UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL AND GEOCHEMICAL APPRAISAL OF METALLIC MINERAL RESOURCES, SOUTHERN NATIONAL PETROLEUM RESERVE IN ALASKA

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature

Contents

	Page
Introduction	1
Work goals and plans	1
Geographic setting	2
Previous work	3
Geologic setting	4
Stratigraphy	4
Structure	4
Regional geochemistry	6
Geochemical summary	10
Mineralization	11
Metallic and related nonmetallic minerals	11
Bedrock examination	12
Drenchwater Creek area	12
Geologic controls	13
Zinc-lead sulfide deposits	13
Barite deposits	14
Conclusions	15
Recommendations for future work	15
References cited	16

Appendix A
- Traverse cross sections
- Tables of semiquantitative spectrographic analyses of rock, soil, and stream sediment samples
- Plate A1 - Location map of rock, soil, and stream sediment samples, Misheguk Mountain quadrangle
- Plate A2 - Location map of rock, soil, and stream sediment samples, Howard Pass quadrangle

Illustrations

Table 1. Summary of site descriptions.

Figure 1. Index map of Alaska showing NPR-A, Misheguk Mountain and Howard Pass quadrangles and belt of mineral potential along south boundary NPR-A.

2. Schematic cross section across the Brooks Range and North Slope.

3. Geologic map of southern NPR-A showing areas of high and low lead, zinc, silver mineral resource potential.

4. Generalized columnar section through lower Mesozoic and upper Paleozoic rocks of the lower structural sequence, southern NPR-A.

5. Summary statistics for 23 elements detected in the 574 samples of -30 mesh stream sediments.

6. Summary statistics for 25 elements detected in the 574 samples of nonmagnetic heavy-mineral concentrate.

7. Geochemical indication of the potential for barite (1:500,000-scale overlay).

8. Geochemical indication of the potential for zinc-rich, massive sulfide deposits (1:500,000-scale overlay).

9. Geochemical indication of As, Pb, Ag and Pb, Zn, Ag anomalies from unknown bedrock source (1:500,000-scale overlay).

10. Summary map of metallic mineral occurrences, geologically favorable areas, and geochemical anomalies in southern NPR-A.

INTRODUCTION

The preliminary results of the mineral resource investigations conducted in the National Petroleum Reserve in Alaska (NPR-A) by the Geological Survey are planned to be open filed in ten parts. This report, numbered Open-file Report 78-70A, is the first part. It is a technical report that analyzes the mineralization found by field teams in 1977 and provides mineral commodity specialists with the geologic framework for evaluating the region. Other open-file reports, in press, that are part of this series include the following, marked by asterisk in the References cited:

*78-70B - Bedrock geologic map of the south half of National Petroleum Reserve in Alaska (Mayfield and others, 1978),

*78-70C - Geologic setting of the lead and zinc deposits, Drenchwater Creek area, Howard Pass quadrangle, western Brooks Range, Alaska (Nokleberg and Winkler, 1978), and

*78-70D - Basic data for the geochemical evaluation of National Petroleum Reserve, Alaska (Theobald and Barton, 1978).

Work goals and plans

Field investigations that form the basis for the reports on geochemistry and mineral deposits were done during the period June 6-July 31, 1977, using helicopter transportation out of the Driftwood camp on the Utukok River. For shorter periods of time, a helicopter-supported temporary camp was used on Drenchwater Creek. The work consisted of geologic investigations and reconnaissance geochemical sampling by the

Geological Survey in response to section 105(c) of the National Petroleum Reserve Act of 1976.

In order to evaluate the mineral potential of this large area (see index map, fig. 1) expeditiously, the work for the 1977 season was concentrated in the southern part of NPR-A and in contiguous parts of the Brooks Range, a poorly known area suspected of having a significant metallic mineral potential. Early in the investigations of bedrock geology, it was determined that red-stained zones, possibly associated with sulfide mineralization, were confined mainly to a thin stratigraphic interval in a structural sequence that is discontinuously covered by overlying thrust plates composed of coeval but lithologically different rocks (Mayfield and others, 1978). It was further determined that lead and zinc minerals in the Red Dog and Drenchwater areas, the only two mineralized areas known, were associated in the same stratigraphic and structural setting as some of the stained zones. Therefore, it was decided to concentrate the bedrock and mineral investigation work on this lower structural sequence (fig. 2). Basic data for this report, including traverse cross sections, semiquantitative spectrographic analyses, and location maps of samples are given in Appendix A.

Regional geochemical sampling was done to provide a stream-sediment reconnaissance of the entire southern part of NPR-A and adjoining Brooks Range (see U.S. Geological Survey Open-file Report 78-70D). Another goal of the geochemical sampling was to analyze rock chip samples and soil samples from areas where the bedrock was investigated.

Geographic setting

The area is about 9,000 km^2 and lies mainly within the southern part of NPR-A between lat 68°25' N. and 68°50' N. and long 156° W. and 162° W. The terrane is mostly rolling hills and low mountains ranging in elevation from 300 to 1,500 m that form the western Brooks Range and its northern foothills. The nearest supply centers to the Driftwood airstrip are Kotzebue, 250 km south; Point Barrow, 300 km north; and Fairbanks, 700 km southeast.

Previous work

Systematic geological evaluation of the region began at about the time of the establishment of the Naval Petroleum Reserve in 1923 and resumed during the period of oil exploration from 1945 to 1953. The results of this effort are summarized in the series of U.S. Geological Survey Professional Papers 303A-H. The Geological Survey studies continued in the area under the direction of I. L. Tailleur, resulting in recognition of significant lead-zinc mineralization at Red Dog near the southwest corner of NPR-A (Tailleur, 1970; U.S. Bur. Mines, 1975). In 1975, Tailleur and others (oral commun.) recognized a similar mineralization at Drenchwater Creek within NPR-A and 180 km east of Red Dog. Interpretations of the structural framework for the western Brooks Range have been formulated by Tailleur, Kent, and Reiser (1966) and Martin (1970). Coal reserves in the northern part of the NPR-A were estimated by Barnes (1967) and by Tailleur and Brosgé (1975). Phosphate occurrences have been identified and reported on by Patton and Matzko (1959).

GEOLOGIC SETTING

Stratigraphy

Bedrock in the NPR-A can be divided into two terranes on the basis of stratigraphy and structure (Mayfield and others, 1978; fig. 2, schematic cross section). The first terrane, present in the south half of NPR-A, includes the rocks of the Brooks Range and its northern foothills. These are mainly highly folded and faulted, relatively thin (about 500 m) sequences of marine sedimentary strata of Paleozoic and early Mesozoic age. Traverse cross sections of this terrane are shown in Appendix A. The second terrane, present in the northern part of NPR-A, consists of much thicker (several thousands of meters) and younger (mainly late Mesozoic age) sandstone, shale, and conglomerate units of marine and nonmarine origin. Bedrock in the northern terrane is far less deformed than in the southern terrane. Because of the widespread surficial deposits, outcrops are exposed in cliffs and cutbanks and the northern terrane becomes a broad, swampy coastal plain in its northern part.

Structure

The southern terrane consists of numerous thrust plates with complex stratigraphy (Mayfield and others, 1978; fig. 2). The rocks of the lowest recognizable structural sequence are mainly fine-grained siliceous clastic sediments--shale, siltstone, and minor sandstone--interbedded with radiolarian chert and, locally, submarine volcanic rocks. In overlying thrust plates, the rocks of Carboniferous age are mainly light-colored limestone whereas rocks of the same age in the lowest structural sequence are mainly interbedded dark chert and shale. This juxtaposition of calcareous sequences with a coeval sequence of chert and shale provides the evidence for thrust faulting on a scale large enough to displace sedimentary facies (Tailleur and Brosgé, 1970; Lathram, 1965).

The predominant south dips of beds, faults, and isoclinal fold limbs suggest north-south compression, but the amount and direction of relative movement of the fault blocks are unknown. Reconstructions of sedimentary environments in the region, particularly for rocks of Carboniferous age that show the greatest variability in facies, indicate that a carbonate rock nearshore and shelf facies developed along what is now the arctic coastal plain (Armstrong and Bird, 1976). These carbonate rocks, in turn, grade southward into shale and chert of a deeper water facies.

The stratigraphy of the lowest structural sequence, which has the only significant base metal mineralization (fig. 3), is generalized in the columnar section of figure 4. The section consists of four broadly similar units; the basal units are a black shale and chert facies of the Lisburne Group that is succeeded by mainly argillaceous and cherty strata of the Siksikpuk and Shublik Formations. This relatively thin stratigraphic thickness, representing much of Carboniferous, Permian, and Triassic time, is overlain by a thick section of coarser grained clastic rocks of Cretaceous age. These four discrete formations are structurally repeated many times.

Structure within the lowest sequence along the northern foothills of the Brooks Range consists of a series of small fault slices forming lenslike blocks. Within the blocks, the beds are tectonically stretched and dismembered into broken formations. Individual formations generally form narrow units that strike east-west and dip moderately to steeply. Internal folds are tight, nearly isoclinal and, in many places, are overturned with axial planes dipping south. Axial plane cleavage is commonly developed and in the argillaceous rocks results in a

characteristic fine micaceous sheen. Within the tectonic blocks, chert and sandstone beds are the least disrupted.

The structural complexity within the lowest structural sequence is indicated at Drenchwater Creek by Nokleberg and Winkler (1978). No single formation persists as a continuous unit from east to west along the regional strike. Instead, a heterogeneous mixture of tectonic lenses of various formations forms the bedrock. Locally, large blocks of chert of the Shublik Formation and Lisburne Group are surrounded by a pervasively sheared matrix of shale from the formations in the lowest structural sequence. In the eastern part of the Drenchwater Creek area, there is a greater continuity of formations. Some formations appear to be thickened by asymmetrical folds and faults. Despite the intense deformation in the Drenchwater area, discrete thrust plates can be identified. Each thrust plate is defined by distinct proportions of various formations and distinct structural domains.

REGIONAL GEOCHEMISTRY

Regional geochemical reconnaissance of the southern part of NPR-A shows geochemical patterns that may be related to five distinct types of mineralization: (1) barium related to concretionary and probably also bedded barite deposits; (2) zinc and silver within the area of abundant barium related to zinc-rich stratabound sulfide deposits; (3) arsenic, lead, and silver in heavy-mineral concentrates related to an as yet unknown bedrock source; (4) lead, zinc, and silver without barium in the southeast part of the area, again related to an unknown bedrock source; and (5) a broad distribution of chromium in heavy-mineral concentrates derived from ultramafic rocks south of NPR-A.

The reconnaissance geochemical evaluation is based on data obtained from 574 sampling sites in the Misheguk Mountain and Howard Pass quadrangles. For comparative purposes, 11 sites in nearby areas were also sampled, including nine sites in the vicinity of the Red Dog prospect in the De Long Mountains quadrangle, and two within the chromium-bearing Avan River ultramafic complex in the southwest part of the Misheguk Mountain quadrangle.

Where possible, three samples were collected at each site: (1) an active stream-sediment, (2) a heavy-mineral concentrate from active stream-sediment, and (3) a streambank soil. The stream-sediment sample provides a composite sample of the drainage basin above the sample site and the inorganic debris being transported from that basin, whereas the heavy-mineral concentrate provides a much enhanced sample of that fraction of the inorganic composite most likely to contain many of the rarer minerals and elements associated with valuable mineral deposits.

The analytical data are summarized in figures 6 and 7. The terrane is noteworthy for its extreme geochemical variability. An unusually large number of elements is anomalously high. The range of concentrations for many of the elements is extreme, particularly in the heavy-mineral concentrates where four of the elements span the total range of the analytical procedure. The geometric deviation is large, particularly in the heavy-mineral concentrates. Barium stands out both for its unusual abundance in these samples and for its extreme variability.

The distributions of seven elements have been plotted at a scale of 1:500,000 and the data contoured to illustrate the spatial distribution of the potential identified above (figs. 14-16). Barium in

stream sediments is unusually abundant throughout the central part of the area. It is unusually low near the ultramafic complexes near Misheguk Mountain and Siniktanneyak Mountain. It is "normal," a few hundreds to a thousand parts per million, only along the northern border of the study area and in the southeast corner. Barite is the mineral responsible for the high values as exemplified by the extreme levels of barium in the nonmagnetic fraction of the heavy-mineral concentrates and the abundance of barite, 80 percent or more, in this sample medium. Although the massive sulfide deposits that have been examined are enriched in barium, they contain only a few thousand parts per million so cannot be responsible for the major features illustrated. Concretionary barite is known from several of the rock units and undoubtedly contributes to the levels of barium observed, but, again, the abundance of concretionary barite does not appear sufficient to explain the major barium anomalies of figure 14. It seems likely, therefore, that an as yet unidentified number of deposits of bedded barite exist within the area of NPR-A.

Zinc-sulfide deposits are known or suspected in at least three of the zinc-rich areas (fig. 15). The other areas with 200 ppm or more zinc have similar potential, particularly where silver is also detectable and, as noted above, barite is abundant. The single exception to this generalization is in the southeast corner of the area where the zinc high in the upper part of the Nigu River is in an area of "normal" barium concentration and the single detectable silver value does not coincide with high zinc. The mineral potential in this area has a different chemical character from that to the northwest and west.

The spatial distribution of arsenic in heavy-mineral concentrates is

unique. All of the high values (including values of 5,000 ppm or more) are in the northeast part of the area (fig. 16), particularly in a pronounced northeast-trending zone that crosses the Utukok River in the vicinity of Driftwood. The distribution of silver in the heavy-mineral concentrates is remarkably similar to that of arsenic though isolated highs scatter farther to the east. Again, the cluster of samples containing 5 ppm or more silver defines a northeast-trending zone through Driftwood. A single high value in the head of the Nigu River falls in the zinc-rich area described previously. The distribution of lead in the heavy-mineral concentrates is more complex than that of the arsenic and silver, reflecting the greater proportion of valid observations. The northeast-trending high through Driftwood is again prominent, locating and validating the arsenic factor described earlier. There is clearly a prominent source of metal in this area, but its nature and whereabouts in bedrock are unknown. A second group of lead-rich heavy-mineral concentrates is in the southeast part of the area, generally coincident with, but more widespread than, the zinc-rich samples in this area. The general coincidence of zinc, silver, and lead in the southeast chemically characterizes yet another metal anomaly with no known bedrock source.

The remaining factor that suggests mineral potential is characterized by calcium, magnesium, and chromium in both sample media. It is illustrated here by the single example of chromium in the heavy-mineral concentrates. The other elements involved display similar patterns. The principal source of these elements is clearly in the ultramafic complexes at Misheguk Mountain, Siniktanneyak Mountain, and on the Avan River. All of these are south of NPR-A. A prominent chromium high

extends north from the Siniktanneyak Mountain complex along the Kuna River, expanding northward along the Kiligwa and Colville Rivers. This anomaly is equivalent in magnitude to the Misheguk Mountain anomaly and larger than the combined anomalies from the other ultramafic complexes. We interpret this feature to reflect ancient erosion of higher, larger, and richer portions of the Siniktanneyak complex and the irretrievable spreading of this material throughout the sedimentary rocks to the north. From this interpretation, we see little potential for extensive deposits of minerals related to the ultramafic suite within NPR-A.

Geochemical summary

The geochemical evaluation of the mineral potential of the southern part of NPR-A is summarized in three illustrations designed as overlays on which the potential is displayed at two levels. The barite potential (fig. 14) is defined as moderate where contiguous stream-sediment samples contain 0.5 percent or more of barium and as strong where they contain more than 1 percent of barium. The zinc-sulfide potential (fig. 15) is defined by the overlap of areas having zinc-rich stream sediments and areas rich in barium. The Driftwood anomaly (fig. 16) is defined by the coincident occurrence of arsenic, lead, and silver in heavy-mineral concentrates. The anomaly is open to the northeast, reaches its maximum intensity at the north edge of the study area, and has no known bedrock source. The Koiyaktot Mountain anomaly, also shown on figure 16, is characterized by the general similarity of the distribution of zinc in stream sediments, silver in stream sediments and heavy-mineral concentrates, and lead in heavy-mineral concentrates. The patterns for the three elements are not strictly coincident and are at least suggestive

of metal zoning. The bedrock source of the Koiyaktot anomaly has not been identified.

MINERALIZATION

Metallic and related nonmetallic minerals

Occurrences of metallic and related nonmetallic minerals have recently been reported in northern Alaska. Preliminary followup work during the 1977 field season has resulted in recognition of significant zinc, lead, and silver mineralization along a fairly well delineated regional geologic trend associated with chert-shale-volcanic rocks of Carboniferous age. This belt trends eastward from the zinc-lead deposits of the Red Dog Creek-Wulik River area in the De Long Mountain quadrangle, across the southern portion of NPR-A to the Drenchwater Creek-Wager Creek area, the most noteworthy showing in NPR-A to date (fig. 3). These zinc-lead deposits appear to have formed contemporaneously with volcanic activity indicated mainly by submarine tuffs with subordinate porphyritic lava flows associated with marine shales and cherts. The entire region of NPR-A in which this assemblage occurs must be considered as quite favorable for other similar occurrences of lead-zinc mineralization. There are not enough data available at present to permit more than qualitative evaluations to be made with respect to resource potential. More effort is needed to fully define the zinc-lead resource within NPR-A.

In the De Long Mountains quadrangle, potentially valuable concentrations of barite are found associated with the zinc-lead deposits, but similar occurrences have not yet been noted within NPR-A. Rocks similar to those hosting the zinc and lead deposits are associated with anomalously high geochemical values for barium. This relationship suggests the

possibility of finding barite deposits within NPR-A as well.

Bedrock examination

In NPR-A, eleven mineralized areas were prospected or examined. For most of the areas, detailed geologic traverses or sketch maps were made, and samples of bedrock, stream sediments, and soil were collected for chemical analyses (Appendix A). A summary description of the eleven areas examined and the analytical results is shown in table 1. Analytical ranges shown in table 1 refer to lowest and highest values from analyses for base metals at each site.

A total of 214 rock, soil, and stream silt samples was collected, each of which was analyzed spectroscopically for 30 elements. Outside the Drenchwater Creek area, lead shows uniformly low values from less than 10 to 150 ppm with an approximate average of 30 ppm for all rock and soil samples. Outside the Drenchwater Creek area, zinc was mainly detected to the southeast of the Drenchwater Creek area with values between none detected to 300 ppm. Very low values of silver, 1-3 ppm, were found in a few samples.

Within the Drenchwater Creek area, lead and zinc show moderate to high values within the zone of sulfide mineralization. Lead ranges from 10 to 15,000 ppm with an approximate average of 200 ppm. Zinc ranges from less than 200 to more than 10,000 ppm with an approximate average of 200 ppm. A few samples show silver values of 1-5 ppm. Barium is discussed in a later section.

Drenchwater Creek area

In the Drenchwater Creek area, sulfide mineralization occurs in the gray to black shales, gray to black cherts, and intermediate to mafic

volcanic rocks of the Lisburne Group contained in a lower structural sequence (figs. 3, 4; Nokleberg and Winkler, 1978). This sequence is internally deformed and is subdivided into thrust plates. The Drenchwater thrust plate contains base metal sulfides and minor barite.

Galena, sphalerite, and pyrite were observed in the tuffs or in dark cherts and dark shales that are either interbedded with or adjacent to tuff. The sulfides may occur in more than one unit of tuff, dark chert, and dark shale; however, the intense folding and faulting and poor exposures in the area preclude any precise determination of number of mineralized horizons. Barite is much sparser and occurs in black chert along Drenchwater Creek and in undifferentiated yellow-green cherts of the Shublik or Siksikpuk Formations in the southwest part of the mapped area. Strongly developed iron staining also occurs in the zone of sulfide mineralization and is primarily the result of weathering of pyrite and lesser amounts of sphalerite in the felsic tuffs. The eastern and western limits of the zone of sulfide mineralization still need to be defined by more mapping and sampling.

Geologic controls

Zinc-lead sulfide deposits

There are two major geologic controls for the occurrences of sulfide deposits along the northern front of the Brooks Range as determined from detailed mapping in the Drenchwater Creek area and from detailed geologic traverses along the northern front.

First, in the Drenchwater Creek area, the association of sphalerite and galena with tuff and with gray to black dark chert and gray to black dark shale adjacent to submarine volcanic rocks strongly suggests that:

(1) sulfide mineralization occurred simultaneously or just after sedimentation and volcanism; and (2) volcanic exhalations may be the source of the mineralizing fluids.

Second, intense deformation, including isoclinal folding, faulting, and melange development, has severely disrupted and dismembered the stratiform deposit. Intense deformation may have obscured a stratigraphic horizon favorable for the localization of base metal sulfide deposits; the original stratigraphic horizon may have extended from at least the Red Dog Creek area on the west to the Drenchwater Creek area on the east.

Barite deposits

Nodules of barite are widely but sparsely distributed throughout the Siksikpuk Formation within the southern part of NPR-A, and geochemically moderate concentrations of barite occur in placers in the streams and rivers draining the northern foothills of the Brooks Range within NPR-A. Typical values of barium in stream sediments range from 1,000 to more than 5,000 ppm. Typical values for barium in rock samples range from approximately 200 ppm to more than 5,000 ppm, with estimated average values of 1,500 to 2,000 ppm. It is assumed that the barium in the rock samples is contained in barite; however, barite has not been identified in any of the analyzed rock samples. Several alternatives exist for the source of barite in the placer deposits. One source might be residual concentration of barite from sparsely scattered nodules or disseminated grains in various rock units. An alternative source might be residual concentration of barite from as yet unidentified bedded barite.

CONCLUSIONS

Based on 1977 fieldwork, much of the southern part of NPR-A shows a potential for metallic mineralization. Regional geologic studies have defined a stratigraphic horizon within the lower structural sequence that is favorable for base metal mineralization. New occurrences of sphalerite and galena were identified at Drenchwater Creek, and barite nodules and veins were found at numerous localities.

Four types of regional geochemical anomalies are identified:

(1) Zinc and silver related to known massive sulfides.

(2) Barium related to barite.

(3) Arsenic, lead, and silver of unknown bedrock source.

(4) Lead, zinc, and silver of unknown bedrock source.

Rocks having criteria for mineral potential are shown on figure 17 which outlines mineral occurrences, geochemical anomalies, and the distribution of rocks in the lower structural sequence. Specific areas with favorable mineral resource potential are: (1) Drenchwater Creek, (2) Koyaktot Mountain area, (3) Driftwood area, (4) Spike Creek area, (5) Mount Bupto area, and (6) Sphinx Mountain area.

RECOMMENDATIONS FOR FUTURE WORK

On the basis of the 1977 work, we believe the following investigations should be undertaken to further evaluate the mineral potential of NPR-A:

(1) Conduct geological investigations of the geochemical anomalies to identify their source and areal extent.

(2) Expand regional geochemistry to include the Utukok River and Lookout Ridge 1:250,000-scale quadrangles that lie to the north of the area studied in 1977.

(3) Make a topical study to identify and evaluate the source of the high barium values in the regional geochemical sampling.

(4) Conduct more detailed investigations in the Drenchwater Creek area to evaluate the extent of mineralization. Those investigations should include geophysical and geochemical surveys.

(5) Conduct more structural and stratigraphic studies in this mineral belt to understand the geologic setting and controls of mineralization.

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TABLE 1. *Summary site descriptions*

(See *figure 3 for location of sites*)

	Area	Mineralization, rocks, and structure	Number of analyzed samples	Analytical ranges, ppm			
				Zn	Pb	Ba	Ag
1.	Inaccessible Ridge	Iron and copper staining. Local marcasite. Yellow clay partings in chert near contact between Lisburne Group and Siksikpuk formation. Intensely folded and faulted	5	N*	10-20	700- >5,000	N
2.	Spike Creek	Iron staining near contact of Lisburne Group and Siksikpuk formation. Dark shale and chert of Lisburne Group. Gray-maroon shale and chert of Siksikpuk formation. Intensely folded and faulted	12	N	10-20	1,500- >5,000	N
3.	Kagvik Creek	Prominent iron staining. Local sparse barite. Gypsum-bearing light-colored shale; dark chert and dark shale of Lisburne Group and Siksikpuk formation. Intensely deformed	2	N	10-15	1,000- 3,000	N
4.	Elbow Creek	Iron-stained, yellow clayey soil at contact between maroon-gray chert of Siksikpuk formation and black chert of Lisburne Group. Two sections of folded rocks of lower structural sequence separated by Cretaceous shale and sandstone	9	N	15-50	>5,000	N
5.	Chertchip Creek	Prominent iron staining with orange, clayey soil. Green-gray chert of Siksikpuk formation and Cretaceous mudstone. Closely spaced structural repetitions of units	14	N	10-150	700- >5,000	N-1.5
6.	Sorepaw Creek	Red, iron-stain soils on black shale, chert, and limestone of Lisburne Group. Local iron staining in gray chert of Shublik formation. Intensely folded	13	N	10-15	700- >5,000	N-1
7.	Rampart Creek	Bright orange iron staining. Black chert of Lisburne Group and olive-gray mudstone of Siksikpuk formation. Intensely folded	7	N	-15	1,000- >5,000	N-2.0
8.	Rolling Pin Creek	Iron staining. Local thin barite seams. Gray-maroon chert of Siksikpuk formation. Intensely folded	13	N	10-30	1,500- >5,000	N
9.	Drenchwater Creek	Iron staining. Dark shale, chert, and mafic tuff of Lisburne Group. Intensely faulted tectonic breccia	63	N-500	10- 15,000	300- >5,000	N-5
10.	Kiligwa River	Iron-stained, orange, clayey soil. Maroon-gray shale and gray chert of Siksikpuk formation. Structural repetition of units	21	N-500	10-100	2,000- >5,000	N-3
11.	Safari Creek	Iron-stained, orange and red soil. Sparse, rich concentrations of barite nodules. Gray-olive chert and shale of Siksikpuk formation. Thinly bedded limestone in dark chert of Lisburne Group. Closely spaced structural repetitions of units	11	N-300	10-15	150- >5,000	N-3

*N means none detected.

FIG. 1. INDEX MAP OF ALASKA SHOWING NPRA, MISHEGUK MOUNTAIN AND HOWARD PASS QUADRANGLES, AND AREA OF MINERAL RESOURCE ASSESSMENT IN NPR-A

AREA OF THIS REPORT

A - MISHEGUK MOUNTAIN QUADRANGLE 1:250,000 SCALE

B - HOWARD PASS QUADRANGLE 1:250,000 SCALE

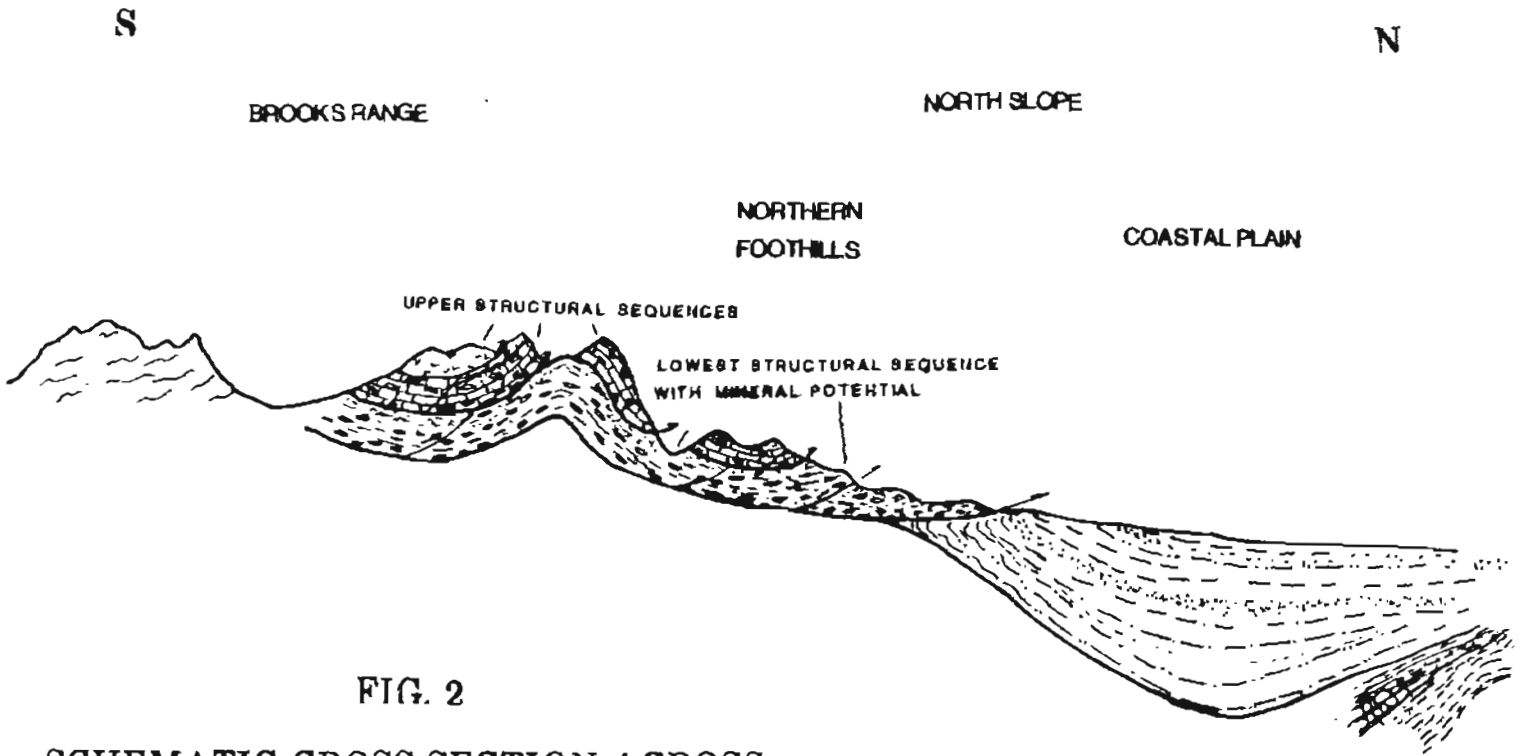
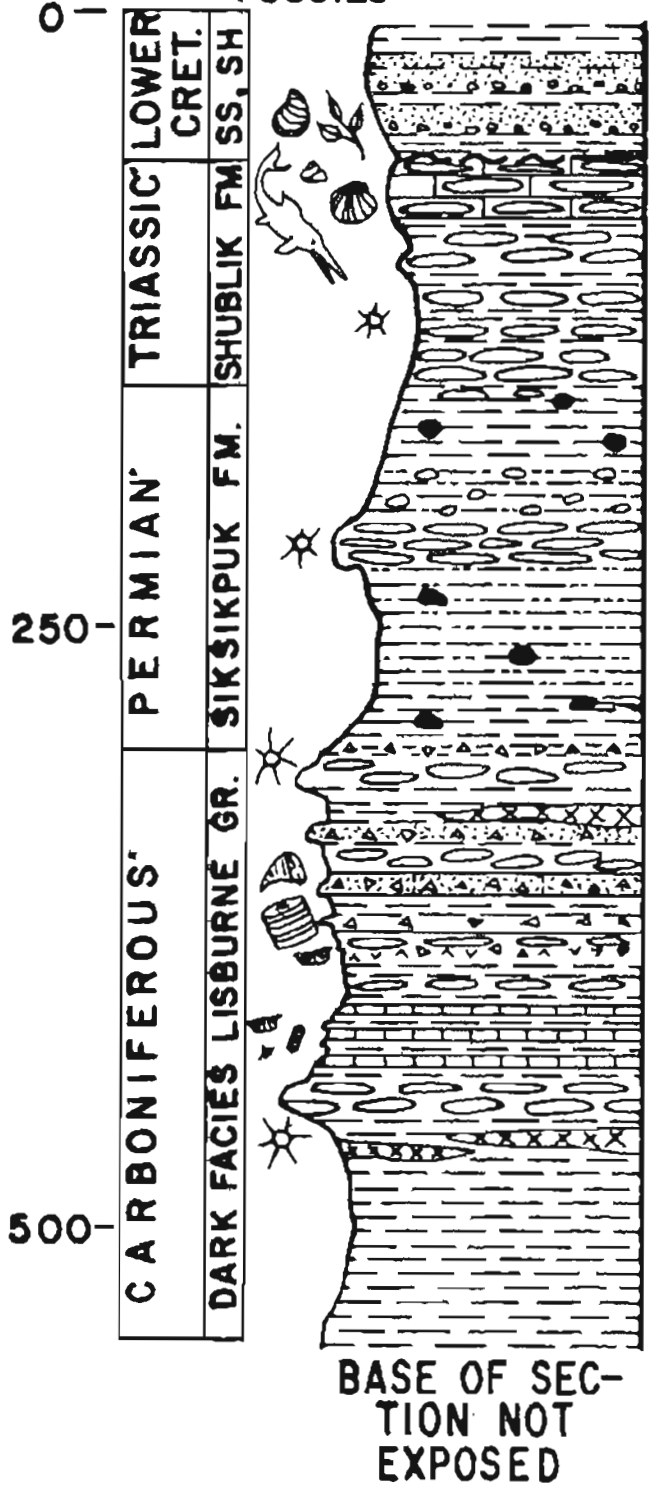


FIG. 2

SCHEMATIC CROSS-SECTION ACROSS
THE BROOKS RANGE & NORTH SLOPE

Figure 4

GENERALIZED COLUMNAR SECTION OF THE LOWEST STRUCTURAL SEQUENCE SOUTHERN NPRA



Lithic sandstone, mudstone, and shale. Minor conglomerate. Turbidite current structures. Pelecypod *Buchia*, plant fragments

Chert, shale, and limestone. Chert is dark to medium gray, weathering light-olive-gray radiolarian ribbon chert interlayered with black shale. Limestone is medium gray, thin bedded, very fine grained and generally fossiliferous with pelagic pelecypods--*Monotis* and *Halobia*. About 100 m thick

Olive-gray siliceous shale, mudstone, argillite, and chert. Maroon and green argillaceous strata are highly cleaved with argillitic sheen on surfaces. Gray to greenish gray radiolarian ribbon chert, knobbly and with rosettes of marcasite, weathers maroon, orange, and shades of green and yellow. Formation is about 100 to 150 m thick. Barite nodules, lenses, and veins in many places are conspicuously on argillaceous talus slopes. Locally, formation brightly stained red

Mainly black siliceous shale and radiolarian ribbon chert. Thin beds and laminae of light-gray turbidites and tuffaceous material interlayered with shale and chert occur in narrow sections of the formation. Locally, intermediate to mafic tuff associated with intermediate to mafic massive porphyritic flows and breccias. Tuffs are cemented by varying amounts of calcite and quartz and contain chert pebbles that, together with layering, indicate submarine origin. Except for shelly fossil fragments (mainly crinoids) that comprise thin beds of clastic limestone, pelagic fossils are radiolaria, sponge spicules, and abundant trace fossils of *Nereites* type. Locally, galena, sphalerite, and pyrite occur in veins and lenses. Formation is about 250 m thick

*Preliminary ages of formations determined by radiolaria (David L. Jones, oral commun., 1978).

FIGURE 5. -Summary statistics for 23 elements detected in the 574 samples of -30 mesh stream sediment from the northern parts of the Misheguk Mountain and Howard Pass quadrangles, Alaska. Seven additional elements sought but not found in these samples are, with their lower limit of detection: As 200, Au 10, Bi 10, Cd 20, Sb 100, Sn 10, and W 50. The values for the minimum, maximum and mean are in percent for Fe, Mg, Ca and Ti, and in parts per million for the other elements. The geometric mean and deviation is only given where a reasonable estimate is possible; that is, where the number of observations falling in the indeterminate categories of N, L, or G is not large. Where the mean and deviation are given in the presence of the indeterminate categories, an arbitrary value either two reporting steps above or below the limits of the analytical method, as appropriate, have been substituted for the indeterminate.

Chemical symbol	Number outside of range[1] N	L	G	Number of observations	Minimum	Maximum	Geometric Mean	Deviation
Fe				574	1	15	5.7	1.6
Mg				574	0.1	10	0.93	2.1
Ca				574	0.05	20	0.44	3.2
Ti				574	0.1	1	0.45	1.7
Mn			3	571	100	G 5000	1500	1.8
Ag	562	3		9	N 0.5	2		
B	8	2		564	N 10	200	71	2.1
Ba			44	530	20	G 20,000	2600	4.7
Be	8	34		532	N 1	5	1.6	1.6
Co		10		564	L 5	200	29	1.7
Cr			3	571	10	G 5000	160	2.6
Cu		1		573	L 5	300	57	1.9
La	224	2		348	N 20	150		
Mo	528	33		13	N 5	10		
Nb	272	300		2	N 20	30		
Ni				574	10	3000	94	1.7
Pb	30	33		511	N 10	150	18	2.1
Sc				574	5	70	19	1.5
Sr	37	64		473	N 100	1500	110	1.9
V				574	20	500	170	1.5
Y	2			572	N 10	100	31	1.4
Zn	392	139		43	N 200	1000		
Zr	1			573	N 10	500	160	1.5

[1] N, none detected.

L, present in an amount less than the lowest standard.

G, more than the highest standard. The value of the highest standard is indicated in the "maximum" column.

FIGURE 6. --Summary statistics for 25 elements detected in the 574 samples of nonmagnetic heavy-mineral concentrate from the northern parts of the Misheguk Mountain and Howard Pass quadrangles, Alaska. Five additional elements sought but not found in these samples are, (with their lower limits of detection): Au 10, Bi 10, Cd 20, Sb 100, and W 50. The values for the minimum, maximum, and mean are in percent for Fe, Mg, Ca and Ti, and in parts per million for the other elements. The geometric mean and deviation is only given where a reasonable estimate is possible; that is, where the number of observations falling in the indeterminate categories of N, L, or G is not large. Where the mean and deviation are given in the presence of the indeterminate categories, an arbitrary value either two reporting steps above or below the limits of the analytical method, as appropriate, have been substituted for the indeterminate.

Chemical symbol	Number outside of range 1/ N	L	G	Number of observations	Minimum	Maximum	Geometric Mean	Deviation
Fe				567	0.15	20	4.6	2.4
Mg				567	0.07	15	0.53	3.0
Ca		4		563	L 0.1	20	2.1	4.4
Ti			1	566	0.02	G 2	0.88	4.7
Mn				567	70	3000	610	2.0
Ag	515	5		47	N 1	15		
As	536			31	N 500	10,000		
B	124			443	N 20	1000	47	3.1
Ba			382	185	300	G 50,000		
Be	375	48		144	N 2	150		
Co	207	11		349	N 10	1500		
Cr	51			516	L 20	10,000	170	4.6
Cu		69		498	L 10	3000	50	3.9
La	384			183	N 50	1500		
Mo	499	27		41	N 10	50		
Nb	473	26		68	N 50	150		
Ni	19			548	N 10	7000	56	2.8
Pb	285	28		254	N 10	10,000	20	3.8
Sc	215		1	351	N 10	G 200	19	3.4
Sn	549			18	N 20	700		
Sr	2	6	35	524	N 200	G 10,000	2000	4.2
V				567	20	1000	160	2.1
Y	175			392	N 20	1500	41	3.2
Zn	452	11	1	103	N 500	G 20,000		
Zr	22	22	153	370	N 20	G 2000	390	7.8

1/ N, none detected

L, present in an amount less than the lowest standard.

G, more than the highest standard. The value of the highest standard is indicated in the "maximum" column.

Appendix A

Traverse Cross Sections

1. Red Dog Creek
2. Atneerich Creek
3. Inaccessible Ridge (western edge near Kelly River)
4. Inaccessible Ridge (western edge northwest of Kagvik Creek)
5. Inaccessible Ridge (main ridge north of Kagvik Creek)
6. Inaccessible Ridge (south of main ridge and north of Kagvik Creek
7. Elbow Creek
8. Chertchip Creek (near Nuka River)
9. South Chertchip Creek
10. Nuka River
11. Nuka Ridge (southeast part)
12. Nuka Ridge (northeast part)
13. Sorepaw Creek
14. Headwaters of Rolling Pin Creek
15. North Rolling Pin Creek
16. Drenchwater Creek
17. Ridge between False Wager and Wager Creeks
18. North of Drenchwater Creek
19. Northeast tributary of Wager Creek
20. Safari Creek

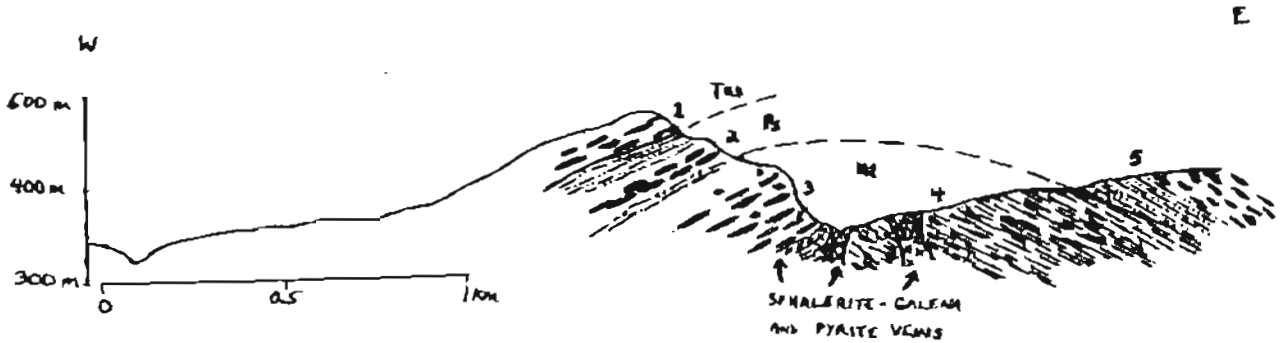
Formation or Unit Symbols

Trs- Shublik Formation

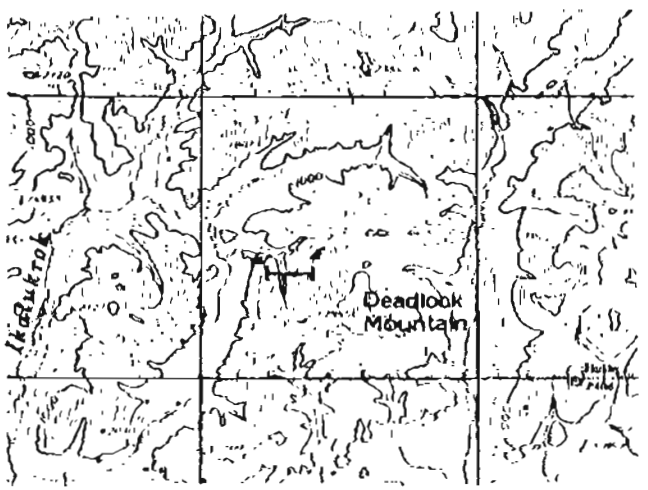
Ps- Siksikpuk Formation

Ml- Lisburne Group (Dark chert and shale facies)

1. RED DOG CREEK



Unit 1 - Shublik chert.
Unit 2 - Siksikpuk Formation - Olive-gray, dark-gray and maroon weathering argillitic mudstone and subordinate sets of ribbon chert.
Unit 3 - Strongly altered Lisburne Formation - Mostly talus of very light gray cinderlike siliceous rock. Has faint lamination and appears to be altered chert. In places, barite rubble and yellow to orange boxwork, less altered chert, has radiolaria, sponge spicules, and feldspar phenocrysts.
Unit 4 - Lisburne Formation - Black cherty shale, and thin bedded chert. Cut by veins up to a meter wide of sphalerite-galena and pyrite.
Unit 5 - Siksikpuk Formation - Pale green argillitic mudstone and chert; weathers maroon



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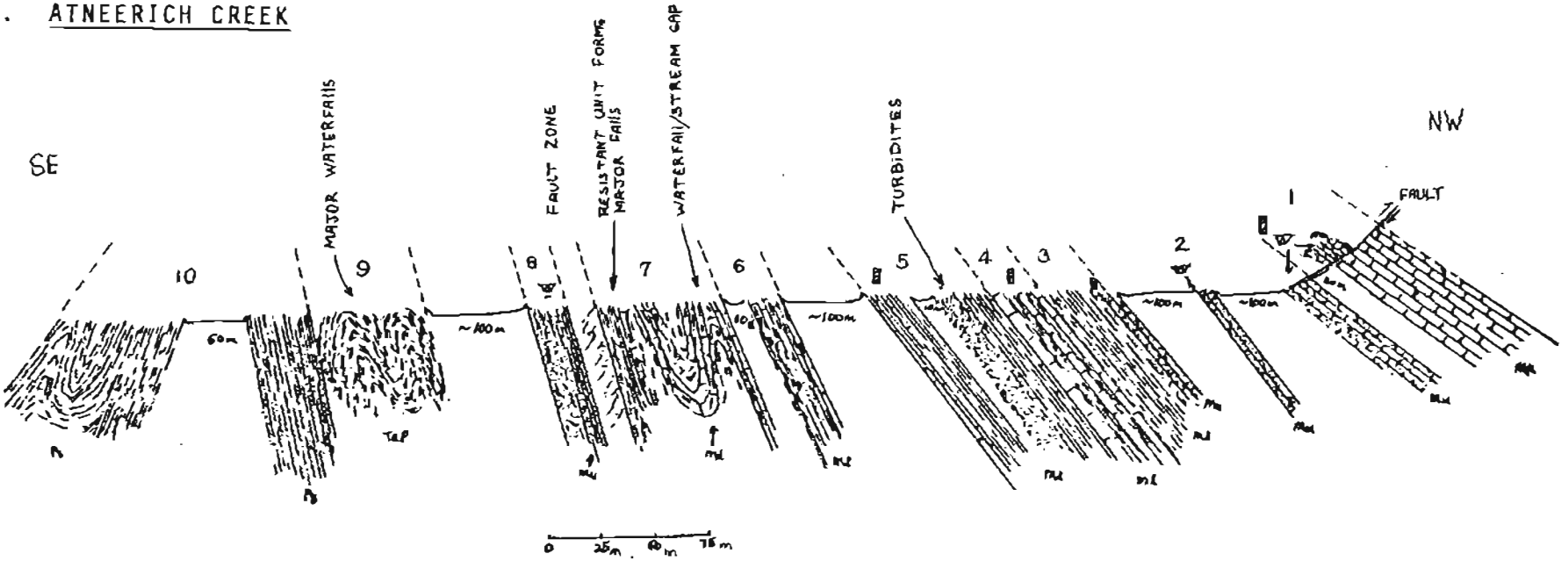
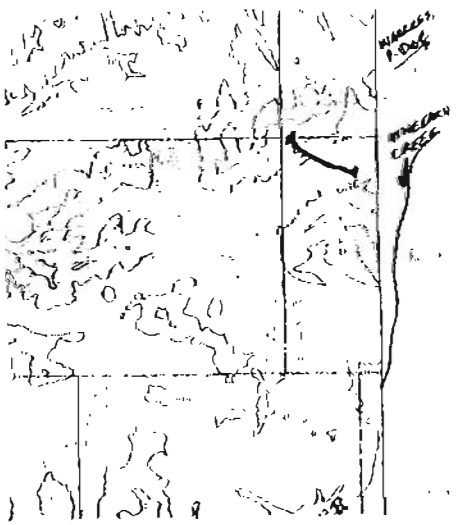
2. ATNEERICH CREEK



UNIT	ESTIMATED THICKNESS	DESCRIPTION	FORMATION OR AGE
1	> 50 m 20 m	Medium-gray, well-bedded limestone adjacent to fault breccia which separates a massive, very thick bedded brecciated medium-dark-gray bioclastic limestone, abundant in crinoids and brachiopods, with minor amounts of broken chert	Kogruk
2	Scattered beds in 200 m covered area	Dark-gray-brown laminated, thin bedded silty limestone, weathers orange; abundant *Spirophyton*, *Productid* brachiopods	Utukok
3	25 m	Black laminated to very thinly bedded indurated shale ("pencil" fragment), pale-yellowish-gray weathering silty limestone to limy siltstone; silty beds appear graded; distal turbidites; limestone near top of beds	Black Lisburne
4	20 m	Crinoidal limestone with black shale interbeds; limestone beds massive to thick	Black Lisburne
5	25 m	Black shale with limy laminae and beds of siltstone and fine-graded sandstone; turbidite structures	Black Lisburne
	20 m	Dark-gray platy limy shale with some thick beds of light-gray crinoidal limestone	Black Lisburne
6	25 m	Black chert and siliceous shale; chert limestone	Black Lisburne
	WATERFALL - STREAM GAP		
7	60 m	Gray medium bedded limestone; tightly folded with lenses of black chert replacement; more argillaceous beds in lower 10 m of unit	Black Lisburne
	FAULT		
8	20 m	Brown limy siltstone to sandy limestone; fossil-rich crinoids, *Spirophyton*, *Spirifer*, with disseminated iron sulphides; calcareous quartz arenite with chert in lower part weathering orange-brown cross bedded	Utukok
9	60 m	Medium-gray knobby thin bedded chert with olive-gray mudstone partings; folded and highly fractured unit	TRF
10	30 m	Olive-gray argillitic mudstone; stained zone, oxidized soil	Siksikpuk
	COVERED AREA		
	80 m	Maroon and olive argillite	Siksikpuk



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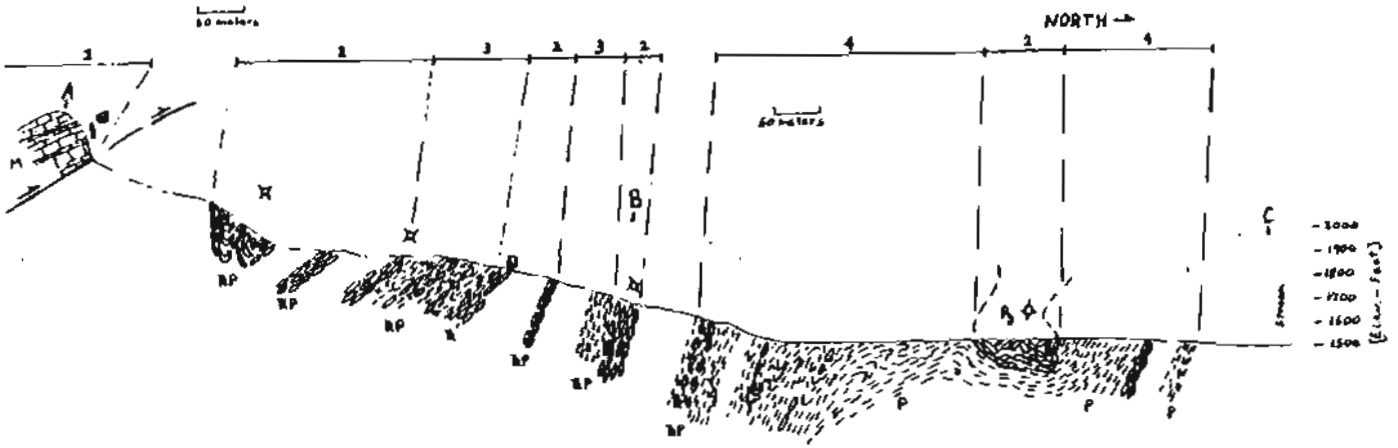
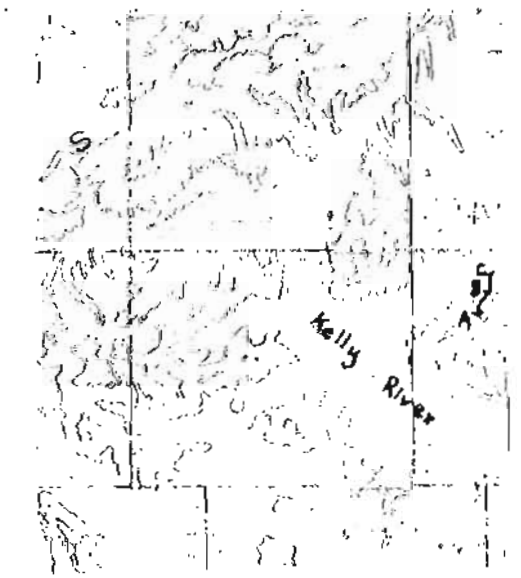
3. INACCESSIBLE RIDGE (WESTERN EDGE NEAR KELLY RIVER)



Rock unit	Unit number	Estimated thickness	Description
Utukok	1	>130 m	Buff-weathering limestone and sandy limestone; crinoids and brachiopods
Shublik	2	20-100 m	Gray- to brown-weathering, gray chert with shale partings; *Monotis*
Siksikpuk	3	45-65 m	Gray shale and siliceous shale, highly fractured and folded
Siksikpuk	4	70 m	Gray or maroon shale, intercalated siliceous shale and chert beds



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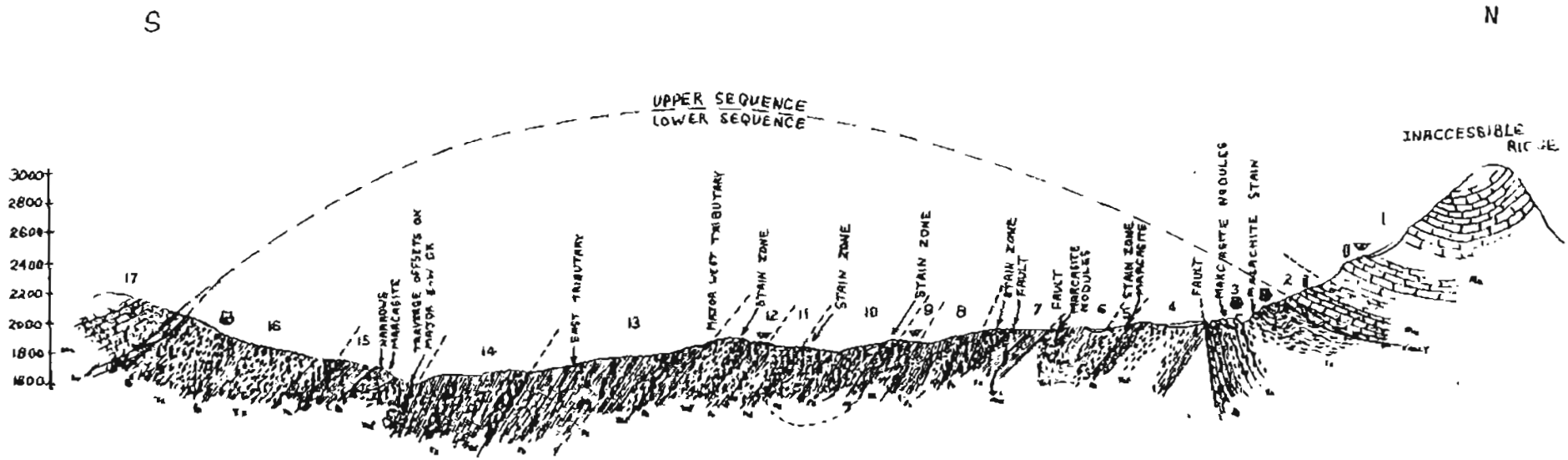
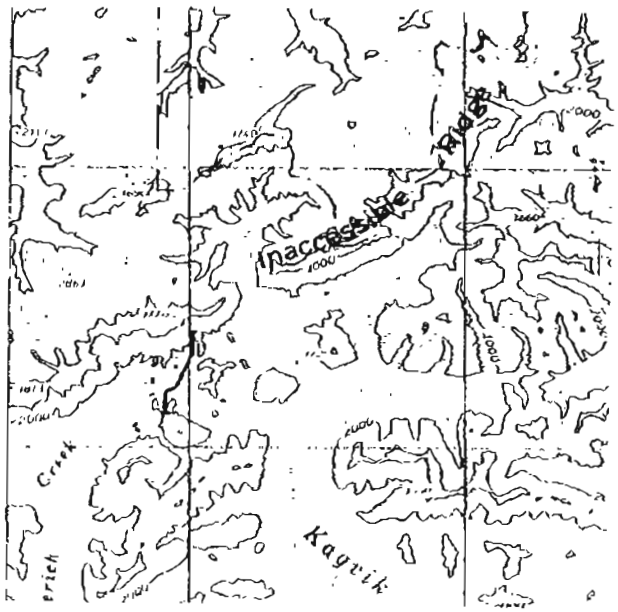
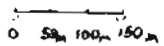
4. INACCESSIBLE RIDGE (WESTERN EDGE NORTHWEST OF KAGVIK CREEK)







Misheguk Mountain
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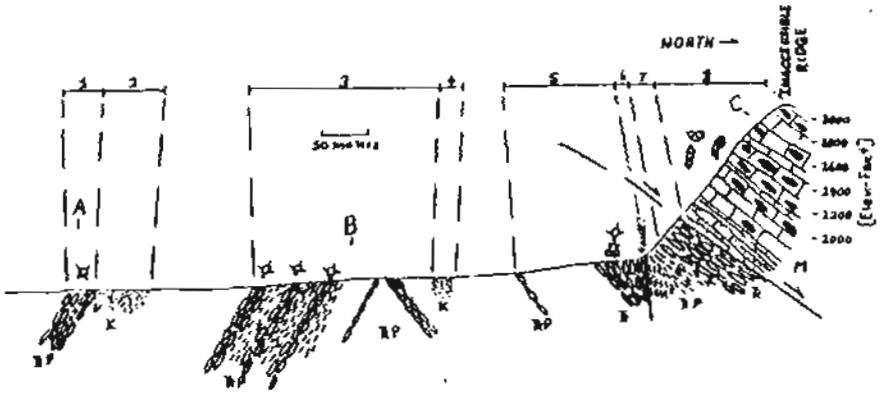
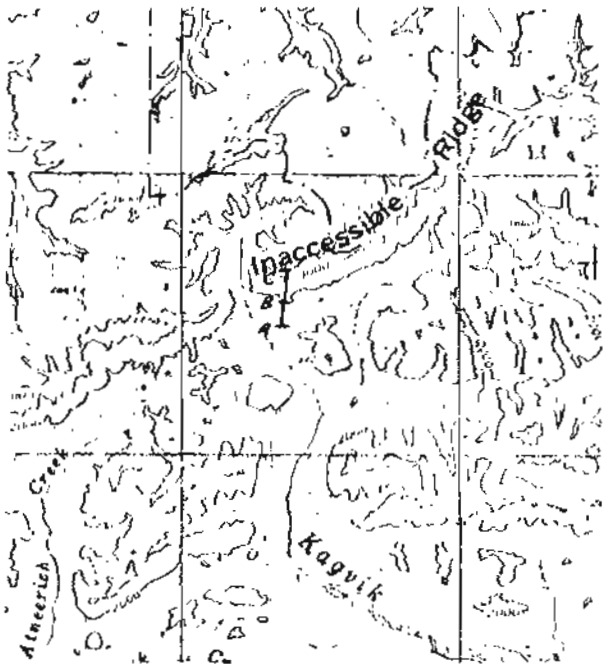
4. INACCESSIBLE RIDGE (WESTERN EDGE NORTHWEST OF KAGVIK CREEK

UNIT	ESTIMATED THICKNESS	DESCRIPTION	FORMATION OR AGE
1	400 m	Medium-gray fossiliferous limestone, thick bedded, blocky, and largely folded, weathers to light gray	Nagrak
2	< 75 m	Brown silty fossiliferous limestone, thin bedded, platy. Some brachiopods and crinoids. Grades to limy laminated siltstone	Umiak
		FAULT	
3	< 25 m	Wedge of medium-gray wacke and siltstone	Cretaceous
	35	Upper beds - tightly folded, medium-gray, laminated, thin bedded (ribbon) chert with *Monotis* and shaly interbeds, malachite staining	Shublik
		CROSS CREEK	
	45 m	Steeply dipping, medium-gray, laminated chert with *Monotis* and siliceous shale and some marcasite nodules intensely mottled by burrowing organisms; resembles deep sea pelagic mud	Shublik
	25 m	Thin bedded, medium-gray chert with black indurated shale partings and some green-gray siltstone	Sikeikpuk?
		FAULT	
		COVERED AREA	
4	25 m	Medium-gray, knobby ribbon chert	TRP
	25 m	Brown-gray silty shale with pencil structure	Ps
5	25 m	Gray, medium bedded, knobby chert with marcasite nodules (stain zone) (may be north limb of a fold)	TRP
		COVERED AREA	
6	30 m	Pale-olive, silty shale to mudstone with minor chert interbeds; some black shale backly, pencil structure; also has slickensided green argillite	Sikeikpuk?
	20 m	Gray, knobby chert with marcasite nodules	TRP
		FAULT?	
7	40 m	Brown, silty shale, fractured and mudstone with quartz veins	Sikeikpuk
	10 m	Medium-gray, knobby chert	Sikeikpuk
		FAULT ZONE	
	40 m	Highly fractured, gray chert with black shale and limonite staining	Sikeikpuk
8	25 m	Medium-gray mudstone; punky and with curved cleavage surfaces	Sikeikpuk?
	25 m	Gray ribbon chert with finely disseminated sulphides	Sikeikpuk?
	30 m	Brownish gray fractured mudstone. Forms small chips with curved fractures	Sikeikpuk?
9	30 m	Black slaty indurated shale with laminated calcareous sandstone and limy nodules interbedded with black silty shale; some brachiopods	Black Lisburne
10	30 m	Black ribbon chert with limy partings; stained zone	Black Lisburne
	20 m	Gray, thin bedded chert with shaly tuffaceous layers	TRP
	50 m	Pale-olive silty shale and mudstone	Sikeikpuk
	50 m	Black ribbon chert with limy partings and limonite stain	Black Lisburne
11	20 m	Thin bedded, yellowish chert and clay	Sikeikpuk
	25 m	Black ribbon chert with black shaly partings	Black Lisburne
12	30 m	Olive, silty calcareous shale (with brachiopods) and dark-gray chert	Sikeikpuk
	25 m	Light-gray, thin bedded chert with yellowish brown argillaceous interbeds (stained)	TRP
	20 m	Maroon and olive-green mudstone	TRP
		MAJOR WEST TRIBUTARY	
13	30 m	Maroon and pale-green-gray fractured mudstone, some siliceous layers	Sikeikpuk
	20 m	Thin bedded, medium-gray chert with clay partings; locally folded	TRP
	25 m	Olive-gray fractured mudstone. Gray chert in lower part	Sikeikpuk
	100 m	Olive shaly mudstone	Sikeikpuk
	50 m	Pale-olive indurated mudstone with curved cleavage and maroon weathering	Sikeikpuk
14	25 m	Light- to medium-gray, thin bedded chert and siliceous shale	Sikeikpuk
	170 m	Olive-gray mudstone with sets of thin bedded chert (10 m)	Sikeikpuk
		TRAVERSE OFFSETS WEST AT MAJOR CREEK	
15	10 m	Pale-green chert; folded with shaly partings	TRP
	30 m	Thin bedded siliceous shale with marcasite; staining orange; soft argillaceous partings with black carbon	Sikeikpuk
	15 m	Argillaceous mudstone and siliceous shale; locally folded	Sikeikpuk
	50 m	Fractured olive-gray mudstone; folded	Sikeikpuk
16	20 m	Thin bedded, gray limy chert	Shublik
	7	Black indurated cleaved shale	Shublik
	100 m	Thin bedded, medium-gray chert; weathers to light brown	Shublik
	25 m	Olive cleaved mudstone	Shublik
	75 m	Medium bedded dark-gray chert bleached white with *Monotis*; some interlayers of brown siltstone	Shublik
	15 m	Maroon-olive argillitic mudstone interlayers with ribbon chert	Sikeikpuk
		FAULT	
17	15 m	Calcareous micaceous sandstone and wacke	Cretaceous
	200 m	Brown limy siltstone with wacke	Umiak

5. INACCESSIBLE RIDGE (MAIN RIDGE NORTH OF KAGVIK CREEK)



Rock unit	Unit number	Estimated thickness	Description
Siksikpuk	1	>25 m	Brown- and gray-weathering gray chert
	2	70 m	Calcareous greenish-gray lithic wacke
Siksikpuk	3	125 m	Gray and maroon, well-bedded shale and chert
	4	20 m	Lithic wacke
Shublik	5	>45 m	Gray well-bedded chert with *Monotis*
Siksikpuk	6	15 m	Gray thin-bedded chert
Siksikpuk	7	30 m	Gray well-bedded chert
Utukok/ Kogruk	8	>300 m	Light-gray-weathering limestone with few black chert nodules; buff-weathering thin-bedded limestone in float at base



Misheguk Mountain
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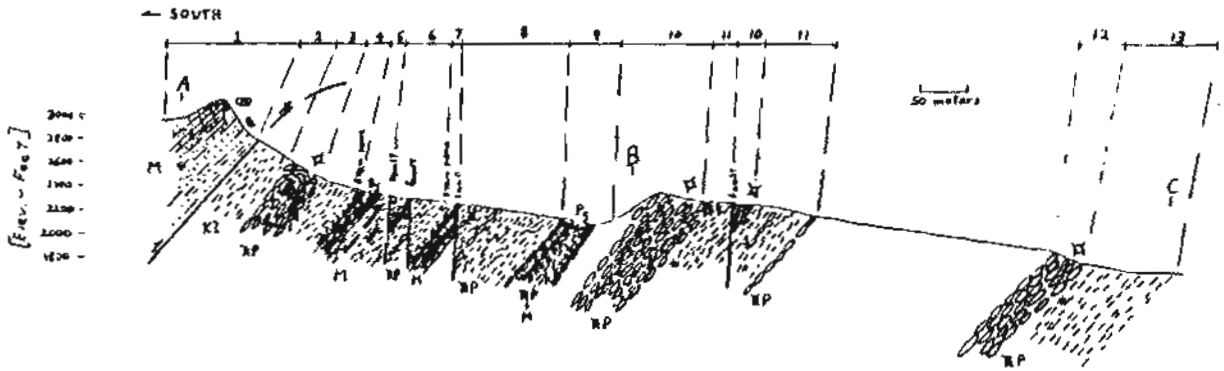
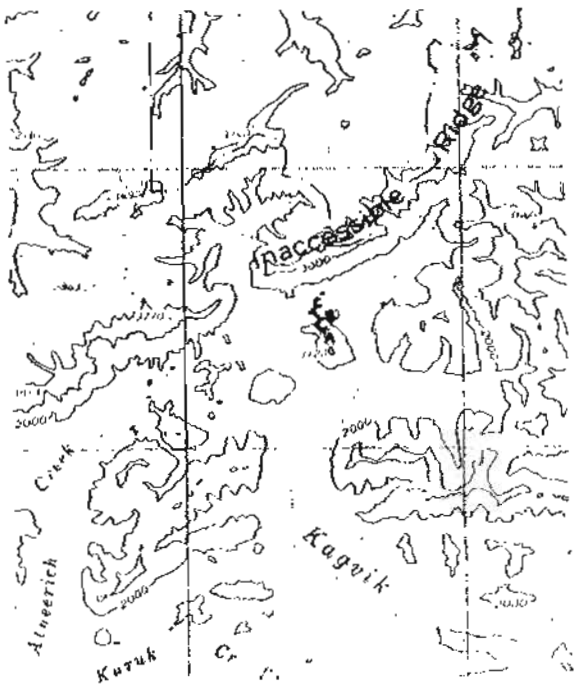
6. INACCESSIBLE RIDGE (SOUTH OF MAIN RIDGE AND NORTH OF KAGVIK CREEK)



Rock unit	Unit number	Estimated thickness	Description
Utukok	1	>200 m	Buff-weathering sandy limestone and dolomite, thin shale and sandstone near base; crinoids, brachiopods, and gastropods
	2	40 m	Thin-bedded, poorly indurated gray shale and mudstone
Shublik	3	20 m	Gray and dark-gray chert, highly fractured, boudins of gray limestone
Siksikpuk	4	60 m	Mostly gray chert at top grading down into olive-gray shale
Lisburne	5	25 m	Black chert and limestone grading down to black shale with few thin limestone beds; yellow clay <1 m thick at top
Siksikpuk	6	40 m	Gray shale and siliceous shale, few gray chert beds
Lisburne	7	10 m	Yellow clay bed on black-well-bedded chert
Siksikpuk	8	90 m	Gray shale and siliceous shale; intercalated gray chert beds
Siksikpuk and Lisburne	9	12 m	Gray shale, black chert, and yellow clay; structurally complex
Shublik	10	65 m	Gray-brown-weathering gray chert, highly fractured
Siksikpuk	11	110 m	Gray and maroon shale; intercalated chert beds
Siksikpuk	12	30 m	Gray chert
Siksikpuk	13	76 m	Gray and maroon shale



Misheguk Mountain
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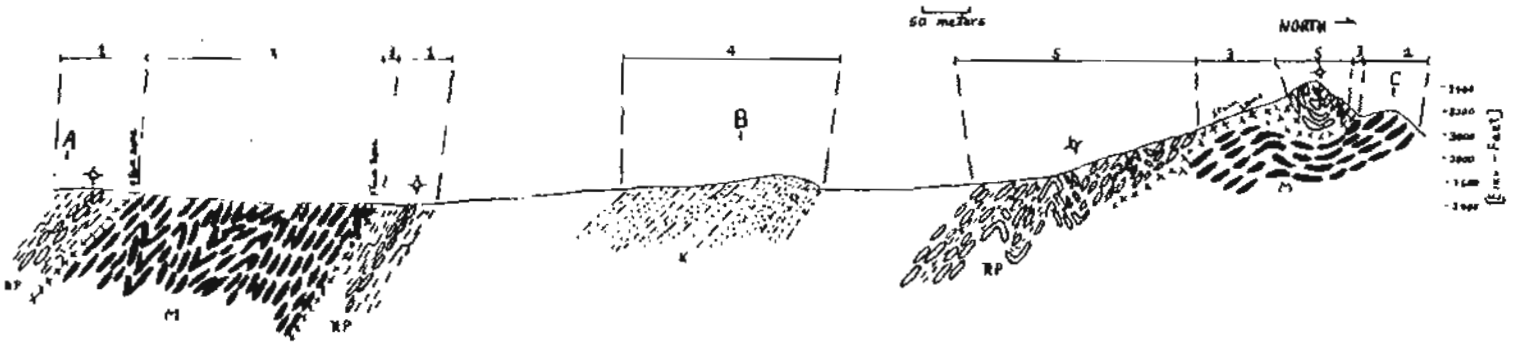
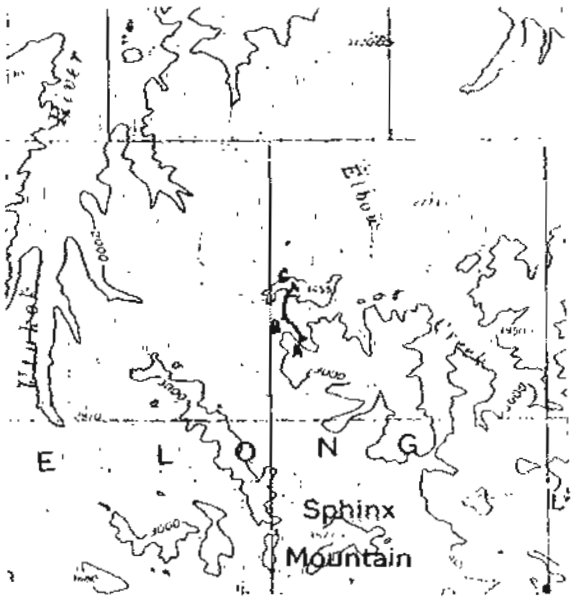
7. ELBOW CREEK


50 meters
NORTH
A
B
C
M
RP
K

Rock unit	Unit number	Estimated thickness	Description
Siksikpuk	1	50 m	Interbedded gray chert and gray to maroon shale, many folds
Lisburne	2	110 m	Mostly black or dark-gray well-bedded chert
	3	2 m	Yellow clay soil zone
	4	>175 m	Interbedded lithic wacke and gray mudstone
	5	40 m	Maroon and olive-gray chert and shale


Elbow
E L O N G
Sphinx
Mountain

Misheguk Mountain
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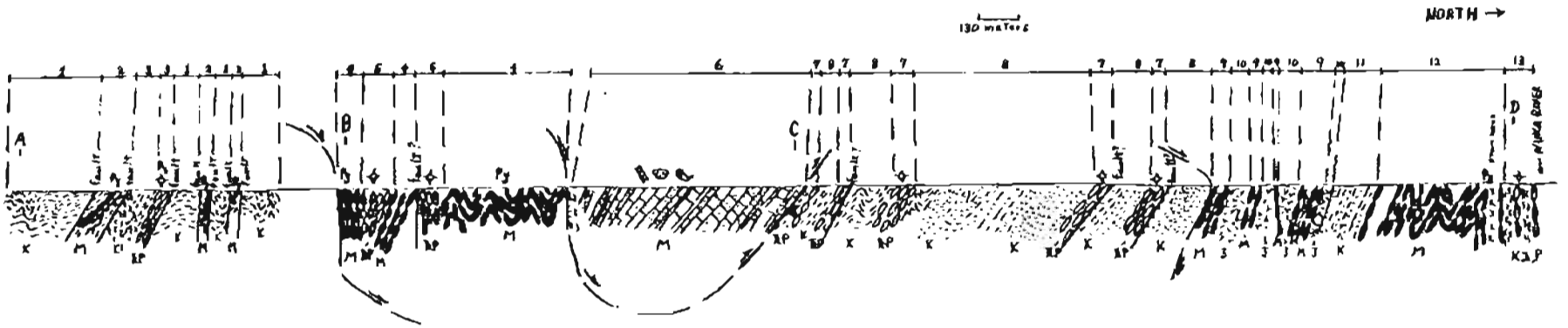
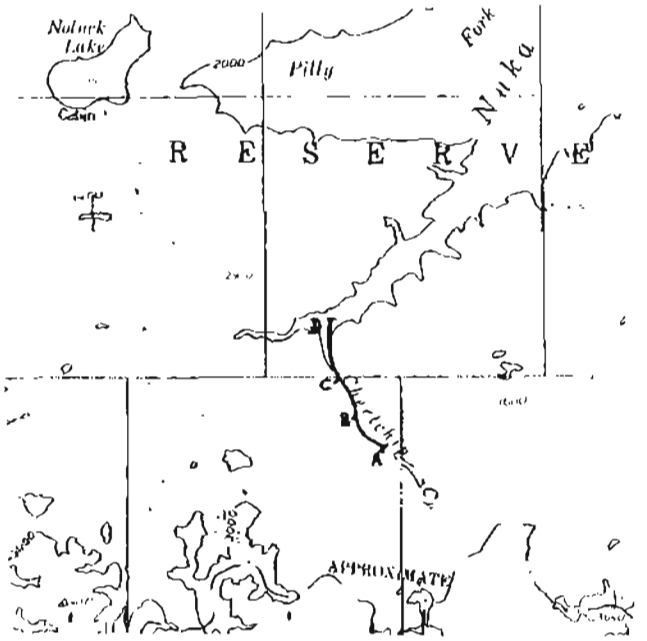
8. CHERTCHIP CREEK (NEAR NUKA RIVER)



Rock unit	Unit number	Estimated thickness	Description
	1	>90 m	Gray thin-bedded mudstone, local thin wacke beds; much folding
Lisburne	2	>85 m	Interbedded black carbonaceous shale, siliceous shale, and dolomite; locally pyritic. Carbon specks throughout
	3	25 m	Pyritic gray chert, shale partings
Lisburne	4	65 m	Well-bedded nodular black chert, rare siliceous carbonate lenses
	5	50 m	Light-gray- or cream-weathering gray chert; well bedded
Utukok	6	300 m	Light-gray limestone and buff-weathering sandy limestone, local thin sandstone and shale beds; abundant crinoids and brachiopods
	7	10-50 m	Highly fractured gray and green chert
	8	25-400 m	Lithic wacke and mudstone, local concretions
Lisburne	9	20-90 m	Black bedded chert with diabase dikes and sills; local chert chip carbonate
	10	<60 m	Diabase dikes and (or) sills
	11	130 m	Interbedded wacke and mudstone with concretions
Lisburne	12	60-200 m	Black bedded chert, local pyrite zones
	13	40 m	Faulted gray chert and shale



Misheguk Mountain
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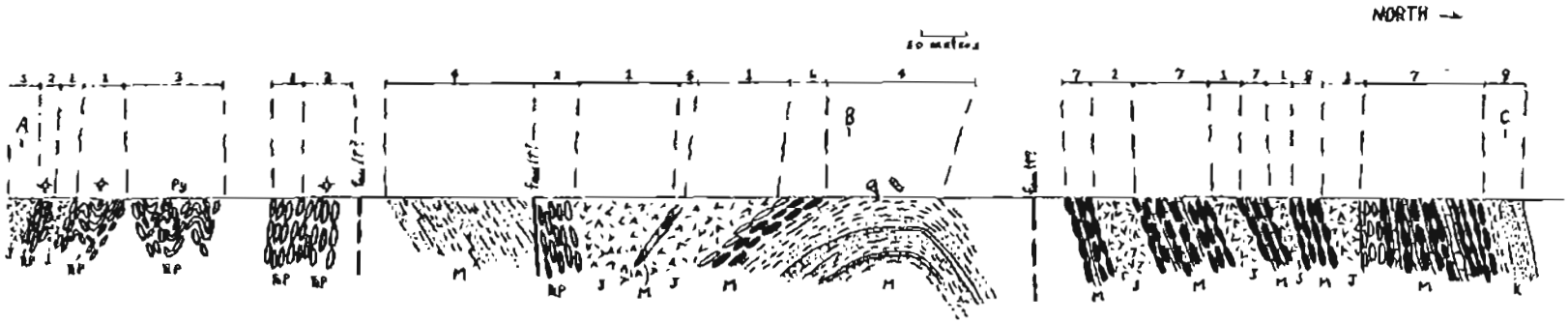
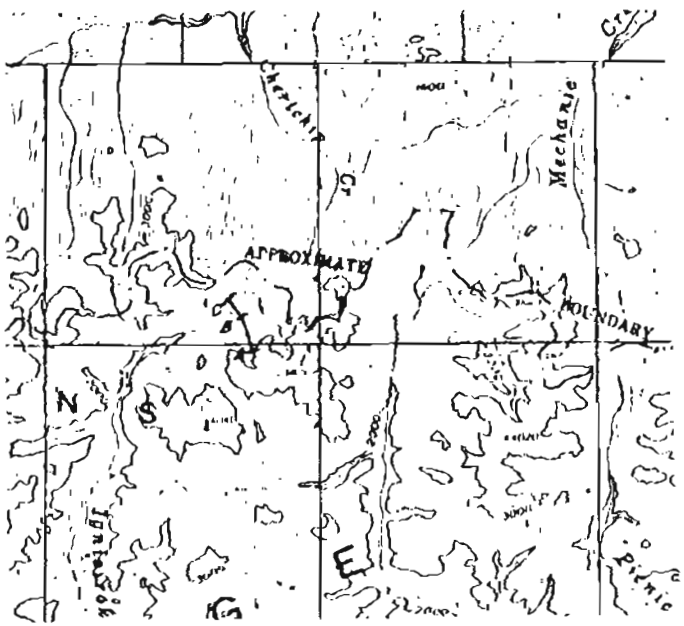
9. SOUTH CHERTCHIP CREEK



Rock unit	Unit number	Estimated thickness	Description
	1	15-250 m	Brown-weathering diabase dikes and sills
	2	20-40 m	Well-bedded gray, dark-gray, and green chert
	3	<100 m	Red chert
	4	>125 m	Interbedded gray shale, siltstone, and calcareous sandstone
Lisburne	5	10 m	Gray limestone with black chert nodules
Lisburne	6	10 m	Well-bedded black and gray chert; local white porcellanite
Lisburne	7	25-135 m	Interbedded black chert and gray limestone
Lisburne	8	40 m	Well-bedded black chert
	9	40 m	Interbedded mudstone and lithic micaceous wacke



Misheguk Mountain
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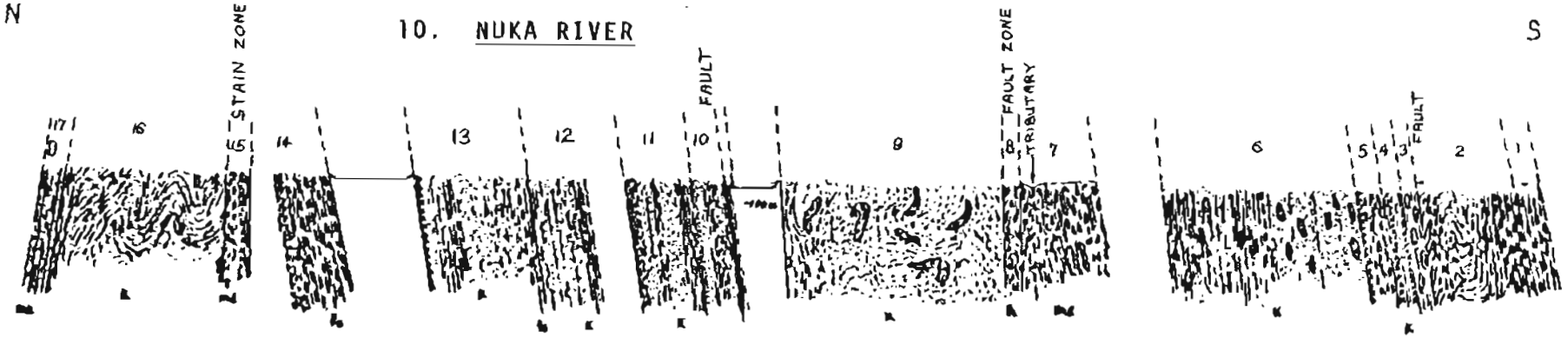
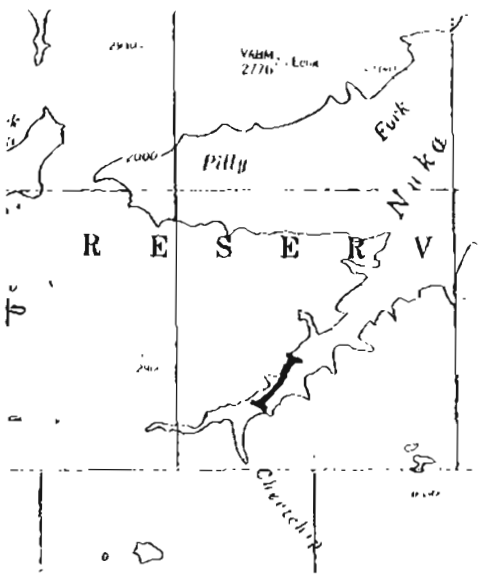
10. NUKA RIVER



UNIT	ESTIMATED THICKNESS	DESCRIPTION	FORMATION OR AGE
1	25 m	Heavy black chert with light-gray silicified shale; strongly slickensided (horizontally and vertically)	Black Lithurna
2	305 m	Pale-green very thin bedded chert, crushed maroon argillite	Sitkinak
		FAULT	
3	10 m	Crushed olive-gray argillite	Sitkinak
		Shattered or broken Cretaceous turbidites in argillite matrix	Cretaceous
4	2 m	Brown weathering diabase	
	6 m	Olive-gray argillite	Cretaceous
	2 m	Serpentine gabbro	
5	20 m	Black chert with several cross-laminated limestone beds	Black Lithurna
	< 2 m	Small gabbro sill	
6	200 m	Olive-gray mudstone with bowlins of turbidites grading to gray shale and silty shales. Minor layer shaly chert (1 m)	Cretaceous
		FAULT	
7	40 m	Black medium bedded chert with minor dolomitic lenses and very thin argillitic partings	Black Lithurna
		FAULT	
8	30 m	Pale-green thin-bedded chert with argillaceous interbeds	Sitkinak
		FAULT	
9	360 m	Broken formation; feldspathic lithic mudstone; intensely deformed	Cretaceous
		COVERED AREA	
10	1 m	Maroon argillite	Sitkinak
		FAULT	
	25 m	Very thin bedded grained graywacke with some dark-gray chert grades to basal conglomerate	Cretaceous
11	25 m	Maroon argillite	Sitkinak
	30 m	Gray turbidites grade into boulder conglomerate with boulders of light-green chert, gabbro, calcareous lithic mudstone and other dolomitic limestone boulders are well rounded angular grit in matrix	Cretaceous
12	100 m	Covered area adjacent to broken formation if mudstone and mudstone, no shearing or substantially apparent	Cretaceous
13	10 m	Light-gray chert and mudstone	Sitkinak
	100 m	Graywacke and pebblestone	Cretaceous
	10 m	Gabbro sill	
		COVERED AREA	
14	60 m	Light-gray chert with some argillaceous interbeds	Sitkinak
	10 m	Gabbro sill	
15	2 m	Maroon argillite	Sitkinak
	2 m	Diabase sill	
	5 m	Black chert; weathers to bluish gray, partings oxidized	Black Lithurna
16	150 m	Graywacke and mudstone with concretions. Greenstone adjacent to Cretaceous unit	Cretaceous
17	25 m	Light- to medium-gray micritic limestone with abundant chert granules and pebbles. Abundant crinoids	Nagrum



Misheguk Mountain
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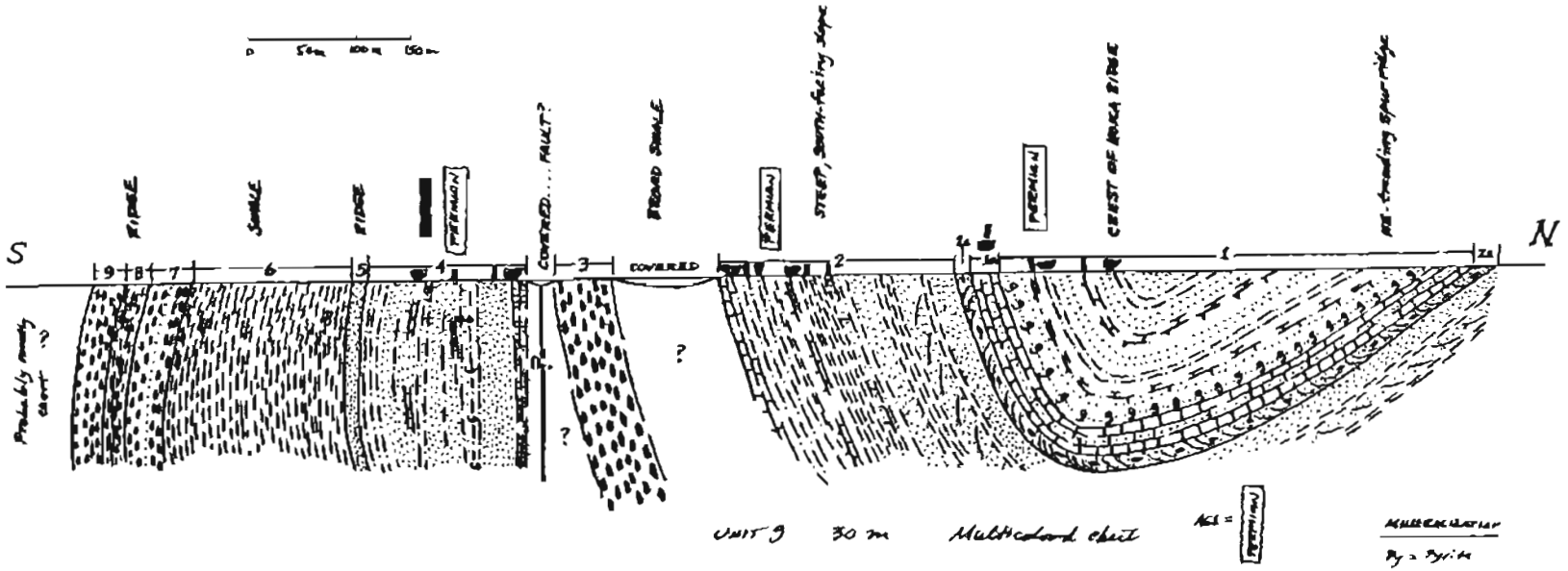
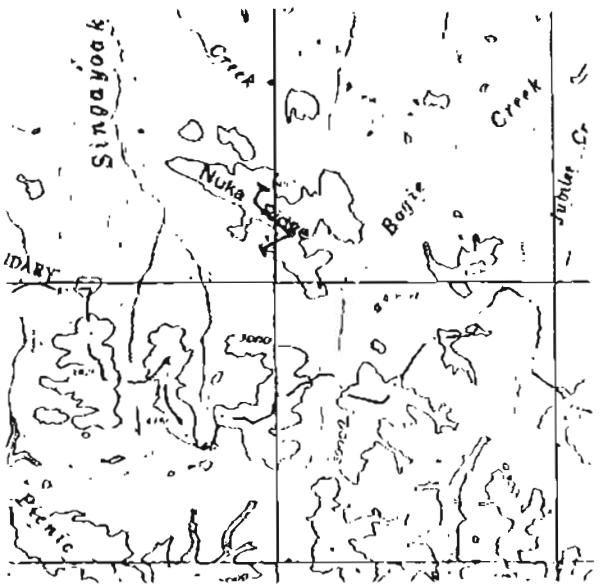
11. NUKA RIDGE

(SOUTHEAST PART)



Unit number	Estimated thickness (m)	Description
1	150	Calcareous sandstone, siltstone, and grit; sandy limestone; glauconitic sandstone. Abundant crinoids and brachiopods in limey horizons
(1a)	(20)	Gray limestone with one 1-m thick bed of quartz-chert granule conglomerate; crinoids and brachiopods
2	260	Gray- to rusty-red-weathering gritty sandstone, in part quartzose and in part feldspathic; dark-green to gray shale. More shale toward base; lowest 20 m is platy silty limestone and limey siltstone that is richly fossiliferous (brachiopods, corals, crinoids)
(2a)	(10)	Red-weathering, cross-bedded quartz-lithic wacke; 1/2 m of red chert in center
COVERED	100	PROBABLY MOSTLY SHALE
3	60	Maroon, green, and dark-gray chert
COVERED	30	PROBABLE FAULT
4	150	Limey granule conglomerate; arkosic sandstone; reddish-silty sandstone and silty limestone; greenish glauconitic? siltstone. Abundant crinoids and brachiopods. May be same unit as number 2
5	15	"Quartz-rich arkose"
6	150	Gray to pale-brown-weathering shale
7	40	Distinctive maroon and greenish-gray chert; one conspicuous bed 2 m thick of calcareous quartzose grit. May be same unit as number 3
8	20	Dark-gray shale or siliceous mudstone



Misheguk Mountain
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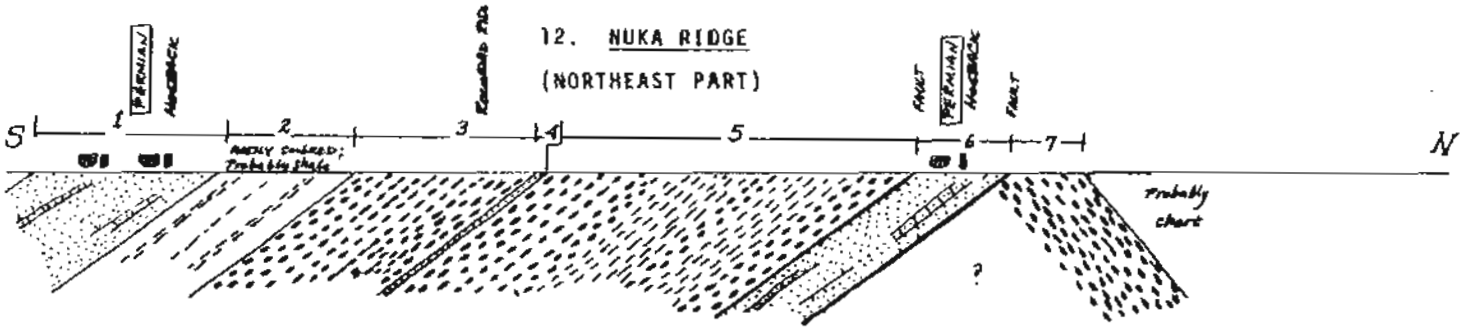
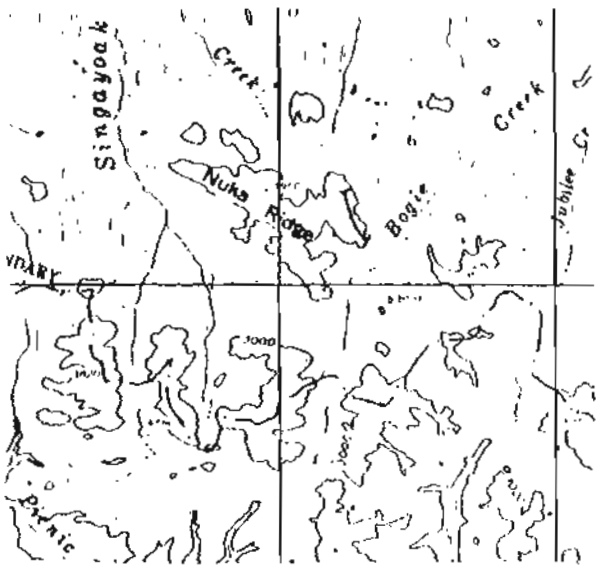


Unit number	Estimated thickness (m)	Description
1	100	Calcareous quartz-feldspar "grit" and arenite; interbedded sandy limestone. Abundant brachiopods and crinoids in limestone
2	75	Mostly covered; float and minor outcrop entirely dark shale
3	100	Multicolored chert, chiefly maroon and dark gray
4	3	One distinctive bed of calcareous quartz-feldspar "grit" (granule conglomerate)
5	200	Multicolored-maroon, dark-gray, and green chert and dark-slaty shale
FAULT		
6	50	Calcareous quartz-feldspar "grit" and arenite; interbedded sandy limestone. Possibly the same as unit number 1
FAULT		
7	50+	Pronounced change in dip from shallow southward (±35°) to intermediate (±50°) northward. Multicolored ("variegated") and gray chert and dark shale



Misheguk Mountain
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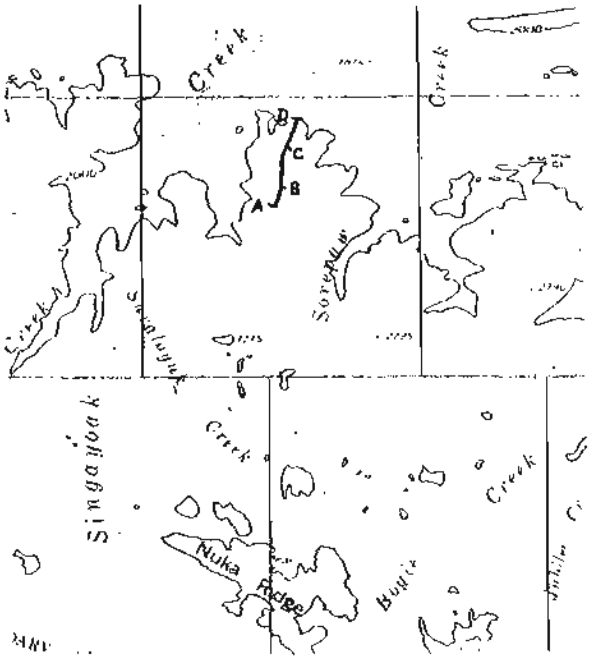
13. SOREPAW CREEK

Rock unit	Unit number	Estimated thickness	Description
	1	>50 m	Lithic wacke with intercalated mudstone; few concretions
Lisburne	2	175 m	Black chert, shale, and thin limestone beds; local orange soil
Shublik	3	30 m	Light-gray- and brown-weathering chert
Lisburne	4	110 m	Black shale with intercalated beds of siliceous shale, chert, and limestone
Shublik	5	12 m	Gray chert
	6	100 m	Calcareous wacke and mudstone
Shublik	7	30-300 m	Light-cream- or gray-weathering, gray or green chert; few limestone beds and local pyritic chert; *Monotis*
Siksikpuk	8	1 m	Maroon and gray shale
Lisburne	9	12-50 m	Black well-bedded chert, few black shale partings; local yellow-weathering clay zones
Lisburne	10	90-130 m	Interbedded black chert, siliceous black shale, and light-gray limestone



Misheguk Mountain
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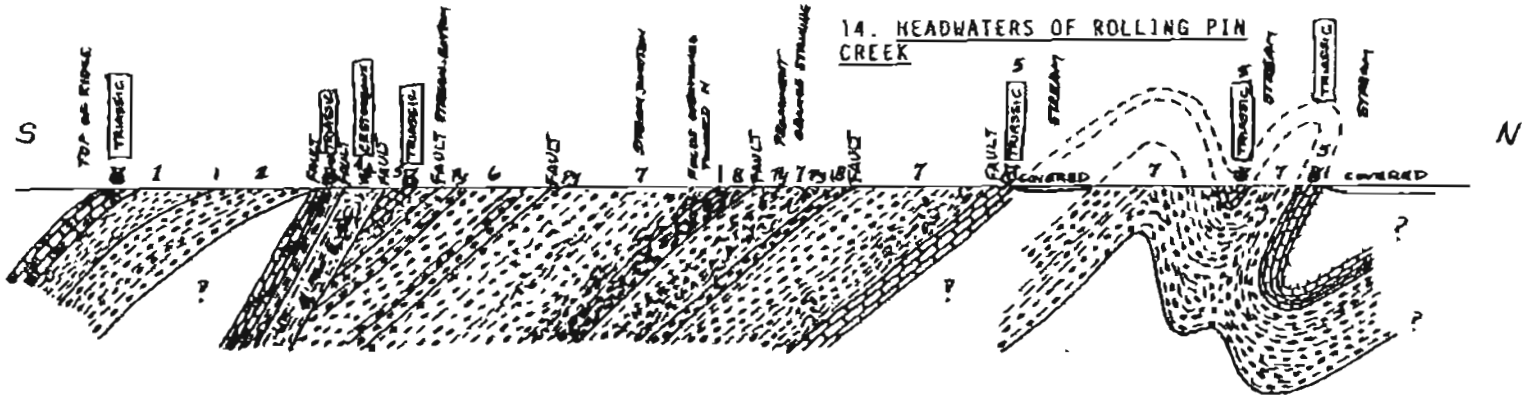
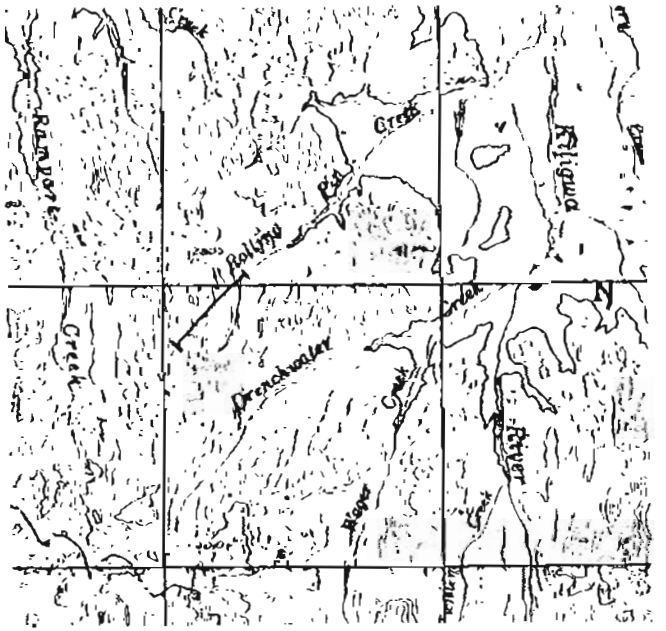
14. HEADWATERS OF ROLLING PIN CREEK



Unit number	Thickness (m)	Description
1 Ts	60	Cherty limestone and shale with muscle, medium green to buff
2 Ps	40	Gray- and green-weathering chert and shale--probable Siskiwit
	FAULT	
3 Ts	70	Same as unit number 5
	FAULT	
4 K	30	Micaceous siltstone and shale with plant fossils; poorly exposed; probably strongly deformed inasmuch as friable shale has cleavage and chloritic sheen
	FAULT	
5 Ts	30	Same as unit number 1
	FAULT	
6 MT	70	Dark-gray and tan-weathering, evenly bedded chert; separated from unit number 4 by pyritic zone that is probably a fault
	FAULT	
7 Ps	500	Interbedded white-gray-weathering chert and argillitic shale, pyritized near top (fault) contact; cherty bedded in lower part with cleavage parallel to fold axes, not to bedding
8 MT	35	Dark-gray, evenly bedded chert
	FAULT	
7 Ps	40	Pyritized; more variegated shale than previously
8 MT	10	Chert, evenly bedded
	FAULT	
7 Ps	80	
	FAULT	
5 Ts	10	
	50	COVERED
7 Ps	80	Strongly folded on small scale; part of large tight fold
5 Ts	30	Unusual to have N dips preserved in this generally S dipping sequence, verified the strongly folded nature of the terrane
7 Ps	40	Brittlely folded and shattered; strongly iron-stained; abundant free carbon in cherty beds; axial plane cleavage development
5 Ts	20	Tightly folded cherty limestone; other limb of major structure



Howard Pass
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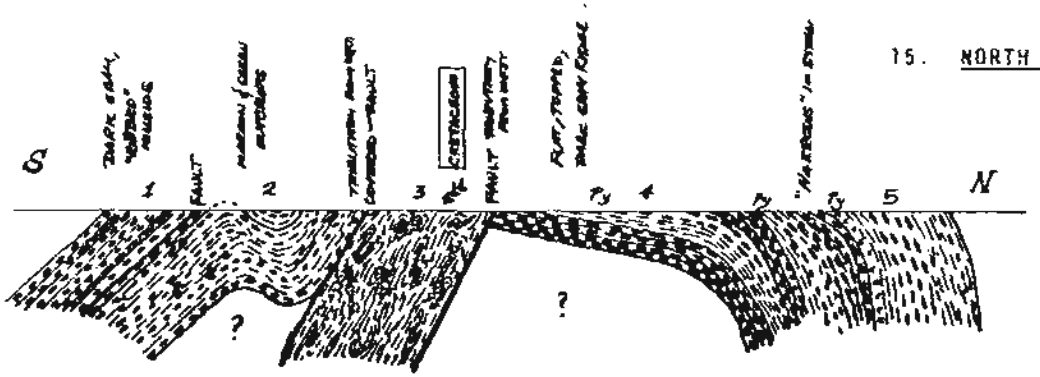
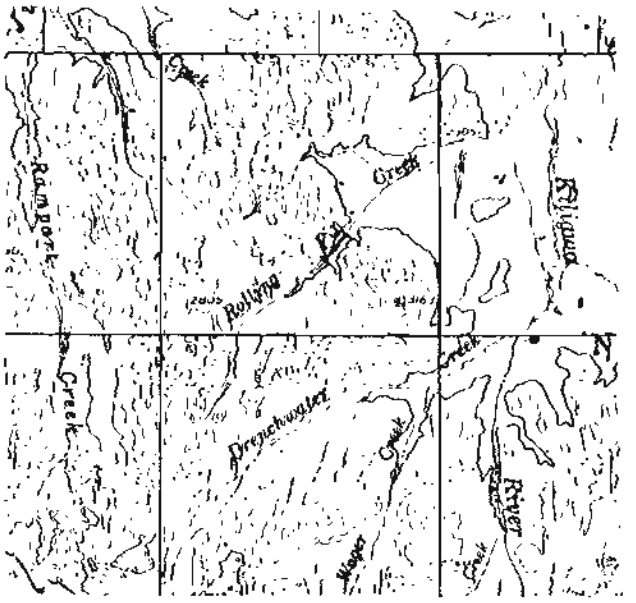
15. NORTH ROLLING PIN CREEK



Unit number	Thickness (m)	Description
1 Ml	60	Dark-gray chert with minor red-weathering dolomitic interbeds
	FAULT	
2 Ps	80	Maroon and green argillitic shale; weathers into spindles; minor gray and green chert; tightly folded
	FAULT	
3 Kc	110	Extremely broken flyschoid sandstone and fissile shale; although sandstone beds are thick, no bed is continuous--sandstone acts as boudins in a sheared matrix of well cleaved shale. ("Broken formation" style of deformation.) Minor carbonaceous debris
	FAULT	
4 Ml	120	Dark-gray, evenly bedded chert and shale; strongly iron-stained
5 Ps	90	Variegated maroon and green shale and light-gray chert; contact with unit number 4 is accordant but may be a fault inasmuch as there is an iron-stained zone 4 m wide adjacent to it in dark chert



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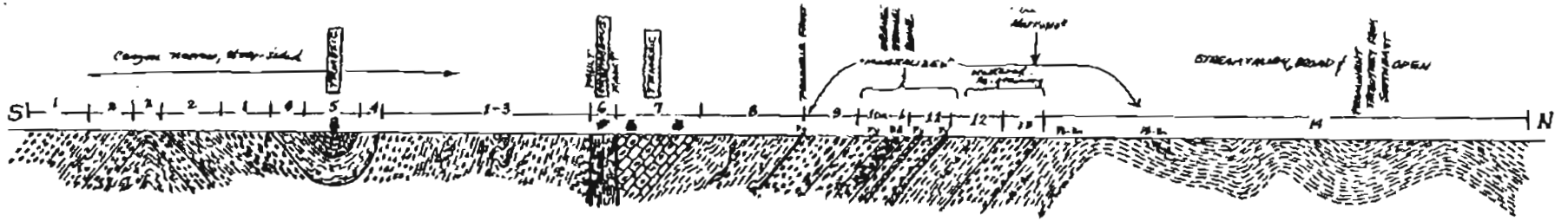
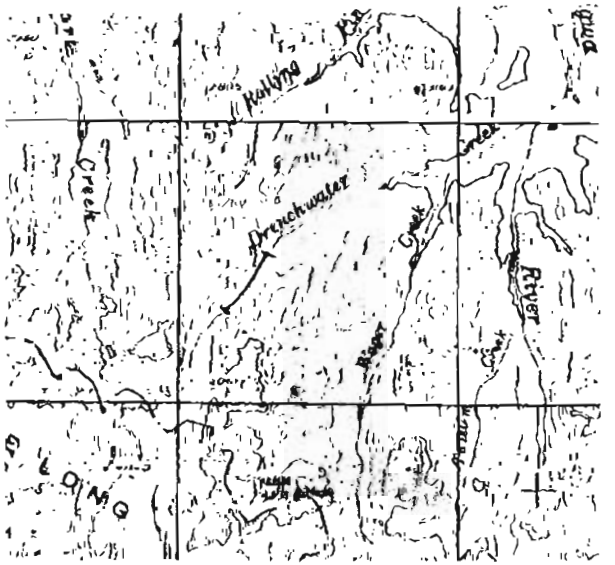
16. DRENCHWATER CREEK





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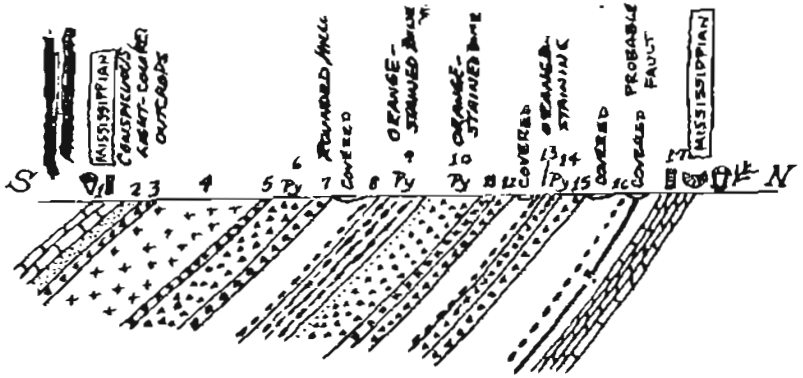
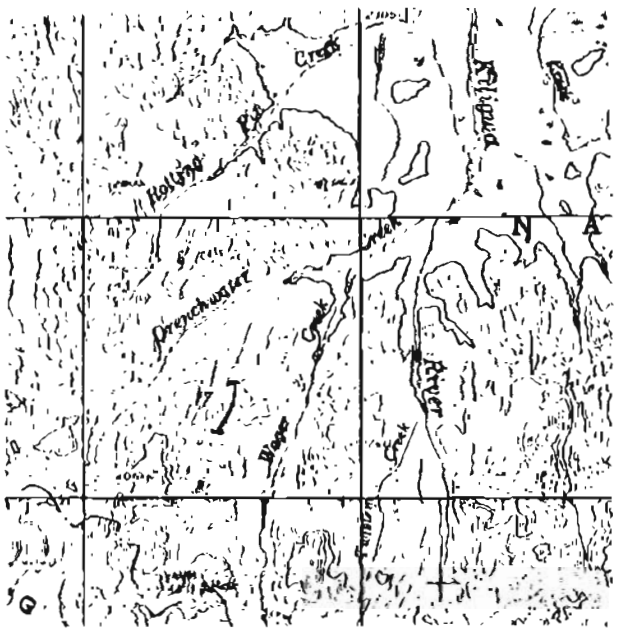
16. DRENCHWATER CREEK

Formation, unit number	Estimated thickness (m)	Description
SIKSIKPUK		
1	60	Gray-, green-, and red-weathering chert
2	40	Platy to argillitic mudstone, mostly gray
3	25	Red and green chert
SHUBLIK		
4	20	Gray to buff shale, in part platy and limey; tightly folded
5	15	Cherty limestone and dolomite with *Monotis*
CRETACEOUS		
6	?	Intensely deformed shale and sandstone in fault zone; shale with sheen of pervasive slickensides; sandstone in boudins that may be detached noses of isoclines; plant fossils
SHUBLIK		
7	80	Limestone; cherty limestone; dolomite; with *Monotis*
SIKSIKPUK		
8	100	Mostly variegated shale and siliceous mudstone, with one prominent bed of gray chert near middle
LISBURNE		
9	50	Dark-gray, evenly bedded chert; transitional downward into 10
10a	30	Recrystallized dark-gray chert with abundant quartz microveinlets but no visible sulfides
10b	15	Dark-, punky-weathering shale with prominent gossan that transects cleavage; irregular barite-rich breccia up to 2 m thick beneath gossan and above strongly altered lithic crystal tuff. (Actually breccia and tuff zones consist of complexly interleaved tuff and breccia; cannot determine individual beds)
11	37	Horizons of altered gray chert with sulfides 10 to 20 m thick separated by two beds of tuff breccia with clasts of dark chert 5 m to 2 m thick
12	50	Dark-gray siliceous mudstone, weathers blocky; perhaps partly chert
13	40	Dark-gray chert, partly iron-stained. Resistant unit forming prominent ledge crossing stream
14	60?	Dark siliceous mudstone, poorly exposed, weathers into dark soil-covered slope; prominent zone of sphalerite/galena/pyrite "nodules" in upper parts; mineralized veins in the nodules transect cleavage nearly at right angles and recement the rock. In places, chert fragments form a breccia that is cemented by sphalerite

17. RIDGE BETWEEN FALSE WAGER AND WAGER CREEKS





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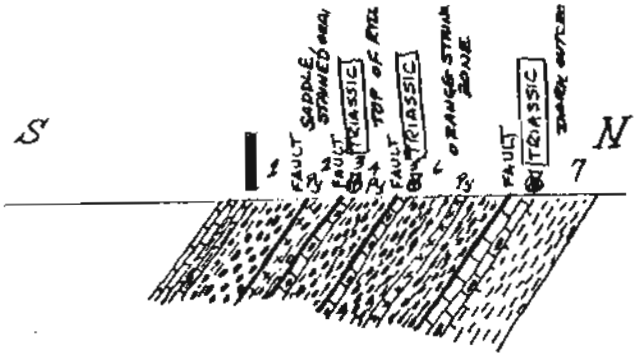
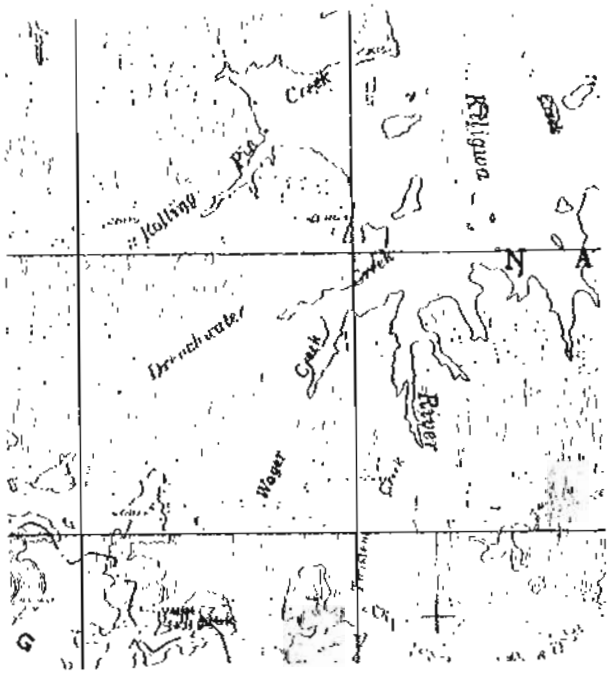
Unit number	Estimated thickness (m)	Description
1	5	Light-gray crinoidal and coralline limestone } KOGRUK LITHOLOGIES?
2	5	Friable calcareous platy weathering sandstone } KOGRUK LITHOLOGIES?
3	5	Fine-grained lithic tuff
4	50	Dacite(?) porphyry
5	5	Fine-grained equigranular holocrystalline volcanic rock
6	20	Lithic tuff of variable grain size, but generally fine-grained; pyritic
7	5	Green-weathering agglomerate; calcareous
	30	COVERED
8	5	Dark-gray chert
9	20	Bleached, "homogenized" chert with quartz microveinlets
10	32	Upper 2 m sand-size lithic tuff, lower 30 m lithic tuff of variable fine- to coarse-grain size; pyritic
11	5	Green-weathering siliceous volcanic rock (tuff?)
12	10	Same as unit number 3; pyritic
	15	COVERED
13	2	Dark-gray chert
14	5	Fine-grained, thoroughly altered and pyritized tuff
15	15	Fine-grained lithic tuff; many specks of dark chert
	25	COVERED
16	2	Dark-gray chert
	5	COVERED--PROBABLE FAULT
17		Medium-gray to pale-purple-weathering platy dolomite and limestone; crinoids, brachiopods, trilobites, bryozoans) UTOKOK LITHOLOGIES?

18. NORTH OF DRENCHWATER CREEK





Howard Pass
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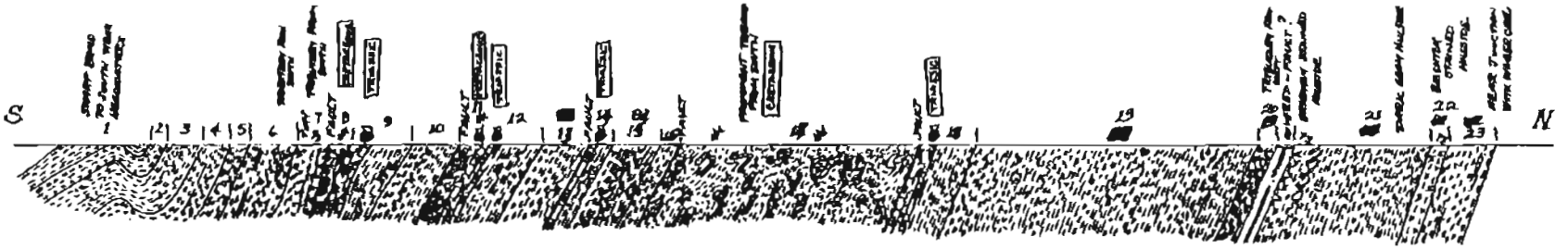
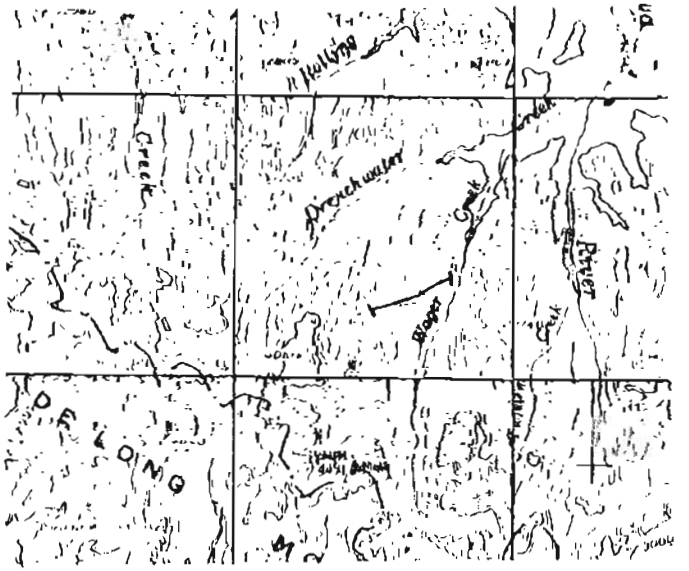
Unit number	Estimated thickness (m)	Description
7 TRs	50	Cherty limestone and shale, green to buff weathering, with *Monotis*
	FAULT	
6 Ps	62	Mostly gray to green chert with 12-m-thick zone in center of altered, iron-stained shale cored by a felsic sill
5 TRs	10	Cherty limestone, green to buff weathering, with *Monotis*
	FAULT	
4 Ps	25	Green- to light-gray-weathering chert and shale, mostly altered and iron-stained; recrystallized, with cross veinlets of tiny quartz euhedra
3 TRs	3	Same as unit number 5
	FAULT	
2 Ps	25	Same as unit number 4
1 Ml	50	Upper 15-20 m of dark limestone, platy limestone, and dark sooty shale, succeeded downward by thick-bedded dark chert with lighter laminae. Minor red-weathering dolomite

19. NORTHEAST TRIBUTARY OF WAGER CREEK





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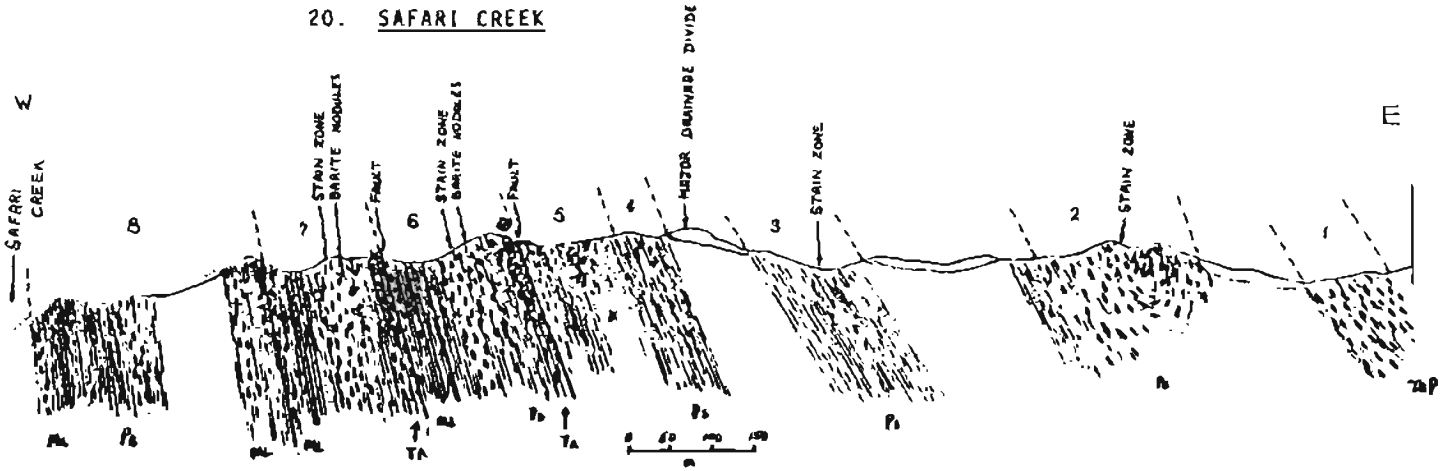
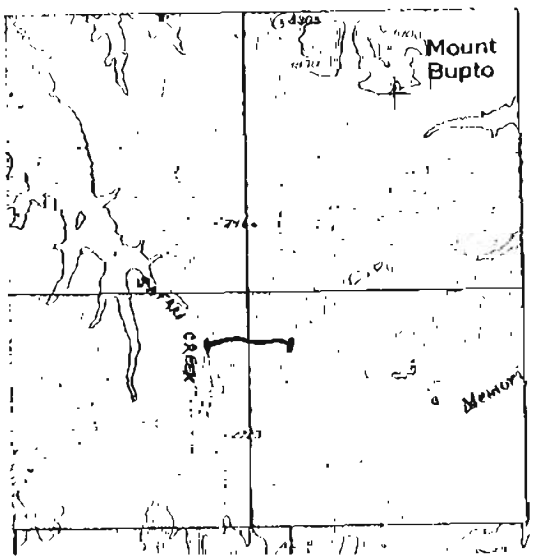
19. NORTHEAST TRIBUTARY OF WAGER CREEK

Formation, unit number	Thickness (m)	Description
SHUBLIK?		
1	30	Variegated shale, poorly exposed
2	20	Two resistant strata of limey chert separated by 5 m of dark shale
3	40	Mostly dark gray shale; strongly folded
LISBURNE		
4	30	Dark, evenly bedded chert
5	20	Interbedded dark shale and chert
6	70	Tightly folded dark chert with minor scattered limestone beds
7	40	Dark chert, strongly altered with pyrite; one thin bed of apparent felsic crystal tuff
CRETACEOUS		FAULT
8	20	Very fissile shale, siltstone, and micaceous sandstone; very tightly folded, sandstones act as boudins; numerous ripple marks and plant fragments
SHUBLIK		
9	60	Tightly folded cherty limestone with *Monotis* above; dark shale below
SIKSIKPUK		
10	50	Medium-gray and green chert and slate; bedding irregular
CRETACEOUS		FAULT
11	20	Very tightly folded shale, siltstone, and micaceous sandstone; same as unit number 8
SHUBLIK		
12	60	Cherty limestone with *Monotis* above; creamy to dark shale below
SIKSIKPUK		
13	50	Medium-gray and green chert and slate; same as unit number 10
SHUBLIK		FAULT
14	25	Thinner section of *Monotis*-bearing cherty limestone and shale; same lithology as units 9 and 12
SIKSIKPUK		
15	50	Same as unit 10 and 13; distinctive lacing of veinlets with randomly oriented barite crystals
LISBURNE		
16	20	Dark, evenly bedded chert
CRETACEOUS		FAULT
17	250	Isoclinally folded dark slatey shale, in part dolomitic, with minor sandstone. Sandstone fold noses are "floating" in intensely deformed shale--could be termed a "broken formation"
SHUBLIK		
18	60	Same as units 9 and 12
SIKSIKPUK		
19	300	Unusually thick section of apparent Siksikpuk lithology: nodular gray and green chert and dark-gray shale (some nodules are pyritic). Tightly folded in places; Unusual thickness may be due to repetition by folding or faulting. Gradational downward into unit number 20
SIKSIKPUK?		
20	20	Dark and thick-bedded chert, in part shaly
SIKSIKPUK		
21	150	Variegated medium-gray, green, and maroon chert and shale; dark shale is conspicuous and unlike the "normal" Siksikpuk lithology
22	20	Strongly iron-stained and oxidized variegated slate, chert, and argillitic mudstone; sulfur stained and spelly soil covered
LISBURNE		
23	50	Dark-gray chert with minor platy limestone beds; unmineralized

20. SAFARI CREEK





Howard Pass
1:250,000

Safari Creek

UNIT	ESTIMATED THICKNESS	DESCRIPTION	FORMATION OR AGE
1	100 m	Medium- to light-gray laminated chert; weathers to light gray; some radiolaria	Footh
		COVERED ZONE	
2	260 m	Dark- to light-gray chert with maroon and olive argillitic mudstone. Orange soil developed	Footh Siliciphyll
		COVERED ZONE	
3	100 m	Pale-olive argillitic mudstone with finely disseminated pyrite, weathers orange	Siliciphyll
		COVERED ZONE	
4	30 m	Argillitic mudstone with chert interbed	Siliciphyll
5	400 m	Gray chert outcropping in lithic mesh float with some argillite	Siliciphyll
		Mudstone and gabbro; may be slide blocks or olistostromes in a Crescent matrix	Crescent float
		FAULT	
6	11 m	Dark-gray limy chert with ammonites; weathers to buff-colored bands; radiolaria abundant	Smallie
	55 m	Pale-olive argillite overlies siliceous shale and argillite with barite nodules	Siliciphyll
	45 m	Medium-gray-olive cast chert with oxidized soil	Siliciphyll
	15 m	Maroon and olive argillite	Siliciphyll
	50 m	Black siliceous mudstone and shale with laminated limestone beds in upper section of unit	Black Lithurma/ Zahra facies
		FAULT	
7	35 m	Dark-gray limy chert with ammonites; weathers to buff/white	Smallie
	30 m	Pale-olive argillite; pencil structure	Siliciphyll
	25 m	Lithomed shales and argillite with barite nodules	Siliciphyll
	40 m	Medium-olive-gray chert with oxidized soil	Footh
	10 m	Maroon and olive argillite	Siliciphyll
	50 m	Black siliceous mudstone and shale with light-gray limestone interbedded	Black Lithurma/ Zahra facies
		FAULT	
8	50 m	Black siliceous shales and chert with some limy beds	Black Lithurma/ Zahra facies
		COVERED ZONE	
	50 m	Light-gray chert with argillite and mudstone	Siliciphyll
	60 m	Light-gray limestone interbedded with black siliceous shale and chert	Black Lithurma/ Zahra facies

Appendix A

Tables of semiquantitative spectrographic analyses of rock, soil, and stream-sediment samples.

Abbreviations: R - Rock sample

SS - Stream-sediment sample

S - Soil sample

Abbreviations are listed in left-hand part of column marked Tag. No.

FILM NO. R-170

REPORT NO. 31206

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Sheet #1

Date 26SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2	////////// ECQ	3	.7	.7	.3	300	N	N	N	N	1500	2	N	N	7	L	7	150	N	N	N
2	77AHE 22	S 857	2	.2	.05	.15	150				30	700	N			N	70	30	50	15		5
3	23	SS 858	2	.7	.3	.3	700				20	1500	N			10	30	15	20	N		15
4	24	SS 859	3	1.5	.7	.3	1000				30	3000	N			15	30	30	L	N		30
5	25	S 860	5	.5	.05	.3	500				50	G5000	2			7	15	150	L	N		15
6	26	S 861	3	.3	.07	.5	300				50	700	N			5	50	30	L	L		20
7	27	S 862	5	1.5	.3	.5	5000				50	G5000	N			20	70	50	L	5		100
8	28	SS 863	1.5	.5	.3	.2	2000				30	2000	2			10	10	15	L	7		20
9	29	SS 864	7	.3	L	.3	70				30	5000	2			N	10	15	50	30		5
10	30	SS 865	1	.3	.3	.1	1000				30	G5000	N			5	10	10	L	N		15
11	31	SS 866	5	.5	L	.5	150				70	G5000	N			N	50	7	L	10		10
12	77AC, 883	S 867	3	.5	.05	.5	700				50	G5000	N			7	20	70	L	N		15
13	891	S 868	2	.5	L	.2	700				50	G5000	N			5	30	30	L	L		15
14	892	S 869	5	1	L	.5	300				100	G5000	2			5	70	50	50	10		15
15	893	S 870	5	.7	L	.5	700				70	G5000	2			10	30	150	50	L		20
16	894	S 871	2	.3	L	.2	100				30	G5000	2			N	15	50	L	L		10
17	896A	S 872	5	.7	L	.5	70				70	2000	N			N	30	30	L	5		15
18	896B	R 873	2	.7	.05	.2	700				50	1500	N			10	15	70	L	L		30
19	896C	R 874	2	2	7	.03	G5000				N	1500	N			N	L	5	L	N		L
20	913A	R 875	1	.5	.07	.15	1500				10	G5000	N			7	10	150	30	L		15
21	913B	R 876	3	1	.1	.15	2000				30	G5000	N			10	15	100	L	N		30
22	923	R 877	2	.5	.05	.15	150				30	5000	N			10	10	100	20	L		30
23	932	R 878	5	1.5	1.5	.5	1500				70	3000	N			15	30	50	L	7		20
24	77Md 56B	S 879	3	.7	.05	.2	1000				30	1500	N			15	20	50	L	N		50

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-170

REPORT NO. 31206

ANALYST BARTON, TURNER

Sheet #2

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) Y	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	ECG	50	N	5	N	500	50	N	30	N	300
2	77AUG 22	857	L		5		N	200		20		200
3	23	858	15		7		N	100		30		150
4	24	859	10		10		150	150		30		150
5	25	860	20		20		200	100		30		150
6	26	861	L		10		N	300		30		100
7	27	862	30		10		100	300		30		200
8	28	863	L		L		N	100		L		100
9	29	864	15		5		100	100		10		100
10	30	865	L		5		N	100		L		30
11	31	866	10		7		200	200		30		150
12	77ACn 853	867	10		10		N	150		20		200
13	891	868	10		10		150	150		20		100
14	892	869	10		15		200	200		50		150
15	893	870	30		30		200	200		50		300
16	894	871	10		15		150	150		30		200
17	896A	872	20		10		N	150		20		300
18	896B	873	L		10		N	70		10		150
19	896C	874	L		L		300	50		10		150
20	913A	875	L		10		700	70		30		70
21	913B	876	10		10		300	100		30		70
22	923	877	10		15		150	30		30		50
23	932	878	30		50		300	100		50		200
24	77DKS 56B	879	15		5		N	100		50		200

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FILM NO. K-171

REPORT NO. 31206

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Date 27 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
		71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2		3	.7	1.5	.3	200	N	N	N	N	1500	2	N	N	10	L	7	150	L	N	N
2	77Md 58	s 880	3	.7	L	.5	200	1			50	5000	N			N	30	100	N	N	N	5
3	" 69	s 881	2	.7	.05	.3	50	N			70	1500	N			N	70	20	N	L	N	5
5	77Md 63D	s 883	7	.7	L	.7	300	N			50	1000	2			7	150	20	100	L	50	L
6	77AHe 34	ss 884	1.5	.3	.07	.7	150	N			50	2000	1			N	15	15	50	5	30	5
7	77ACn 941	s 885	5	.7	L	.7	70	1.5			100	3000	1			N	70	30	50	15	N	15
8	AWk 1288	ss 886	3	1	.15	.5	1000	N			100	5000	3			50	100	70	30	7	N	100
9	Md 67A	ss 887	3	1.5	.1	.3	1500	N			70	G5000	2			30	70	100	N	10	N	50
10	Md 69I	ss 888	5	1.5	.07	.5	2000	N			100	G5000	2			30	50	150	N	L	N	50
11	ACn 971	ss 889	5	3	1.5	.7	1500	N			50	2000	N			20	200	50	N	L	N	100
12	AWk 133A	st 890	5	2	.1	.5	2000	N			100	G5000	1			20	70	150	N	10	N	70
13	133D	s 891	7	1.5	L	.7	500	N			100	G5000	N			7	70	70	N	10	N	30
14	Md 68G	s 892	10	1.5	L	.3	150	N			70	G5000	N			N	50	50	30	15	N	15
15	70A	s 893	2	.7	L	.3	700	N			70	G5000	N			N	30	100	N	N	N	20
16	70F	ss 894	7	1.5	.1	.5	5000	N			150	G5000	3			50	70	100	30	10	N	150
17	69J	s 895	7	1.5	L	.5	300	N			150	G5000	2			15	70	100	N	N	N	50
18	69H	s 896	7	1	L	.3	300	N			100	G5000	2			7	50	100	N	N	N	10
19	ACn 1101	s 897	5	1.5	.07	.5	150	N			100	G5000	1			7	70	70	30	N	N	20
20	1094	s 898	7	1.5	L	.5	500	N			70	G5000	3			30	100	150	30	15	N	70
21	Md 70B	ss 899	7	2	.2	.5	5000	N			100	G5000	3			70	100	150	50	15	N	150
22	AWk 133C	R 900	2	1	.5	.2	150	3			70	G5000	2			N	150	70	50	10	N	70
23	ACn 1002	R 901	2	1.5	5	.15	700	N			30	200	N			N	10	L	150	5	50	N
24	973	R 902	.7	.07	.05	.07	30	N			20	300	N			N	L	10	N	20	N	N

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-171

REPORT NO. 31206

ANALYST BARTON, TURNER

Sheet #2

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	F-2	//////////	50	N	5	N	700	70	N	30	N	300
2	77 Mid 58	880	15		15		N	100		15		100
3	59	881	10		7		N	100		20		100
5	77 Mid 63D	883	150		5		300	100		15		700
6	77 AHG 74	884	70		L		150	150		15		300
7	77 ACn 94	885	30		15		300	150		70		300
8	AWK 128B	886	20		10		200	150		50		200
9	Md 67A	887	15		10		300	200		50		300
10	Md 69I	888	20		15		700	150		50		300
11	ACn 97L	889	15		10		150	200		30		200
12	AWK 133A	890	30		15		500	200		50		300
13	133B	891	15		15		300	200		50		300
14	Md 66G	892	100		15		300	150		30		300
15	70A	893	20		10		300	100		30		200
16	70F	894	20		15		500	150		50		300
17	69J	895	20		20		500	100		30		200
18	69H	896	50		20		200	70		20		300
19	ACn 110I	897	15		20		500	100		50		300
20	109H	898	30		20		500	150		70		300
21	Md 70P	899	30		20		700	200		70		300
22	AWK 133C	900	20		7		700	200		100		300
23	ACn 108B	901	50		N		300	20		30		300
24	773	902	L		N		N	150		10		70

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FILM NO. K-172

REPORT NO. 31206

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Sheet #1

Date 27 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2	//////////	3	.7	1	.5	700	N	N	N	N	2000	2	N	N	10	L	7	200	L	N	N
2	77 AWK 128C	ECQ R 903	1.5	.07	L	.15	N	2			20	300	N			N	70	L	N	30	N	15
3	ACn 941	R 904	2	.7	L	.15	1500	N			20	65000	N			10	L	150	N	N	N	30
4	Md 70E	R 905	5	1.5	2	.3	3000				100	1500	1			10	70	100	N	N	N	50
5	ACn 972	R 906	3	.7	L	.15	150				30	1500	N			N	20	100	N	5	N	50
6	Md 69K	R 907	1.5	.3	.07	.15	700				30	2000	N			N	15	150	N	L	N	10
7	Md 63E	R 908	.5	L	L	.007	100	2			15	700	N			N	L	L	N	N	N	N
8	63B	R 909	3	.05	L	1	50	N			30	1500	N			N	L	L	200	10	150	N
10	Md 70C	R 911	2	3	5	.1	65000				70	65000	N			15	30	150	N	5	N	20
12	ANK 4F	R 913	2	.3	.07	.7	100				70	300	N			N	15	L	150	L	70	N
13	Md 63C	R 914	1.5	.15	.1	.07	300	5			10	500	N			N	L	L	N	N	N	N
14	AWK 130	R 915	1.5	.7	.5	.1	1000	N			30	65000	N			10	10	70	N	N	N	15
15	Md 63G	R 916	5	.15	L	.7	150				30	1500	N			N	20	5	50	5	100	N
16	AWK 144B	R 917	1.5	.15	L	.07	30				20	2000	N			N	N	L	100	N	100	N
17	128D	R 918	1.5	.3	L	.2	30				20	1500	N			N	15	10	N	L	N	5
18	ACn 1041	R 919	1.5	.3	L	.2	30				30	2000	N			N	70	50	N	L	N	7
19	Md 69F	S 920	1.5	.7	.05	.07	500				30	3000	N			7	10	100	N	N	N	15
20	70D	R 921	1.5	1	1.5	.03	65000				30	1000	N			10	L	30	50	5	N	150
21	ANK 4D	R 922	2	.15	.1	.5	700	10			10	300	N			7	30	20	50	N	30	10
22	Md 26	SS 923	3	1.5	1.5	.5	1000	N			100	2000	2			10	300	50	N	5	N	100
23	44B	SS 924	5	2	.05	.7	1500	N			70	65000	2			10	100	100	N	7	N	50
24	44C	SS 925	5	2	.15	.5	2000	N			100	65000	N			10	70	150	N	5	N	70

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-172

REPORT NO. 31206

ANALYST [illegible]

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(70) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	//////////	70	N	5	N	700	70	N	20	N	300
2	17 AWK 128E	ECO 903	100		5		N	200		N		70
3	AC 761	904	N		7		200	50		10		50
4	MJ 70E	905	20		10		150	100		30		50
5	AC 97	906	N		7		100	200		N		50
6	MJ 69K	907	N		5		100	30		N		50
7	MJ 63E	908	15		N		N	20		N		30
8	MJ 63B	909	150		5		700	50		70		500
10	MJ 70C	911	L		7		500	70		20		200
12	AWK 4F	913	20		N		100	50		30		500
13	MJ 63C	914	70		N		N	10		N		30
14	AWK 120	915	L		5		300	30		N		30
15	MJ 63G	916	100		L		100	50		20		200
16	AWK 144E	917	100		N		100	20		10		300
17	128D	918	70		5		N	50		N		100
18	AC 1041	919	L		15		150	150		30		150
19	MJ 69F	920	L		5		100	50		N		70
20	70D	921	N		L		150	70		30	300	300
21	AWK 4D	922	15000		N		N	100		20	N	300
22	MJ 2C	923	20		10		200	200		30		100
23	44B	924	50		15		300	150		30		150
24	44C	925	15		15		300	150		30		150

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FORM K-173

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

Sheet #1

REPORT NO. 31206

6-Step D.C. Arc

Requested by CHURKIN

Date 27 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2	////////	3	1.5	1.5	.3	200	N	N	N	N	2000	2	N	N	10	L	7	200	L	N	N
2	77AMd 46A	ECQ S 926	7	1.5	.05	.5	300				100	G5000	2			7	150	70	N	15		50
3	46C	ss 927	3	2	.2	.3	2000				50	G5000	2			7	70	70	N	L		70
4	46D	ss 928	5	1.5	.5	.3	5000				70	G5000	2			15	100	70	N	7		100
5	49B	s 929	3	.5	.1	.3	300				70	2000	1			7	20	70	N	L		70
6	49JB	R 930	1.5	.2	L	.15	100				30	G5000	N			N	L	30	N	30		10
7	49J	ss 931	3	.7	.2	.15	3000				30	1500	N			15	30	10	N	N		20
8	50C	s 932	5	1.5	.05	.3	1000				100	G5000	2			10	100	100	N	L		30
9	50D	s 933	7	.5	.07	.3	3000				70	5000	1			10	70	100	N	20		30
10	11C	s 934	7	1	.05	.3	1000				100	G5000	1			15	50	100	N	10		30
11	11E	ss 935	3	1.5	1.5	.2	3000				70	G5000	2			20	70	50	N	L		70
12	12E	ss 936	5	2	2	.5	1500				70	2000	2			15	150	50	50	L		70
13	16D	R 937	5	2	.15	.3	1000				70	G5000	2			10	70	30	N	N		70
14	16E	R 938	1.5	.7	.15	.15	1000				30	G5000	1			5	30	70	N	L		15
15	18B	R 939	10	1.5	.05	.3	1500				150	G5000	N			7	70	50	N	5		20
16	18C	R 940	2	.7	L	.3	1500				100	G5000	1			N	30	70	N	N		5
17	47	R 941	7	.7	.07	.3	300				30	G5000	N			10	70	100	N	10		30
18	77ACa 601A	R 942	2	3	7	.1	G5000				N	G5000	N			5	L	70	N	N		15
19	633	s 943	5	1.5	.05	.3	700				100	G5000	1			7	70	100	N	5		15
20	692	R 944	2	5	7	.2	5000				70	5000	N			N	70	5	N	L		5
21	693	R 945	1.5	1.5	5	.1	1500				15	G5000	N			7	L	30	N	L		7
22	694	R 946	5	1.5	.7	.3	150				70	5000	2			7	30	100	N	5		15
23	722	R 947	3	.7	.5	.3	50				50	700	N			5	70	L	N	N		N
24	731B	R 948	7	.7	L	.3	70				50	3000	N			N	70	10	N	10		N

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

REPORT NO. 31206

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	//////////	70	N	5	N	1000	100	N	20	N	300
2	77[illegible] 46A	ECG 926	15		15		300	200		20		200
3	46C	927	15		10		500	150		30		150
4	46D	928	20		10		300	200		50		150
5	47B	929	15		10		100	100		30		150
6	49B	930	150		7		150	70		N		100
7	49J	931	L		N		N	70		N		150
8	50C	932	20		20		200	150		50		150
9	50D	933	30		20		200	70		20		100
10	11C	934	20		15		150	100		20		150
11	11E	935	10		10		300	100		30		150
12	12E	936	15		10		300	150		70		200
13	16D	937	10		15		300	150		70		200
14	16E	938	15		15		300	70		N		150
15	18B	939	20		15		150	100		50		150
16	18C	940	15		7		N	70		N		150
17	47	941	15		7		200	300		N		100
18	77K, 60A	942	L		5		700	20		30		150
19	683	943	10		10		200	100		30		150
20	692	944	L		5		700	70		20		150
21	693	945	L		5		300	50		10		30
22	694	946	20		10		300	200		70		150
23	722	947	10		5		100	70		50		700
24	721	948	15	N	7	N	200	100	N	20	N	70

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

K-174

REPORT NO. 31206 — 6-Step D.C. Arc — Requested by CHURKIN — Date 28 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2	////////	5	2	1.5	.5	700	N	N	N	N	2000	2	N	N	10	15	7	200	N	N	N
2	77 ACN 784	ECO R 949	3	2	1.5	.15	1000	↓	↓	↓	50	G5000	N	↓	↓	7	30	150	N	7	N	70
3	731	R 950	2	.3	L	.1	700	↓	↓	↓	30	G5000	N	↓	↓	5	30	70	N	L	N	15
4	711	R 951	5	.7	.05	.3	30	3	↓	↓	100	2000	N	↓	↓	N	300	70	N	15	N	15
5	726B	R 952	5	.7	L	.3	20	N	↓	↓	100	1000	N	↓	↓	N	70	50	N	5	N	5
6	77 MA 38B	S 953	7	1	L	.3	200	↓	↓	↓	100	G5000	1	↓	↓	10	70	100	N	10	N	30
7	39B	S 954	7	2	.05	.7	1000	↓	↓	↓	150	G5000	2	↓	↓	20	150	150	N	N	N	50
8	77 AWK 128A	S 955	1.5	.3	L	.15	200	↓	↓	↓	20	2000	N	↓	↓	10	30	70	N	L	N	50
9																						
10																						
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24																						

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

REPORT NO. 31206

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
			13						14			
1	G-2		70	N	5	N	1000	70	N	30	N	300
2	77 AC 784	949	15		10		300	150		50	N	70
3	731	950	10		5		700	70		N	N	30
4	711	951	10		7		150	150		20	N	200
5	726B	952	10		7		N	150		20	N	300
6	77 MN 35A	953	20		10		150	200		15	N	200
7	79B	954	15		20		300	150		30	N	300
8	77 AWK 128A	955	10	↓	7	↓	N	70	↓	N	N	70
9												
10												
11												
12												
13												
14												
15												
16												
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21												
22												
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24												

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

REPORT NO. 31204

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1		//////////																				
2	77AUK 107	GC-92 R 742	3	3	.7	.7	1500	N	N	N	100	65000	2	N	N	30	200	150	N	L	N	150
3	109	S 743	5	1.5	.07	.5	700	3			200	65000	2			10	150	150	N	L	N	50
4	110	R 744	.1	L	L	.002	L	N			N	5000	N			N	N	L	N	N	N	N
5	111A	R 745	20	.15	L	.7	30				70	700	N			N	300	70	30	10	20	N
6	111B	R 746	7	.5	15	1	3000				20	150	N			20	500	50	100	N	30	70
7	112	R 747	7	.3	.05	.7	700				30	150	N			N	N	10	100	N	200	L
8	113A	R 748	3	.7	5	.3	1500	2			70	3000	3			N	L	5	100	N	100	L
9	114A	R 749	3	.15	L	.15	700	N			15	500	N			30	20	50	N	7	N	70
10	114B	SS 750	10	2	.7	.5	3000	N			150	5000	2			70	150	100	70	10	N	150
11	116B	R 751	1.5	.03	.05	.01	20	15			N	200	N		6500	20	70	1000	N	N	N	70
12	117	R 752	7	1.5	.3	.7	3000	3			150	5000	1		N	50	300	150	50	10	20	70
13	132	SS 753	5	.3	.3	.3	70	15			150	2000	N			N	100	70	100	L	N	15
14	136	SS 754	7	.2	.7	.5	3000	N			200	5000	N			50	150	100	50	10	N	100
15	77AUK 108	R 755	10	5	1	.7	3000	N			200	3000	1			30	150	30	30	N	N	70
16																						
17																						
18																						
19																						
20																						
21																						
22																						
23																						
24																						

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

REPORT NO. 31204

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			I3						I4			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1		////////										
2	77AUK 107	ECO 742	20	N	20	N	200	100	N	70	L	300
3	109	743	30		20		300	150		50	L	300
4	110	744	20		N		N	20		N	N	N
5	111A	745	500		10		N	300		N	L	70
6	111B	746	70		70		300	150		20	N	300
7	112	747	200		L		100	50		70	N	1000
8	113A	748	30		N		N	30		50	N	1000
9	114A	749	500		L		N	70		N	N	200
10	114B	750	50		30		200	200		150	500	500
11	116B	751	700		N		N	70		N	G10,000	20
12	117	752	300		15		150	300		70	500	700
13	122	753	20		10		100	150		50	300	200
14	126	754	30		15		100	150		100	300	300
15	77AUK 108	755	30		20		150	200		70	N	300
16												
17												
18												
19												
20												
21												
22												
23												
24												

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FILM NO. K-175

REPORT NO. 31205

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Sheet #1

Date 25 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-71
1	G-2	////////	3	1	1.5	.3	300	N	N	N	N	1500	2	N	N	10	L	7	200	L	N	N
2	77ACu 1/71	259 s 756	7	.7	L	.5	100	N			100	65000	2			N	70	70	N	N	N	50
3	77Md 77	s 757	3	.5	L	.3	50	N			70	5000	2			N	30	30	N	5	N	10
4	76	s 758	5	1	L	.5	200	N			100	2000	1			10	70	50	N	L	N	30
5	79B	ss 759	5	.7	.7	.5	150	.7			70	1500	3			20	200	50	N	L	N	100
6	78C	ss 760	5	1.5	.7	.5	2000	N			100	3000	3			70	70	70	N	L	N	100
7	78D	ss 761	7	2	.7	.5	3000	N			100	65000	3			100	70	150	N	10	N	200
8	78B	s 762	3	.7	L	.15	30	N			70	65000	1			N	30	20	N	N	N	N
9	79D	s 763	5	1	.5	.3	150	N			70	1500	3			50	150	30	100	N	N	100
10	77 AWK 136	R 764	7	.7	L	.5	100	.7			70	2000	1			N	70	10	200	5	150	N
11	AWK 173	s 765	7	1.5	.05	.3	200	N			100	3000	1			7	100	50	50	10	N	70
12	AWK 78	s 766	7	.5	L	.5	30	1.5			70	2000	2			N	100	10	N	20	N	5
13	10B	s 767	5	1	L	.3	150	N			70	3000	1			10	50	70	N	5	N	30
14	10C	R 768	7	5	L	.2	150	N			30	3000	N			N	10	70	N	N	N	5
15	AWK 171A	s 769	5	1	.05	.3	150	N			70	65000	2			N	30	70	N	N	N	30
16	AWK 5D	s 770	7	.3	L	.5	150	1.5			30	500	N			N	15	20	100	L	70	N
17	ACu 1/71	ss 771	7	.7	L	.5	1000	N			70	65000	N			5	50	50	100	10	N	20
18	1111	ss 772	5	.7	.05	.3	300	N			100	65000	1			15	50	70	50	10	N	50
19	Md 71D	ss 773	2	.3	L	.15	300	N			50	700	N			N	L	20	N	N	N	N
20	71E	ss 774	5	.7	L	.3	30	.7			100	1500	N			N	50	15	N	10	N	N
21	AWK 5C	s 775	5	.3	L	.3	50	.5			70	700	2			N	10	7	100	5	150	N
22	4G	s 776	5	.7	L	.3	150	N			100	1500	3			N	50	7	70	10	20	N
23	4A	s 777	7	.3	L	.3	30	5			50	700	N			N	L	7	100	L	200	5
24	Md 75A	ss 778	3	.5	L	.3	150	N			70	65000	N			10	20	70	50	N	N	30

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-175

REPORT NO. 312015

ANALYST BARTON, TURNER

Sheet #2

	Field No.	Tag No.	13 (10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	14 (50) W	(10) Y	(200) Zn	(10) Zr
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	//////////	70	N	5	N	700	70	N	30	N	300
2	77ACu 1171	756	15		20		150	150		30		200
3	77Md 77	757	15		10		100	150		20		200
4	76	758	10		15		150	150		50		200
5	79B	759	L		15		100	200		100		200
6	78C	760	10		20		150	200		70		200
7	78D	761	10		20		300	150		70		300
8	78B	762	L		10		100	100		20		150
9	79D	763	15		20		150	150		100		300
10	77 AWK 126A	764	70		5		300	100		70		700
11	AWK 173	765	15		20		300	150		50		200
12	AWK 78	766	30		15		300	150		50		300
13	10B	767	15		20		150	100		30		200
14	10C	768	15		15		L	100		30		150
15	AWK 171A	769	10		20		300	100		20		200
16	AWK 5D	770	100		N		L	70		50		500
17	ACu 1121	771	20		20		300	150		70		200
18	1111	772	15		15		300	100		50		200
19	Md 71D	773	L		5		N	100		N		200
20	71E	774	10		10		100	150		50		200
21	AWK 5C	775	100		N		L	70		70		700
22	4G	776	100		15		150	100		70		300
23	4A	777	200		N		150	50		100		1000
24	Md 75A	778	15		15		200	100		30		200

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FILM NO. K-176

REPORT NO. 31205

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHUPKIN

Date 28 SEP

Sheet #1

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G 2	//////////	3	1	1	.3	300	N	N	N	N	1500	2	N	N	7	L	7	200	L	N	N
2	77 Md 718	ECG S 779	5	1	L	.5	150	N			100	2000	1			5	30	50	N	N	N	15
3	Md 80	S 780	3	.3	L	.3	50	N			30	1500	N			N	15	20	N	20	N	N
4	ACu 1103	S 781	5	1.5	L	.5	300	N			100	G5000	2			10	30	70	50	L	N	20
5	AWK 148	S 782	5	1	L	.5	300	N			150	G5000	2			5	70	100	50	10	N	15
6	AWK 146A	S 783	5	.3	.05	.5	500	N			70	1500	5			N	20	7	200	L	200	N
7	ACu 957	R 784	15	.5	.05	.07	200	N			30	G5000	N			N	10	50	N	N	N	20
8	1112	R 785	3	3	5	.15	5000	.5			30	G5000	N			15	30	70	N	N	N	20
9	1181	R 786	.3	.7	7	.05	500	3			10	1500	N			N	200	20	N	10	N	50
10	1182A	R 787	5	1.5	2	.15	700	.7			30	700	1			N	200	10	N	N	N	15
11	1182B	R 788	1	.7	L	.3	15	.5			70	1000	2			N	300	5	70	L	N	50
12	1182C	R 789	10	.7	G20	.005	300	N			20	150	N			N	15	L	N	5	N	30
13	1201	R 790	3	.05	.05	.007	10	2			15	200	N			N	15	15	N	5	N	20
14	1202	R 791	1.5	.05	.05	.3	30	2		L	10	150	N			N	N	L	200	10	300	N
15	AHE 39	R 792	3	.7	.05	.2	30	2		N	50	G5000	1			N	70	50	100	5	N	5
16	40	R 793	2	.7	L	.3	300	N			30	G5000	N			15	30	70	N	15	N	30
17	41	R 794	2	.7	.07	.3	700	N			50	G5000	1			N	30	70	N	L	N	30
18	A Md 88H	R 796	3	.1	L	.2	100	2			20	350	1			N	L	L	200	10	200	N
20	88J	R 797	5	.2	3	.3	700	N			10	70	N			10	150	50	N	N	30	10
21	Md 79A	R 798	2	.07	.05	.03	L	N			10	200	N			N	30	L	N	N	N	N
22	79C	R 799	15	5	1.5	.07	700	N			15	300	1			N	30	7	N	N	N	20
23	78E	R 800	3	2	1.5	.3	2000	N			70	G5000	2			20	70	50	50	L	N	50
24	63F	R 801	5	.5	.05	.5	70	N			50	2000	1			N	N	L	150	5	150	N

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-176

REPORT NO. 31205

ANALYST BARTON, TURNER

Sheet #2

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G 2	////////	50	N	5	N	700	70	N	20	N	300
2	77 Ind 71B	779	20		20		N	100		20		200
3	Ind 80	780	20		5		N	100		N		100
4	ACN 123	781	20		20		300	100		30		200
5	AWK 148	782	15		15		500	100		70		200
6	AWK 166	783	70		N		200	50		100		700
7	ACN 951	784	30		L		700	30		N		30
8	1112	785	20		10		5000	70		50		100
9	1181	786	N		N		200	70		30		30
10	1182A	787	L		7		N	100		20		30
11	1182B	788	10		15		N	150		30		200
12	1182C	789	N		L		500	10		30		N
13	1201	790	70		N		N	20		N		20
14	1202	791	100		N		150	50		50		700
15	AHE 39	792	15		10		300	100		30		150
16	40	793	L		10		200	100		30		200
17	41	794	10		15		100	100		30		200
19	A Ind 88H	796	150		N		200	70		50		500
20	88J	797	30		7		N	150		N		50
21	Ind 79A	798	N		N		N	50		N		20
22	79C	799	15		30		N	100		15		30
23	78E	800	20		20		300	100		50		200
24	63F	801	150		N		200	50		100		500

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. K-177

REPORT NO. 31205

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Date 29 SEP

Sheet #1

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-7
1	G-2	////////	3	1	1.5	.5	300	N	N	N	N	2000	2	N	N	7	L	7	200	L	N	N
2	77ACN 802	ECO s 802	1.5	.3	.05	.15	1500	N			30	G5000	N			7	15	50	N	L	N	50
3	812	s 803	5	1.5	L	.3	300	N			70	5000	1			5	30	30	N	10	N	15
4	813	s 804	3	.7	L	.3	150	N			50	3000	1			N	30	15	N	10	N	L
5	814	s 805	7	1.5	L	.3	200	N			100	G5000	2			7	70	50	N	5	N	15
6	821	s 806	5	2	L	.3	700	N			100	G5000	2			7	100	70	N	7	N	20
7	822	s 807	7	3	L	.5	1000	.5			100	G5000	2			7	150	100	50	20	N	30
8	823	R 808	7	3	1	.2	200	1.5			50	G5000	N			N	10	15	N	20	N	10
9	841	R 809	3	1	7	.3	1000	N			50	700	N			10	150	50	N	N	N	15
10	861	s 810	3	1	.05	.2	3000	N			70	1500	N			5	L	70	50	N	N	20
11	862	s 811	10	1	.05	.5	150	N			100	5000	1			5	150	50	50	7	L	20
15	ACN 69E	s 815	15	1.5	L	.7	150	N			150	G5000	1			5	70	100	N	L	L	15
16	ACN 109G	s 816	7	1.5	L	.3	1500	N			200	G5000	2			10	70	100	50	L	N	20
17	ANK 146B	s 817	7	.5	L	.5	700	N			70	700	2			N	30	7	150	5	200	N
18	ANK 5A	s 818	10	.7	L	.5	200	1.5			150	2000	2			N	100	7	100	15	20	N
19	ANK 41B	s 819	7	2	L	.5	3000	N			150	G5000	1			15	150	70	50	10	N	50
20	41A	s 820	7	1.5	L	.3	700	N			150	G5000	N			5	100	70	50	10	N	15
21	ANK 5B	s 821	7	.7	L	.3	200	.7			70	1500	3			N	20	10	100	15	200	N
22	4B	ss 822	10	.5	.15	.5	200	3			70	5000	2			7	150	20	70	10	50	30
23	ACN 1114	s 823	5	.7	.05	.3	700	1			100	G5000	N			10	70	50	50	7	N	20
24	ANK 160	R 824	5	1	.05	.2	500	N			200	G5000	N			7	70	30	30	5	N	15

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-177

REPORT NO. 31205

ANALYST BARTON, TURNER

Sheet #2

	Field No.	Tag No.	13 (10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	14 (50) W	(10) Y	(200) Zn	(10) Zr
	//////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	//////	70	N	5	N	700	70	N	30	N	300
2	77AKa 802	ECG 802	N		10		150	70		30		150
3	812	803	10		10		150	150		30		200
4	813	804	10		7		100	100		30		300
5	814	805	15		15		300	150		50		300
6	821	806	10		15		200	150		30		200
7	822	807	15		15		200	150		50		300
8	823	808	30		5		150	70		N		100
9	841	809	N		10		N	150		N		30
10	861	810	10		7		N	100		10		70
11	862	811	50		10		100	150		50		200
15	AK 69E	815	30		20		300	70		50		300
16	AK 49E	816	30		20		300	150		50		300
17	AUK 19C	817	300		L		300	70		100		1000
18	AUK 5A	818	200		15		200	150		30		300
19	AUK 14B	819	15		15		300	150		50		300
20	14B	820	10		20		300	150		50		300
21	AUK 5B	821	300		15		100	50		100		700
22	4B	822	300		10		L	150		100		300
23	ACu 114	823	20		15		150	150		50		200
24	AUK 16C	824	20		10		300	70		50		200

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FILM NO. K-178

REPORT NO. 31205

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by SHORKIN

Date 29 Oct

Sheet #1

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	G-2	////////	3	1.5	1.5	.3	300	N	N	N	N	2000	2	N	N	7	L	7	200	L	N	N
2	77 ACn 1184	CCO S 825	7	1	L	.5	150	N			100	3000	2			5	70	70	50	L	N	15
3	1154	S 826	5	1	.05	.5	700	N			100	G5000	2			10	50	100	50	L	N	50
4	Md 75C	S 827	7	.7	L	.3	700	N			100	G5000	2			10	70	150	50	L	N	70
5	71C	S 828	10	1	.05	.5	200	N			50	5000	1			5	30	100	50	30	N	15
6	57	S 829	5	.5	L	.2	150	.7			50	1500	1			N	20	50	20	10	N	5
7	60E	SS 830	7	3	1	.5	3000	N			70	G5000	2			20	500	50	L	5	N	150
8	60D	S 831	3	.5	.05	.2	100	.7			50	1000	2			N	500	20	N	30	N	5
10	Md 60C	S 833	7	1.5	.05	.2	70	1			100	3000	1			N	700	30	30	20	N	15
12	ACn 931	S 835	5	1.5	.05	.3	1000	N			100	G5000	2			20	100	100	30	15	N	50
13	93C	R 836	7	2	.15	.5	700	N			100	G5000	3			20	150	30	30	N	N	150
15	Md 63A	S 838	7	.7	L	.3	300	.5			150	G5000	1			5	150	30	N	10	N	15
16	AHE 33	SS 839	5	2	.5	.5	700	L			70	G5000	1			20	700	20	100	5	100	100
17	35	SS 840	3	.7	.7	.3	1500	1.5			70	G5000	2			10	500	70	70	7	30	150
18	Md 61C	R 841	5	1.5	.5	.5	5000	N			100	G5000	2			20	150	100	70	10	N	100
19	AHE 36	S 842	7	.5	L	.5	500	L			100	3000	N			N	70	10	100	5	150	N
20	Md 6C	SS 843	3	1.5	.7	.3	1500	2			70	2000	2			30	300	30	100	10	20	100
21	61D	SS 844	5	1.5	.7	.5	5000	N			100	G5000	2			50	150	100	100	10	N	100
22	AWK 138	S 845	7	1.5	.05	.5	2000	N			150	G5000	2			20	70	200	70	10	N	100
23	ACn 1045	R 846	7	3	.5	.5	G5000	3			150	G5000	3			70	300	500	70	15	N	200
24	Md 8B	R 847	1	.5	L	.15	30	N			30	2000	N			N	20	10	N	L	N	5

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. K-178

REPORT NO. 31205

ANALYST BARTON, TURNER

Sheet 12

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G-2	//////////	70	N	5	N	700	70	N	30	N	300
2	77 ACo 1141	ECO 825	20		15		150	100		50	N	200
3	1158	826	15		15		150	150		30	N	200
4	Md 75C	827	20		20		200	100		50	L	200
5	71C	828	20		15		150	100		30	N	300
6	57	829	10		5		N	150		20	N	200
7	60E	830	10		15		200	150		50	N	300
8	60D	831	L		7		N	200		20	N	150
10	Md 60C	833	10		10		100	200		50	N	70
12	ACo 981	835	30		20		200	100		30	N	300
13	913	836	15		20		500	100		70	L	300
15	Md 63A	838	10		15		300	100		50	N	300
16	AHE 33	839	200		10		200	100		70	N	500
17	35	840	20		10		200	200		70	L	300
18	Md 61C	841	20		10		300	150		70	L	300
19	AHE 36	842	300		L		100	100		50	N	500
20	Md 66	843	100		10		200	150		70	500	200
21	61D	844	10		20		300	150		100	L	300
22	AMK 133E	845	100		30		300	100		100	L	300
23	ACo 1145	846	150		30		300	150		100	200	300
24	Md 8B	847	L	✓	5	✓	100	100	✓	20	N	150

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown

FIELD NO. K-179

REPORT NO. 31205

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by CHURKIN

Sheet #1

Date 29 SEP

	Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
	//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
1	6-2	////////	3	.7	1.5	.3	300	N	N	N	N	1500	2	N	N	10	L	7	200	L	N	N
2	77 Md 16F	Era SS 848	3	1.5	.2	.3	3000	N			100	65000	2			50	70	150	50	10		150
3	17	s 849	5	1	.05	.7	700	N			100	65000	1			7	70	100	50	7		70
4	21	SS 850	5	1.5	.3	.3	2000	N			70	65000	2			30	100	70	50	5		70
5	22	SS 851	3	1.5	.2	.3	3000	N			70	65000	2			30	50	150	50	7		70
6	24	s 852	5	1.5	.1	.3	5000	N			100	65000	2			20	50	150	L	L		100
7	25	s 853	10	.7	L	.5	150	.5			100	65000	N			10	70	100	50	30		70
8	27	SS 854	3	2	5	.3	1500	.7			100	1500	1			20	150	30	L	5		100
9	23A	SS 855	5	1.5	3	.3	1500	1.5			100	5000	1			20	150	50	70	10		150
10	41A	s 856	3	.7	L	.2	300	N			70	65000	N			N	20	30	L	N		7
11																						
12																						
13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						
21																						
22																						
23																						
24																						

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

JOB NO. K-179
REPORT NO. ~~3102~~ 31205

ANALYST BARTON, TURNER

Sheet 12

	Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
			13						14			
	//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
1	G 2	//////////	70	N	7	N	700	70	N	30	N	300
2	13 HU ICE	ESG 849	20		20		500	150		70	L	150
3	17	849	20		20		200	150		50	N	300
4	21	850	20		15		300	100		50	L	150
5	22	851	15		20		300	100		50	L	200
6	24	852	20		30		500	100		100	L	300
7	25	853	20		10		200	150		70	N	150
8	29	854	15		10		200	150		100	N	150
9	29B	855	10		20		300	200		100	L	150
10	44A	856	L		10		N	70		10	N	150
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. L-[illegible] (3)

REPORT NO. [illegible]

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by THEOBALD

Sheet #1

Date [illegible]

Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
	////////																				
77 Md 53C	ECA S 956	2	1	L	.5	150	.5	N	N	70	G5000	1.5	N	N	L	70	100	70	20	N	50
53E	S 957	3	.7	L	.5	200	.5			70	G5000	1			10	100	70	30	N		50
53F	S 958	3	1.5	L	.5	150	L			50	G5000	1			7	100	70	30	7		50
53G	R 959	.7	.02	L	.003	10	N			L	3000	N			N	L	7	N	N		30
53I	S 960	2	.7	L	.2	70	2			70	2000	1			N	200	50	20	30		50
54C	S 961	3	1	L	.7	1500	N			70	5000	1.5			15	150	150	30	L		70
77 Md 8A	S 965	3	.7	L	.7	150	L			100	300	1			L	70	70	L	10		30
12E	SS 966	2	1.5	.2	.7	1000	L			70	G5000	3			30	70	150	20	5		70
18D	S 967	3	.3	L	.2	700	N			70	5000	1			5	30	70	L	N		50
23	S 968	2	.7	.05	.2	1500	N			50	G5000	1.5			15	30	100	L	N		50
28A	S 969	5	.7	.15	.5	1000	1.5			100	G5000	3			20	100	200	20	30		100
34	SS 970	3	1	.3	.5	1000	.7			70	3000	2			20	100	100	20	5		150
35C	SS 971	3	3	1	.7	1500	N			70	1500	1.5			20	70	30	L	N		150
35D	SS 972	3	1.5	2	.7	1500	L			70	2000	1.5			30	70	30	L	5		150
36B	S 973	7	.3	L	.3	100	1			70	2000	1			N	100	30	50	10		20
77 ACn 41	R 974	3	.02	L	.5	700	1.5		L	20	300	L			N	L	15	100	N	200	5
47	R 975	1	.7	.5	.3	500	N		N	50	5000	N			10	15	70	L	N	N	30
47J	R 976	1.5	.5	.05	.2	700	N			20	G5000	N			5	10	50	L	N		70
47K	R 977	5	.5	L	.3	300	L			150	G5000	1			N	30	30	L	10		15
47S	R 978	.5	.5	15	.07	1500	1.5			L	3000	N			L	30	30	L	5		50

REMARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. L-40241

REPORT NO. 3/20/8

ANALYST HARTON, TURNER

Sheet #2

Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		13						14			
//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
	//////////										
77 Md 53C	ECG 956	30	N	15	N	300	200	N	70	N	200
53E	957	20		10		L	200		30	N	200
53F	958	20		10		L	200		50	N	200
53G	959	L		N		N	50		N	N	L
53I	960	L		7		N	500		30	N	200
54C	961	30		30		150	150		50	N	200
77 Md 8A	965	L		10		300	300		50	N	200
12E	966	10		10		500	300		50	L	200
18D	967	L		5		N	100		L	N	100
23	968	20		7		300	70		20	N	150
28A	969	70		10		500	1000		70	700	200
34	970	15		7		100	200		50	700	150
35C	971	15		7		100	150		50	N	150
35D	972	10		7		L	200		50	N	200
36B	973	10		5		L	200		50	N	200
77 ACr 411	974	150		L		L	10		150	N	5-1000
491	975	L		5		150	70		L	N	100
473	976	L		L		L	50		L	N	100
474	977	20		5		300	70		30	N	150
475	978	L		L		700	70		100	L	70

* Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

ILM NO. 2-77 L 42-

EPORT NO. 71208

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by THEOBALD

Sheet #1

Date 1 MAR 78

Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni	
	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	
G-2		1	.7	1	.3	500	N	N	N	L	5000	2	N	N	5	L	10	150	N	N	L	1
77ACn591	R 984	2	1.5	5	.07	1500	.7			50	G5000	N			7	10	50	30	N		50	7
77ACn602	R 988	1.5	2	10	.1	G5000	.7	N		N	G5000	N			5	L	50	L	N		30	11
601A	R 989	1.5	3	7	.1	G5000	2	N		N	G5000	N			10	L	50	20	N		30	12
591S	R 990	15	.07	.07	.15	700	7	300		10	G5000	N			20	100	100	L	200		100	13
77ACn611	R 992	1	.7	7	.1	1000	N			10	2000	N			5	L	30	L	N		20	15
601B	R 993	1.5	7	15	.07	G5000	7			N	1500	N			10	L	50	L	N		30	16
723	R 994	1.5	1	.07	.3	2000	N			20	G5000	1.5			20	10	100	20	N		100	17
726A	R 995	3	.7	L	.5	150	3			30	1500	1.5			N	200	50	30	20		30	18
726	R 996	.3	.02	L	.003	50	N			N	G5000	N			N	L	L	L	N		7	19
751	R 997	.2	.07	L	.01	150	N			L	G5000	N			5	L	10	L	N		L	20
783	R 998	.7	.5	.5	.1	700	N			20	G5000	N			7	L	70	L	N		30	21
762	R 999	3	3	10	.07	G5000	1			L	G5000	N			5	L	20	L	N		20	22
791	EAP R001	3	.7	3	.15	G5000	30			20	G5000	1.5			150	30	150	50	N		50	23
762A	R002	.3	.2	.07	.07	1500	N			N	G5000	N			N	L	10	L	N		5	24

ARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc.
Lower limits of determination are in parentheses.

FILM NO. L-41542

REPORT NO. 31208

ANALYST BARTON, TURNER

Sheet #2

Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		13						14			
//////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
G-2	//////////	70	N	L	N	1000	50	N	20	N	200
77 ACn 591	984	L		5		1500	70		30	N	50
77 ACn 602	988	L		7		6500	20		20	N	70
601A	989	L		7		3500	20		70	N	100
591S	990	30		L		200	30		N	300	20
77 ACn 611	992	L		5		200	15		50	N	30
601B	993	L		10		3600	15		70	N	70
723	994	15		10		1500	200		30	L	100
726	995	15		7		50	150		50	N	70
736	996	L		N		1000	10		N	N	L
751	997	L		N		5000	15		N	N	L
783	998	L		5		300	20		L	N	70
762	999	L		7		3000	30		150	N	70
791	EAP 001	50		15		700	150		30	N	200
962A	002	L	↓	N	↓	5000	15	↓	N	N	L

* Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. L-42-43

REPORT NO. 3:20 8

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Sheet #1

Requested by TIECOMPLO

Date 2 MAR 75

Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni	
//////////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	
G-2	////////	1.5	.7	1	.5	700	N	N	N	N	5000	2	N	N	15	L	70	150	N	N	L	1
77ACn 461	EAP R003	2	.3	.7	.07	5000	N	1	1	N	6500	N	1	1	36	L	(+2000)	L	N	1	30	2
77AHE 13	S 11	3	.5	.05	.3	1500	.7	↓	↓	50	6500n	1.5	↓	↓	10	70	100	30	50	↓	70	10
77ACn 491	B 13	1.5	1	.05	.5	700	.7	N	N	1m	6500n	2	N	N	7	70	70	50	30	N	30	12

MARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc.
Lower limits of determination are in parentheses.

FILM NO. L-42-43

REPORT NO. 31208

ANALYST BARTON, TURNER

Sheet #2

Field No.	Tag No.	13 (10) Pb	13 (100) Sb	13 (5) Sc	13 (10) Sn	13 (100) Sr	13 (10) V	14 (50) W	14 (10) Y	14 (200) Zn	14 (10) Zr
//////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
G-2	//////	15	N	N	N	1500	30	N	30	N	200
97AOR 461	EAP 003	L	1	5	1	200	300	1	20	N	L
97AHE 13	11	10	↓	10	↓	200	150	↓	30	N	100
97AHE 14	12	L	N	7	N	150	500	N	50	300	200
97ACR 491	13	10	N	10	N	150	300	N	50	200	200

* Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. L-43

REPORT NO. 1269

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by [illegible]

Date [illegible]

Sheet #1

Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni
//////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70
G-2	//////////	1	.7	.07	.5	500	N	N	N	L	2000	2	L	1.1	10	10	20	150	N	N	L
77ANK 14C	EAP SS014	3	.5	.05	.5	2000	2			70	G(5000)	2	N		20	300	100	150	5		50
14D	SS 15	3	1	.05	.5	3000	5			70	5000	2			20	500	70	100	5		200
14E	SS 16	2	.7	.05	.3	2000	1			100	3000	2			20	150	70	70	5		100
13I	S 17	1	.07	L	.2	30	7			30	700	1			1	300	30	100	20		30
13C	SS 18	1.5	.5	L	.3	700	3			100	G(5000)	1.5			10	200	50	20	10		50
77AMd 100	SS 19	10	.5	L	.5	1000	N			30	300	1			20	300	30	50	L		50
110	SS 20	5	.7	L	.5	3000				30	700	2			50	200	30	50	L		100
115	S 21	10	.7	.2	.15	1500				20	3000	1			10	500	20	70	5		20
77ANK 14H	SS 22	1.5	1	.2	.5	1500				70	5000	2			30	200	100	50	5		70
77Md 119F	S 23	2	.5	L	.5	150	L			70	G(5000)	1.5			5	70	70	70	7		20
77ACn 1415	SS 24	1.5	1	.7	.5	1500	3			100	2000	5			30	500	100	200	5		200
77 AMd 101	SS 25	3	.7	L	.3	3000	L			20	700	1.5			30	100	30	50	L		50
102	SS 26	3	.3		.3	2000	N			20	500	1			20	150	30	30	N		30
77ANK 181	R 27	15	.7		.3	1500	3			70	G(5000)	1.5			15	300	200	70	7		70
182	R 28	20	1		.5	3000	N			150		1.5			50	300	300	50	5		70
77ACn 1231	S 29	15	1		.5	150	L			150		1			5	200	150	70	L		30
1332	S 30	G(20)	1		.5	700	N			100		1.5			5	300	150	70	L		50
1351	S 31	15	.7		.3	700	N			100		1.5			15	500	150	50	L		30
1353	S 32	7	.5		.3	150	N			150		1			5	200	50	70	N		30
1232	S 33	7	.5		.3	700	L			150		1			5	200	70	20	L		20

MARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. L-43

REPORT NO. 31209

ANALYST TURNER

Sheet #2

Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		13						14			
//////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
G-2	//////////	100	N	L	N	1000	70	N	30	L	300
77ANK 14C	EAP 014	70	N	7		L	300		70	500	300
14D	15	70	L	7		L	150		150	500	300
14E	16	70	N	10		L	200		100	1000	200
13T	17	500	L	5		N	200		30	300	200
13C	18	100	N	10		150	200		30	200	200
77AMd 100	19	70	N	10	L	N	100		50	300	300
110	20	70	N	10	N	L	150		100	300	300
115	21	15	L	5	15	L	70		30	200	70
77ANK 14H	22	300	N	10	N	L	200		100	700	100
77 Md 119E	23	50	N	10		100	150		30	200	100
77ACn 1415	24	70	L	10		100	150		200	500	300
77 AMd 101	25	200	N	10		L	100		50	300	300
102	26	L	N	7		N	70		30	200	200
77AWK 187	27	70	L	15		L	300		150	300	200
182	28	70	N	50		500	150		70	200	300
77ACn 1231	29	30	N	20		L	150		70	L	300
1332	30	70		20		L	200		50	200	300
1351	31	20		30		100	150		50	300	200
1353	32	L		10		L	150		30	200	150
1232	33	15		15		L	150		30	200	100

* Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. [illegible]-74

REPORT NO. [illegible]

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS--BRANCH OF EXPLORATION RESEARCH

6-Step D.C. Arc

Requested by THEOBALD Date

Sheet #1

Field No.	Tag No.	(.05) Fe %	(.02) Mg %	(.05) Ca %	(.002) Ti %	(10) Mn	(.5) Ag	(200) As	(10) Au	(10) B	(20) Ba	(1) Be	(10) Bi	(20) Cd	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Mo	(20) Nb	(5) Ni	
//////////	71-78	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	
G-2	////////	1.5	.5	1	.7	500	N	N	N	10	2000	2	N	N	10	L	10	200	N	L	L	1
77ACn 1392	EAP B 034	2	.3	L	.5	200	N			100	1500	2		N	15	70	100	50	15	L	30	2
1313	R 35	3	.5	5	.5	1500	N			15	300	1.5		N	15	100	15	70	N	30	30	3
1352	R 36	.15	.3	G(20)	.05	200	7			L	1000	1		L	L	200	70	50	10	N	30	4
1362	R 37	.7	.2	3	.15	150	7			30	1500	2		L	L	700	100	200	10	N	50	5
1364	R 38	1	.5	7	.2	200	5			50	700	1.5		L	10	500	70	70	L	L	100	6
77AMd 116	R 39	2	.02	1.5	.15	700	100	300		10	700	N		G(500)	100	20	500	50	20		30	7
77ANK 13D	R 40	.5	.03	.1	.05	30	30	N		20	500	L		N	15	20	50	30	L		30	8
13G	R 41	1	L	L	.01	50	150			15	1500	N		200	20	20	70	70	20		20	9
13K	R 42	1.5	.07	L	3	15	20			50	700	1.5		150	10	15	200	100	10	70	L	10
14B	R 43	3	.1	1.5	.7	2000	.5			10	300	1		N	15	30	30	200	L	50	70	11
77AHE 53	S 46	3	.7	.05	.3	3000	L			70	G(5000)	1.5		N	15	70	100	20	10		30	14
77AMd 111	SS 47	3	.5	.1	.5	2000	N			50	700	3		N	20	150	50	30	N		70	15
112	SS 48	3	.3	.1	.2	1500	N			15	1500	1.5		L	15	150	50	70	N		20	16
114	SS 49	2	1.5	.15	.5	2000	L			50	1500	1.5		N	30	150	70	50	L		100	17
117	SS 50	1.5	3	.2	.3	3000	1			30	2000	3		N	15	100	50	100	L	70	50	18
118	SS 51	2	.7	.2	.3	G(5000)	7			70	G(5000)	5		N	50	200	100	70	5	50	500	19
77ANK 13B	S 52	1.5	.07	.05	.1	150	3			30	1500	1		L	L	200	50	150	L	20	7	20
77ANK 13J	S 53	3	.3	.07	.5	1500	L			70	1000	5		N	5	15	10	200	L	100	30	21
																						22
																						23
																						24

MARKS: Fe, Mg, Ca, and Ti reported in %; all other elements reported in ppm. Results are in the series 1, 1.5, 2, 3, 6, 7, 10, etc. Lower limits of determination are in parentheses.

FILM NO. L-44

REPORT NO. 31209

ANALYST TURNER

Sheet #2

Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		13						14			
//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
G-2	////////	70	N	L	N	700	70	N	30	L	500
77ACn 1297	EAP 034	50	N	10	N	300	150		50	200	100
1313	35	L	N	5	N	100	70		30	500	300
1352	36	L	150	7	N	1500	150		200	200	50
1362	37	L	300	7	N	150	200		300	200	70
1364	38	20	150	15	N	500	150		200	300	70
77AMd 116	39	G(2000)	500	L	20	L	30		20	G(1000)	70
77ANK 13D	40	1500	100	L	N	N	30		20	1500	50
13G	41	G(2000)	300	N	N	N	15		10	G(1000)	L
13K	42	1000	100	L	L	N	50		50	G(2000)	300
14B	43	70	N	5	L	L	150		50	1000	300
77AHE 83	46	50		10	N	L	150		30	300	200
77Amd 111	47	70		10	L		150		100	300	300
112	48	20		7	L		70		30	200	100
114	49	30		10	L		200		50	200	200
117	50	100		5	N		100		50	300	300
118	51	30		10	L	150	150		150	1500	300
77ANK 13B	52	200	L	7	N	N	150		30	200	70
77ANK 13J	53	150	N	N	L	L	20		70	200	G(1000)

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.

FILM NO. L-44

REPORT NO. 51209

ANALYST TUENER

Sheet #2

Field No.	Tag No.	(10) Pb	(100) Sb	(5) Sc	(10) Sn	(100) Sr	(10) V	(50) W	(10) Y	(200) Zn	(10) Zr
		13						14			
//////////////	71-78	1-7	22-28	29-35	36-42	43-49	64-70	1-7	8-14	15-21	22-28
G-2	////////	70	N	L	N	700	70	N	30	L	500
77ACn 1292	EAP 034	50	N	10	N	300	150		50	200	100
1313	35	L	N	5	N	100	70		30	500	300
1352	36	L	150	7	N	1500	150		200	200	50
1362	37	L	300	7	N	150	200		300	200	70
1364	38	20	150	15	N	500	150		200	300	70
77AMd 116	39	G(20000)	500	L	20	L	30		20	G(1000)	70
77ANK 13D	40	15000	100	L	N	N	30		20	1500	50
13G	41	G(20000)	300	N	N	N	15		10	G(1000)	L
13K	42	1000	100	L	L	N	50		50	G(1000)	300
14B	43	70	N	5	L	L	150		50	1000	300
77AHE 53	46	50		10	N	L	150		30	300	200
77AMd 111	47	70		10	L		150		100	300	300
112	48	20		7	L		70		30	200	100
114	49	30		10	L		200		50	300	200
117	50	100		5	N		100		50	300	300
118	51	30		10	L	150	150		150	1500	300
77ANK 13B	52	200	L	7	N	N	150		30	200	70
77ANK 13J	53	150	N	N	L	L	20		70	200	G(1000)

G = Greater than value shown. N = Not detected at limit of detection, or at value shown. L = Detected, but below limit of determination, or below value shown.