz.	Two placer samples (3, 7) contained 0.2925 and 0.0418 oz gold/yd^3. Two samples (8, 9) from tributaries contained 0.0003 and 0.0013 oz gold/yd^3. One fineness value was 532. An estimated 15,000 yd^3 of gravel occurs on Stampede Creek above the mine. This section may have relatively coarse gold but will be difficult to mine due to boulders and narrow stream width. A larger volume of gravel, 200,000 yd^3, occurs below the mine where conditions are suitable

APPENDIX B. - Summary of stream drainages in the Kantishna Hills study area - Alphabetically listed - Continued

Drainage/location	Summary of deposits	Workings and production	Sample data
Stampede Creek - Cont.			for mining using heavy equipment. An alluvial fan occurs where Stampede Creek joins the Clearwater Fork of the Toklat River. Additional evaluation of this potential resource is warranted as it is estimated to contain in excess of 500,000 yd^3 of gravel.
Willow Creek Mt. McKinley C2 Quad. T16S, R16W	Upper Willow Creek occupies a relatively steep narrow colluvial filled valley with a short bedrock walled section. The average gradient is about 240 ft/mi. A large alluvial fan has developed above its junction with Moose Creek.	Several prospect pits were dug by backhoe during the 1983 mining season. No reported production.	Two 0.1 yd^3 samples (105, 106) recovered 0.0002 oz gold/yd^3. Approximately 300,000 yd^3 of recent alluvial gravels are estimated to occur above the alluvial fan.

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