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# GEOPHYSICAL REPORT

ON A

HELICOPTERBORNE MAGNETOMETER SURVEY

OVER THE

KAMLOOPS - AFTON AREA

SITUATED IN THE

KAMLOOPS MINING DIVISION

LATITUDE 50° 40' N; LONGITUDE 120° 30' W

N.T.S. 92-I/9,10

by


S.L. SANDNER & ASSOCIATES

VANCOUVER, B.C.


AUGUST 11, 1972


Magnetometer Operator:

J. Denham

Report By:

A. Mlcuch, PhD.

Geophysicist



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# REPORT ON
# HELICOPTERBORNE AEROMAGNETIC SURVEY
# KAMLOOPS - AFTON AREA

## PREFACE

Magnetic susceptibility may change perceptibly from one lithologic unit to another; thus accurate detailed mapping of the geomagnetic field often provides valuable information about subsurface geology, even in heavily drift covered areas. Aeromagnetic surveying can aid in the delineation of buried contacts and disruptions, or the location of areas of possible plutonic differentation. Often local magnetic patterns associated with known ore bodies can be identified, and the existence of similar variations in magnetic intensity elsewhere may lead to the discovery of new ore bodies.

## INTRODUCTION

During May 1 - 9, 1972, S.L. Sandner and Associates of Vancouver, B.C., conducted an airborne magnetometer survey over a 220 square miles area, south and west of the City of Kamloops, in the Kamloops Mining Division of British Columbia. A total of 1630 line miles of total intensity airborne magnetometer surveying was flown. This report describes the instrumentation, field procedure, data processing and discussion of the results obtained.

## INTRODUCTION TO AEROMAGNETOMETRY

The earth has a magnetic field which is basically that of a magnetic dipole. There are, however, major and minor divergences from the basic dipolar field. Major divergences are interpretable as indications of structure within the geoid proper and are of mostly academic interest. Minor differences are of more interest to the mineral prospector since they may be attributable to local variations in either the ferromagnetic susceptibility or the natural rock magnetism, or both. Since ferromagnetic susceptibility and natural rock magnetism change measurably from one rock type to another, accurate detailed mapping of the local geomagnetic field often provides valuable information about the subsurface geology (even in heavily drift-covered areas). Aeromagnetic surveys can provide information about the type, general attitude, configuration and complexity of the geo-superstructure. Local elements associated with known ore bodies can often be identified, and the existence of similar local elements elsewhere may lead to the discovery of new ore bodies. Aeromagnetic prospecting can be applied to the delineation of buried contacts and disruptions, or the location of areas of possible plutonic differentation and its varied products.

## LOCATION

The survey area covered by this report is approximately centered at latitude 50° 40' N and longitude 120° 30" W (N.T.S. 92-I/9,10) immediately south and west of the City of Kamloops in south central, British Columbia.

## GENERAL SETTING

The area covered by this report lies within the belt of Interior Plateaux, South of Kamloops Lake. The topographic features comprise rolling summits and broad upland areas separated by deeply cut valleys. The elevation of the map-area varies from 1,100 to 4,600 feet A.S.L. The lower slopes of the valleys are open and covered with sagebrush, the upper slopes support park-like forests.

The general geology of the area consists of the Iron Mask batholith (Jurassic and (?) later) cutting the Nicola series (Triassic) and of the Kamloops group with thick accumulations of Tertiary volcanic rocks.

The Nicola volcanic rocks occur in the vicinity of the south-west corner of the map area and in a narrow strip south-west of Kamloops. The trend of the folds in the Triassic rocks swings to the northwest. The Iron Mask batholite is apparently intruded into one limb of a syncline in the rocks of the Nicola group, the axis of which runs north-westerly towards Kamloops Lake.

The main exposure of the batholith is 12 miles long and roughly 2 1/2 miles wide, the direction of elongation paralleling the stribe of the enclosing rocks. Similar rocks appear further to the northwest along the stribe, where they form an elliptical mass that is partly concealed by Kamloops Lake. The rocks are medium grained, grey or greenish grey, in some places red and in others very dark in colour, marked by phases, that are rich in ferronnagnesian minerals. They show considerable alteration.

The batholith varies in composition from syenite to ultrabasic types. All are deficient in quartz. Magnetite and apatite are present in most of the rocks, which are gabbros and diorites. Augite and hornblende are common, and there is a wide variation in the proportion of mafic minerals.

Certain breccias in the vicinity of Kamloops Lake are tentatively correlated with the Kingsvale group. These rocks are practically indistinguishable from the Triassic greenstones, but they carry fragments believed to be derived from the Iron Mask batholith.

The Kamloops group includes a considerable thickness of volcanic and sedimentary rocks. The thickest accumulations of volcanic rocks are in the area south of the Thompson River and around Kamloops Lake. These are overlain by the Tranquille beds, which are in turn overlain by thick accumlations of agglomerate, breccia, tuff.

The volcanic rocks show a wide range of colour from white, through various shades of red, pink, brown, grey to black. They are usually massive and fine grained rhyalites, audesites, and basalts, but the group is very largely composed of basalt and basalt breccia. Interbedded with these volcanic rocks and grading upwards into the agglomerates are the Tranquille beds. These beds consist of sandstone, shake, and conglomerate, with tuff beds and, locally, thin seams of lignite. The section varies from place to place. The sandstones are generally tuffaceious and except locally, where they are well indurated in thin beds, are soft and friable. The shales and tuffs are also commonly friable.

Pleistacene and Recent deposists are of considerable importance in the area for they cover much of the bedrock. They include glacial drift, the deposits of Glacial streams and lakes, and the deposits of recent streams. The evidence indicates that all the map-area was covered by ice during Pleistocene time, for glacial striae are found near the higher summits and glacial erratics are widespread.

The general geology map (Figure A,B,C,D,E,F,G) is included in the section Figures.

(1) G.S.C. Memoir 249, W.E. Cockfield, Geology and Mineral Deposits of Nicola Map-Area, British Columbia. Department of Mines and Technical Surveys, 1961.

(2) Annual Report, Minister of Mines and Petroleum Resources, British Columbia, 1966.

AIRBORNE FIELD PROCEDURE

The total intensity of the geomagnetic field was measured and recorded along 208 flight lines, flown in a general northeast - southwest direction. Two tie lines were flown consecutively in northwest - southeast direction.

The survey was flown in a Bell Jet Ranger 206A towing an air foil sensor with a Varian V4937A proton precission magnetometer (± 1 Gamma), Varian SDV 4991 digital paper punch recorder and a Neyhard Automax 35 m.m. pulse camera. The terrain clearance was recorded with a Bonzar pulse type radar altimeter.

Analog records were made of the total magnetic field intensity and terrain clearance during flight.

At one second intervals, the field amplitude and fiducial number were recorded on punch tape by the digital recording system. At thirty second intervals, the time and line number were punched on the tape. At five second intervals, a split image camera simultaneously photographed (1) the terrain, and (2) the clock and fiducial display panel. Thus, each terrain photograph is bordered by a photograph of the clock, and fiducial number.

A ground magnetometer monitored the geomagnetic field during the survey.

Solar flare warnings and predictions, issued daily at the Space Disturbance Forecase Centre in Boulder, Colorado, were used to schedule the flight during a magnetically quiet period.

The punch tape, chart and strip photograph processing is described in the following section. Instrument specifications are in Appendix I.

## DATA PROCESSING

The data processing procedure consisted of four steps discussed under the following headings:

1. Flight line X-Y positioning.
2. Editing of the paper tape.
3. Tabulation of critical fiducial numbers and their X-Y co-ordinates.
4. Contour plotting.

### 1. Flight Line X-Y Positioning

From the aircraft, while the lines were being flown, the flight lines were roughly positioned on government aerial photographs. In the office, the beginning and end of each flight line was marked on the strip photographs. S. L. Sandner & Associates personnel transferred the flight lines onto a mosaic prepared from the government photos.

An X-Y co-ordinate system was superimposed on the flight line mosaic with +Y north and +X east (see Figure 4). Thus, every position along a flight line was defined in terms of X (number of feet east of the origin) and Y (number of feet north of the origin), and has a corresponding magnetic value in gammas.

2. Editing of the Paper Tape

A computer printed listing of the contents of the paper tape was made and compared with the analogue record as a guard against possible machine or operator error.

3. Tabulation of Critical Fiducial Numbers

The first and last fiducial number on each line were tabulated along with their X-Y co-ordinates. In addition, points where the flight line changed direction were tabulated along with the appropriate fiducial number. The tabulated information was then keypunched onto computer cards.

4. Contour Plotting

The punch tape information was input to a computer, along with the X-Y co-ordinates of the start, end and any changes of direction that may have occurred in the flight line. The data sampling interval along the flight lines was roughly

200 feet. The magnetometer readings were evenly spaced along the line segments and posted by a computer-plotter unit. The posted values were than hand contoured at a contour interval of 100 gammas.

## DISCUSSION OF AIRBORNE DATA

This section is intended as an aid to geologic interpretation of the airborne geophysical survey data.

In general, geophysical features which can originate from, or are associated with mineralization are used to localize favourable sites for more intensified exploration. The presence of certain minerals (e.g. magnetite), and geologic features (e.g. faulting) are detectable from geophysical observations. Faulting is sometimes expressed in a magnetic map as a steep gradient or magnetic low. Magnetic highs can be caused by increased concentrations of magnetic minerals.

Contact between two different rock types or phase differences within the same rock type often are expressed as moderate gradient along the interface. This effect is related to the difference in magnetic susceptibility between the two rock types.

In general, the geophysical data from a survey of this type can only be evaluated after a detailed examination and comparison of the geophysical data, terrain clearance charts, air photographs and government photograph mosaic. For instance, an anomaly on the magnetic map may be due to an occurrence of concentrated magnetic minerals. However, relative to the other magnetic peaks it may be partially influenced by terrain clearance. Thus, an anomaly adjacent to it may prove to have an equal concentration of magnetic minerals.

## COMMENT ON RESULTS

The low level airborne magnetic survey produced interesting details of three major anomalies south of Kamloops Lake and the Thompson River.

The first most significant anomaly lies south of Trans-Canada Highway along the contact of the Nicola group rocks and the Iron Mask batholith. The anomaly starts east of Huges Lake and spreads out in the vicinity south of Coal Hill. The maximum magnetic relief is approximately 4500 gammas. Two parallel lines of high magnetic intensity peaks with deep depressions between them strike in a general east-west direction.

The northern line has four magnetic highs with a maximum peak in the western corner with diminishing peak values to the east. The southern line covers the same number of highs with similar values remnants and distances as the northern line. Both lines appear to be of an earlier east-west fault system. More recent faults in the northwest - southeast direction disrupted the earlier structure creating a new system of anomalies along the northwest southeast trend.

An important aspect of this feature is that four known mineralization zones lie within embayments of this anomaly. Known copper miniralization is found where the steep gradient broadens out away from the magnetic peak or when it forms a tongue shaped flank.

The second anomaly is situated north of Edith Lake and stretches out in the northwest - southeast direction. A magnetic profile drawn in this direction shows three highs while the width shows only little change to the south. It can be reasonably assumed therefore, that this anomaly is caused by the continuation of the fault farther to the southeast, described earlier.

The third anomaly lies along the strike at Cherry Bluff and Roper Hill where similar rocks to the Iron Mask batholith are exposed. The highest magnetic value on the map sheet is located in the northern portion of this anomaly.

A profile shows an apparent fault pattern parallel to Kamloops Lake except in the north section where the contours terminated abruptly displaying a deep magnetic depression. A cone shaped anomaly appears on the northwestern side of this depression. The geology map shows that the Kingsvale rocks cover this area.

The southern portion of the west half of the map area displays a low magnetic relief with overall changes of less than 1000 gammas. Little magnetic or structural significants is indicated in this area.

A lessor but still significant anomaly can be seen in the vicinity of Separation Lake and west of Knutsford Hill.

The vicinity of Red Bluff north of Kamloops Lake display magnetic changes of possible anomalous conditions.

Further analysis of specific areas using larger scale base maps may produce even more useful results.

In conclusion, this detailed aeromagnetic survey represents one of the most significant and meaningful coverages ever carried out in British Columbia.

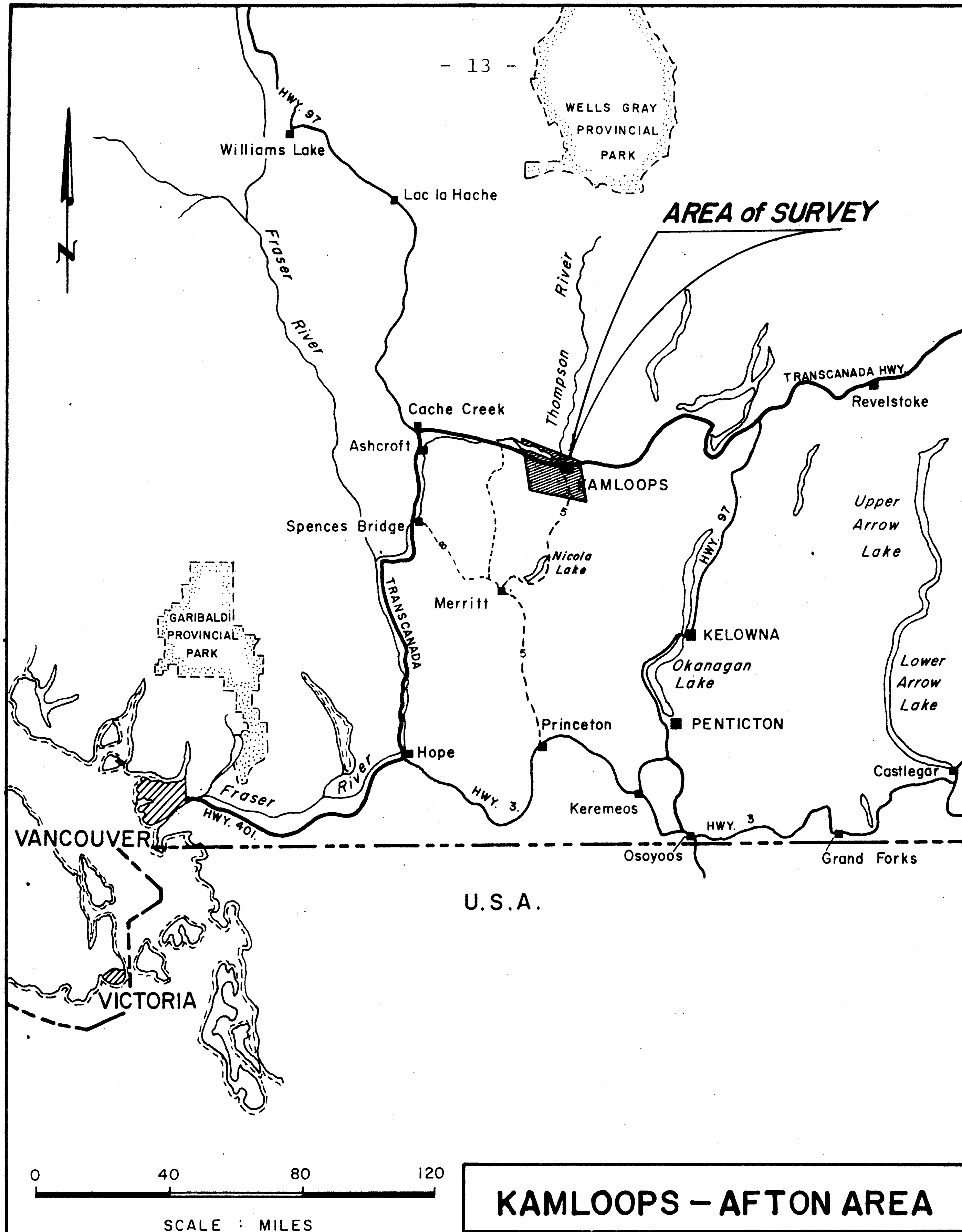
Respectfully Submitted:

Alexander Mlcuch

A. Mlcuch, PhD.
Geophysicist.

S. L. Sandner, B.Sc.
Geologist/Geophysicist.

August 11, 1972




# KAMLOOPS – AFTON AREA

LOCATION MAP

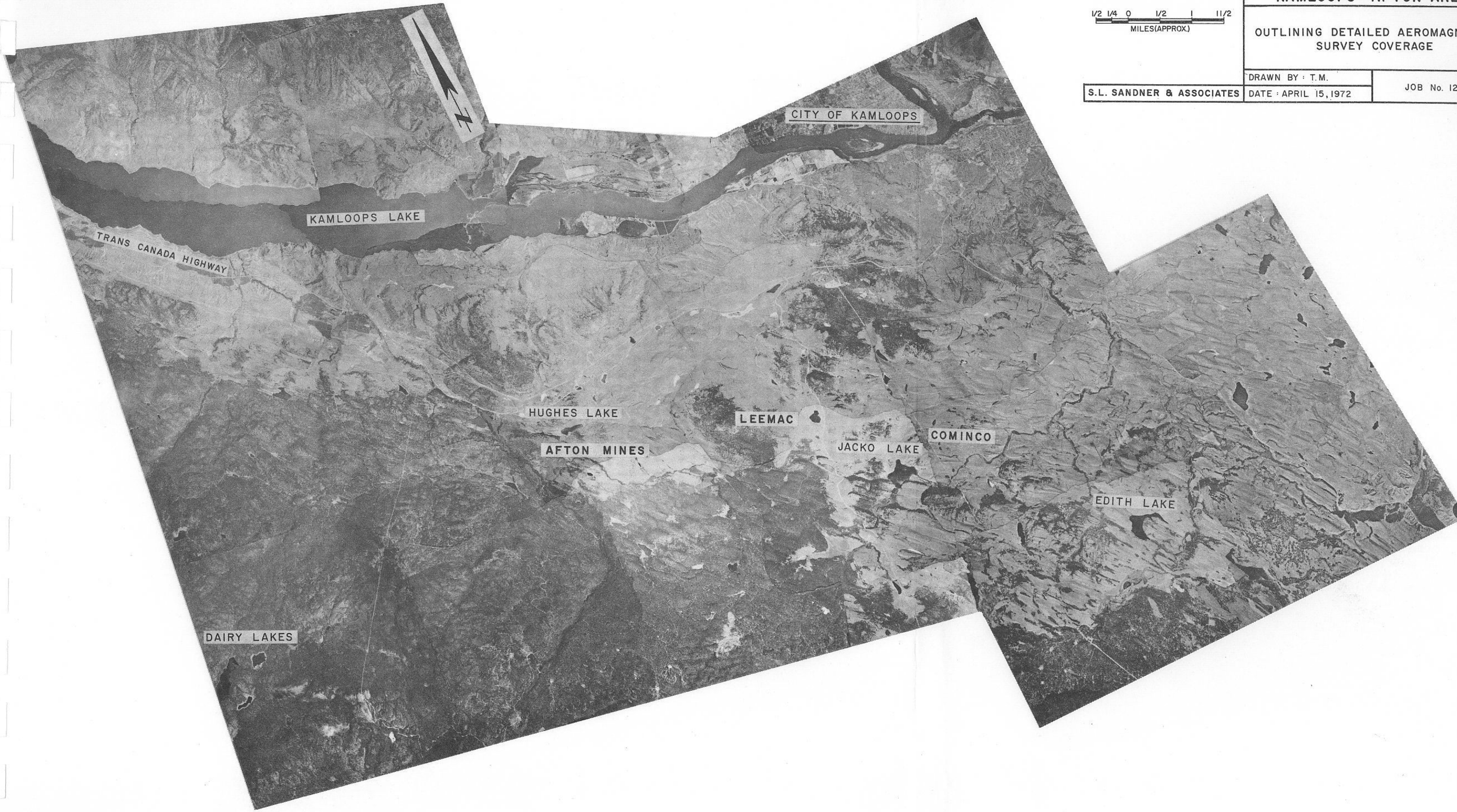
| SANDNER ASSOCIATES | DRAWN AXTEN | DATED AUG. 4, 72 | FIG. NO. 1 |
|---|---|---|---|
| | CHECKED A. M. | JOB NO. 1204 | |

AIRPHOTO MOSAIC
of
KAMLOOPS – AFTON AREA

OUTLINING DETAILED AEROMAGNETIC
SURVEY COVERAGE

1/2 1/4 0 1/2 1 1 1/2
MILES (APPROX.)

| S.L. SANDNER & ASSOCIATES | DRAWN BY : T.M.<br>DATE : APRIL 15, 1972 | JOB No. 1204 |
|---|---|---|



# APPENDIX I

## SPECIFICATIONS OF THE V-4937A MAGNETOMETER SYSTEM

### Performance

| | |
|---|---|
| Range: | 20,000 to 100,000 gamma (worldwide) |
| Sensitivity: | ± 1/2 and ± 1 gamma in any field. |
| Sampling Rate: | manual and "clock" operation permits any timing sequence. |

### Power Requirements

22-30 V, 6 amps for magnetometer, 60 watts for analog recorder and 100 watt maximum for digital recorder.

### Physical Specifications

| | |
|---|---|
| Console: | size - 19 x 17 x 24 inches; Weight 68 lbs. |
| Analog Recorder: | dual channel - 15 x 10 x 10 inches, 30 lbs. |
| Scanner-coupler: | fucical counter, ident. control, 24 hr. clock, 40 lbs. |
| Recorder: | size - 14 x 11 x 28 inches; Weight 41 lbs. |

### Data Output

| | |
|---|---|
| Digital Recording: | BCD 1-2-4-8 (four line output)<br>"O" state - 18 to -30v through 100K ohms<br>1 state -1 to +3v through 100k ohms |
| Print Command: | Positive going 12 to 25v pulse; 15M second. |
| Auxiliary Channels: | A & B for radio altimeter and navigation equipment. |
| Analog Recording: | Galvanometric -1 mA full scale into 1500 ohms<br>Potentiometric: 100mV full scale. Minimum load resistance 20K<br>Full scale resolution of the least most significant digits of the total geomagnetic field 0-99, 0-999 at 1 gamma sensitivity; 0-49, 0-499 at 1/2 gamma sensitivity. |

APPENDIX I Cont'd.

Instrument Specifications

Camera

| | |
|---|---|
| Type: | Neyhard Automax 35 m.m. pulse camera |
| Model: | G-2 with auxiliary data box |
| Pulse Rate: | Up to 10 frames per second |
| Film Format: | 0.738" x 0.738" square picture with 0.200" x 0.738" data area. |
| Magazine: | Mitchell 400 foot 35 m.m. |
| Lenses: | (a) 17 m.m. F/14 Super-Takumar Fish-eye<br>(b) 35 m.m. F/2.0 Super Takumar |
| Data Box: | (a) 24 hour Accutron Clock<br>(b) Frame counter<br>(c) Available for optional feature |
| Dimensions (less magazine): | 8 3/8" high, 4 1/2" deep, 6 1/4" wide. |
| Weight (less lens and magazine): | 12 lbs. |

## APPENDIX II

### PERSONNEL AND DATES WORKED

A. Feild Work:

| | | |
|---|---|---|
| S.L. Sandner | Supervisor | |
| Chad Murray | Pilot | May 1 - 9 incl. |
| Joe Denham | Operator | May 1 - 9 incl. |

B. Report Preparation:

| | |
|---|---|
| S.L. Sandner | |
| A. Mlcuch - Data Processor | Apr. 17 - 20 |
| | May 10 - 31 |
| | June 1 - 2 |
| | Aug. 1 - 11 |

C. Drafting and Reproduction:

| | |
|---|---|
| T. Malesku | Apr. 20 - 21 |
| A. Rivard | June 1 - 31 |
| | July 1 - 31 |
| Axten Drafting Limited | July 25 - 31 |
| | Aug. 1 - 7 |