TECTONIC ANALYSIS OF FRACTURE DENSITY

TO ACCOMPANY GEOLOGICAL SURVEY REPORT

of

C.COVENEY,P.ENG.,and F.LEE, GEOLOGIST

PHOTOGEOLOGICAL REPORT

by

D.A.CHAPMAN & ASSOCIATES LTD.

on the

HIGHLAND VALLEY MINES LTD. (N.P.L.)

ELLA GROUP OF CLAIMS

SOUTHWEST OF TUNKWA LAKE

Kamloops Mining Division, B.C.

Latitude: 50°35'N

Longitude: 121°56'W

MAY 26th 1969.

TECTONIC SURVEY

OF

ELLA GROUP CLAIMS

KAMLOOPS MINING DIVISION

BRITISH COLUMBIA

FOR

HIGHLAND VALLEY MINES LIMITED

Maps 2076-1. -- Location map
2076-2 -- Tectonic Anomaly map

May 26, 1969

D.A. CHAPMAN & ASSOCIATED LTD.

D.A. Chapman & Associates Limited
#2 • 515 GRANVILLE STREET • VANCOUVER 2, B.C.

Highland Valley Mines Ltd.
Attention: Mr. C.J. Coveney, P.Eng.

Re. Cost analysis for Tectonic Aerial Survey of Ella Claim Group, Highland Valley Area, British Columbia.

Service costs - D.A. Chapman & Associates Ltd.

1. Fracture/joint interpretation and annotation of aerial photographs ..... 45 hrs.@ $20.00/hr	$900.00
2. Counting procedure and compilation of Empiric Data Input for programme analysis ...25 hrs	$500.00
3. Computer data correlation and report including organization expense (liasson, dispursements, etc.)	$350.00
	$1750.00
4. Computer Programme charges: *	
J.S. Robertson & Associates invoice attached.....	$500.00
	$2250.00

* Note: minimum programme fee of $500 is based on the programme module of 30 lines and 30 columns.

D.A. Chapman
per D.A. Chapman & Assoc. Ltd.

C.J. Coveney

30 - 5 - 69.

D.A.Chapman & Associates Ltd.,
#2 - 515 Granville Street,
Vancouver, B.C.

Invoice for services on Highland Valley Mines Ltd:

No. 1. Program No. 1201 (run on I.B.M. 1130-8K)

No. 2. Isogram Map Preparation

No. 3. Typing and compilation of report (5 copies)

Total Cost - $500.00

J.S.Robertson & Associates,
1229 Bracknell Crescent,
North Vancouver, B.C.

D.A.Chapman

D.A. Chapman & Associates Limited
#2 • 515 GRANVILLE STREET • VANCOUVER 2, B.C.

PREFACE:

Tectonic analysis of a fracture density survey is an empirical and analytical study of the visible effects of horizontal strains across fracture interfaces (jointing systems) which result from increases or decreases of vertical pressure due to a relief of stresses by faulting (rupture).

Simply stated; the density of fractures in any area observed is proportional to the vertical pressure induced by changes in shearing (tangential) stresses and is visibly expressed as surface tension.

A fracture density survey, compiled from aerial photographs counts or estimates the total of observed fractures in any unit area, whereas, a tectonic analysis measures the rate of fracture incidence observed in a unit of area relative to the rate of incidence observed in adjacent and lateral unit areas.

This observed variable is used in a programmed calculation to derive coefficients of the deformation stress acting across and through points on the crustal surface of the area examined.

Method of Compilation:-

(1) Linear isostatic traces of the jointing pattern are interpreted and annotated to clear film overlays on the photographs of the area surveyed.

(2) The annotated overlay is then superimposed on a counting grid consisting of numerous overlapping and interlocking circles of equal unit area and the density per unit area is estimated (counted).

Preface (Cont'd.)

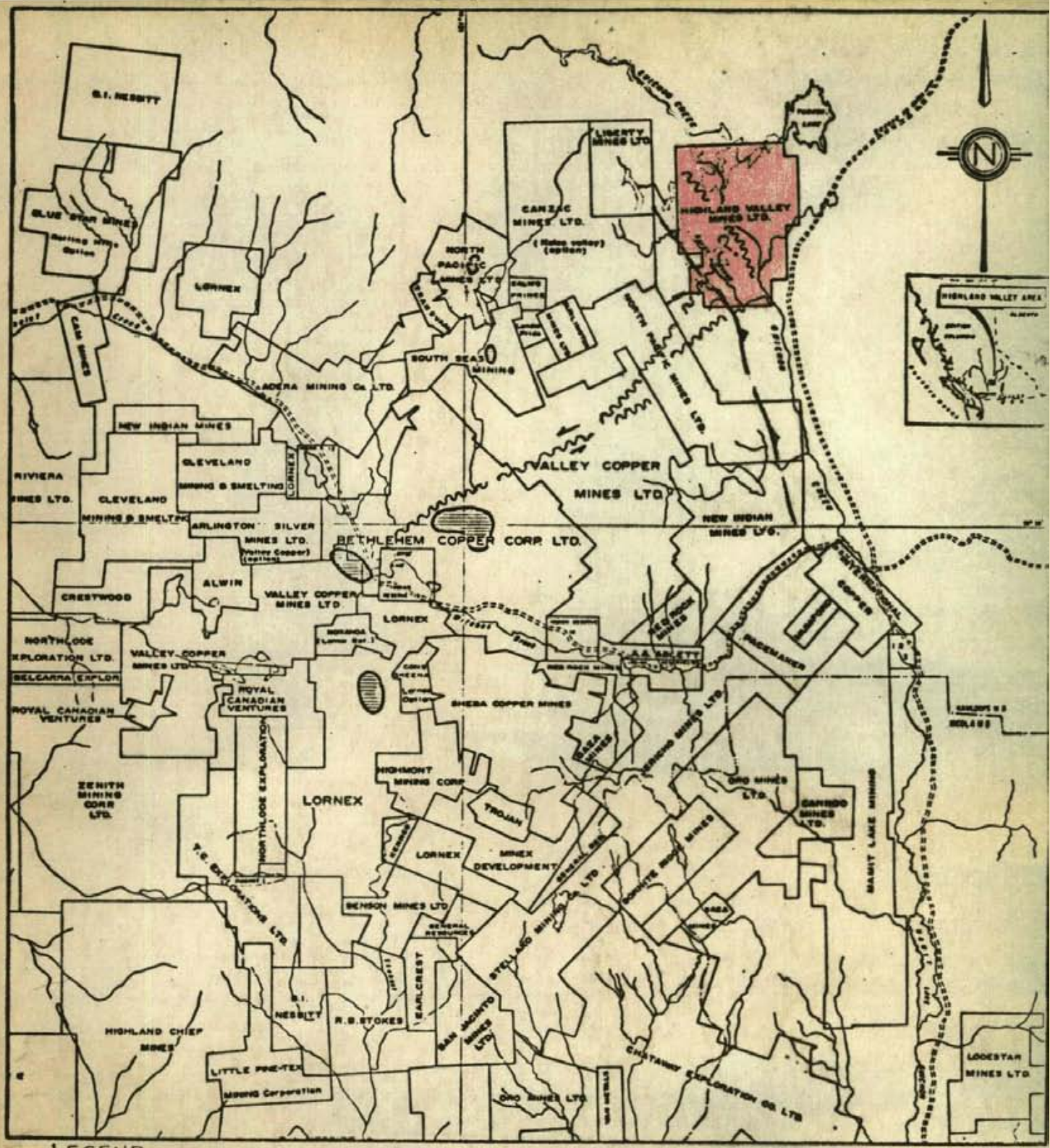
(3) The empirical observation at each point on the grid is statistically analysed by a computer program for the following:-

a) changes in tangential stress.

b) induced pressure coefficients.

c) deformation stress coefficients.

(4) Isogradients of deformation stress are used to correlate with other geological, geophysical, and geochemical data when available.



LEGEND

Guichon Overthrust

Bose Lake Faults

HIGHLAND VALLEY MINES LTD. (N.P.L)

LOCATION MAP

ELLA GROUP, HIGHLAND VALLEY AREA

KAMLOOPS MINING DIVISION, B.C.

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT

NO. 2076 MAP 1

D.A. CHAPMAN & ASSOCIATES LIMITED
#2 - 515 Granville Street
Vancouver 2, B.C.

Telephone 685-3281

May 26, 1969

Highland Valley Mines Limited
#617 - 789 West Pender Street
Vancouver 1, B.C.

Attention: Mr. C.J. Coveney, P. Eng.
Mining Consultant for
Highland Valley Mines Limited.

Dear Sirs,

As requested, I have completed an Air Photo Study of the Ella Group of approximately 93 mineral claims, which straddle Guichon Creek just south west of Tunkwa Lake in the Highland Valley, Kamloops M.D. British Columbia.

MAP STANDARD

Mapping of the isograms was compiled from B.C. aerial photographs, scale 1" = 2640'. This dictates the scanning interval of fracture incidence readings.

The grid interval most practical for this scale is 3/8" or every 990' at ground scale. This grid on this scale of photograph is a reconnaissance standard in relation to the magnitude of fracture length visible and the physical limitations imposed on interpretation of fracture traces, and tends to enlarge the anomaly area.

COMMENTARY

The area of the Ella Group lies within the Guichon Creek Valley. The greater portion of the claims are covered by a mantle of glacial drift and valley alluvium. In some areas, depths of overburden may be greater than 300 feet. Geochemical surveys will be of limited use and costlier geophysical methods will have to be utilized

Commentary Cont'd

to correlate structural and geological targets for drilling.

The tectonic survey is in essence a structural study which measures the relative differences in deformation stress. These stresses create and alter the frequency of the crustal surface patterns of isostatic fracture traces observable in air photographs. This observed effect is expressed as surface tension visible across fracture interfaces at the boundary condition of the earth's crust, i.e. the horizontal surface viewed through vertical aerial photographs, and will reflect any lateral change in horizontal tension due to the changes in vertical pressure created by relief of stress through crustal faulting.

In areas of overburden the incidence of isostatic fracture traces is increased due to a granular flow of the unconsolidated overburden around and along fracture interfaces at the underlying rock or crustal surface. This action is continuous and is propogated by the earth's motion. A reasonable analogy to this ground effect is the wave motion observable in oceans where the amplitude of the wave is increased at the surface.

In areas of overburden, a distinct difference in the concept of a tectonic survey as opposed to a fracture density count is the rate of change of fracture incidence is applied. The rate at which the increased density or incidence occured in the unconsolidated mantle would be similar to the underlying fractures in the crustal surface.

Finally, the anomalous structural trends indicated by the survey are defined by analytical rock mechanic theories and principles

Commentary Cont'd

applied to observed empirical forms of data derived from the aerial photograph. Thus by the effect of surface tension observed, fault and shear trends are determined analytically with quantative data and not by personal interpretations.

REGIONAL GEOLOGY

The area of the claims is probably underlain by rocks related to the Guichon batholith and the Nicola Greenstones and can be described by three general classifications:

a) intrusive rock of the Guichon batholith and younger.

b) dioritized and metamorphosed contact phases of the Nicola Group.

c) greenstones and meta volcanics of the Nicola Group.

REGIONAL STRUCTURE

Two major regional structures intersect within the area of the claims;

a) the Guichon Creek contact/fault system comprised of over-thrusts on the western side of the valley floor and shear structure with fold/faulting on the eastern side of Guichon Creek.

b) the Bose Lake Syntectonic fault system of wrench shear zones antithetic to the strike of the Guichon batholith which appear to horsetail from Bose Lake eastward and terminate in the Guichon Valley.

These two systems would provide intense deformation of the rock at their intersection to prepare suitable host structures for mineralizers. The depth and intensity of two strong breaks in the earth's crust would also indicate a good probability for an intruding stock to take advantage of the breaches in the restraining mantle.

Regional Structure Cont'd

These are favourable geological factors for the presence of ore bodies but are offset by the depth of overburden with its limitations on exploration by visual prospecting and the necessity to rely basically on geophysical tools for drill targets.

TECTONIC SURVEY - OBSERVATIONS & CONCLUSIONS

1. A stress dome near central to the claim area is responsible for most of the deformation stresses and the resulting tectonic anomalies, suggesting the valley floor in the area is underlain by an intrusive stock.

2. Collapse structures around the periphery and within the stock indicate a postulated vaulting of the domal crown and possible brecciation zones within the stock.

3. A strong shear along the eastern side of the Guichon Creek may be along the N-S contact with the greenstones of the Nicola Volcanics, with possible embayments into the stock due to shear folding.

RECOMMENDATIONS

1. Geomorphological evidence of the structural trends should be field mapped with random geochem samples taken along the traverses.

2. An airborne magnetometer survey using a proton recession instrument and flown on a close pattern of flight lines should confirm the structures and geological interpretation placed on them. If sufficient field evidence is not available this may prove the most economic and useful method for determining the drill targets to test for mineralization.

3. By the preceding methods correlating target areas should occur, then a portable siesmic survey to determine the depth of the

overburden could be restricted to the vicinity of the target areas depicted and would be practical to determine drilling procedures.

Respectfully submitted,

D.A. Chapman.

THEORY OF TECTONIC ANALYSIS OF FRACTURE DENSITY SURVEYS FOR EXPLORATION TARGETS

INTRODUCTION

The principal objective of a Tectonic Analysis of a Fracture Density Survey is to provide starting points for field investigation by exploration teams. The locating of favourable tectonic areas is not sufficient in itself as it cannot assume that mineralization occured in conjunction with structural zones indicated by this method of interpreting aerial photographs.

STATIC ANALYSIS THEORY OF PRESSURE DOMES

A natural arch theory is applied to the condition of near equilibrium at the surface of the earth's crust where a boundary condition or standard state exists for all stresses and strains in the earth's elastic body. To accomodate the volumetric changes which are a product of these stresses and strains, adjustments by plastic flow or rupture is required. The latter is prevalent at or near the surface, and it is these ruptures which are clearly visible in aerial photographs, as fractures.

The adjustments to relieve stresses are observable variations in the jointing pattern of the fractures across the surface of the earth's crust and are related to the differences between planar resistance and shearing stress. By applying the natural arch theory to the visible effect, i.e. fracture incidence, a reasonable calculation of the deformation as a result of the stresses and strains is possible.

The calculated values are plotted and contoured as isogradients. The higher value isogradients outline the Tectonic Anomalies,

i.e. the areas of maximum volumetric expansion as a result of shearing (deformation) stresses. The diminishing value of the isogradients represent diminishing planar stress and one could expect a sequence of fissure, brecciation, shearing and drag folding down to a system of hairline fractures enveloping the principal stress axis.

Tectonic anomalies are zones of increased rock permeability relative to the openings and voids of the fracture planes and they indicate the major and more probable structures to host ore deposits if a flow of mineralizers has passed through the area and are therefore excellent geological targets for ground exploration.

D.A. Chapman & Associates Ltd.

CERTIFICATION.

1. I, Douglas A.Chapman, certify that I have practised the art of photogeological interpretation for mineral exploration for more than 15 years.

2. I received a Technical Diploma in 1949 from the Vancouver Technical School.

3. From 1950 to 1955 I was engaged in mapping and surveys using both ground and airborne methods, first with the Canadian Government and secondly with Photographic Surveys (Western) Ltd., in Vancouver.

4. From 1955 to 1959 I was engaged by Blanchet and Associates in Calgary where I practised interpretation and compilation of fracture patterns for structural studies related to oil exploration.

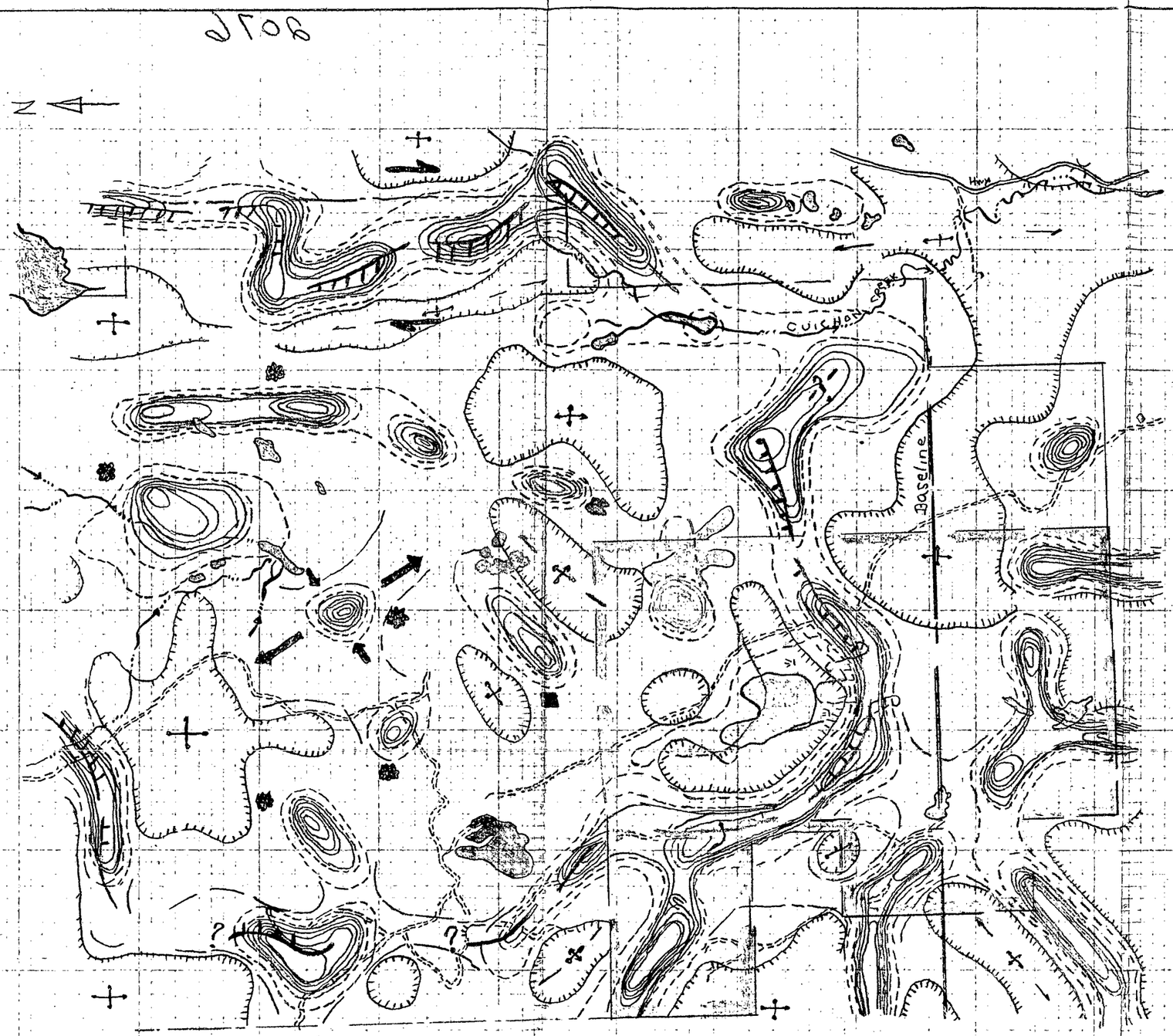
5. From 1961 to 1964 I was engaged by Chapman, Wood and Griswold Ltd., and assisted Mr. Blanchet in the formation of their air photo department as well as carrying out studies relating to tectonics and their association to mineral deposits.

6. In 1965 I formed D.A.Chapman & Associates Ltd., to provide air photo interpretation for mining exploration and primarily exploration reports to assist consulting engineers in planning field programmes.

Signed this 10th day of October, A.D. 1969.

D.A.Chapman.

D.A.Chapman & Associates Ltd.



LEGEND

DEFORMATION STRESS ANOMALY
zone of maximum planar stress
conversion zone of tension shear stress to maximum tangential stress
resultant stress envelope ??

PRESSURE DOME

STRESS DOME

ARROW IN DIRECTION OF REBOUND TENSILE STRESSES

ROAD

STREAM

BUILDING

LAKE

Interpreted Stress Contact of Stock

Recommended I.P Survey Target Area

Localized Target within Stock and Possible breccia zones.

Interpreted Shear Stress Sense.

SCALE 1" = 1000'

DEFORMATION STRESS ($\mu = \frac{2G}{E} - 1$)

2076

TECTONIC ANOMALY MAP.

HIGHLAND VALLEY MINES LTD. (NPL)

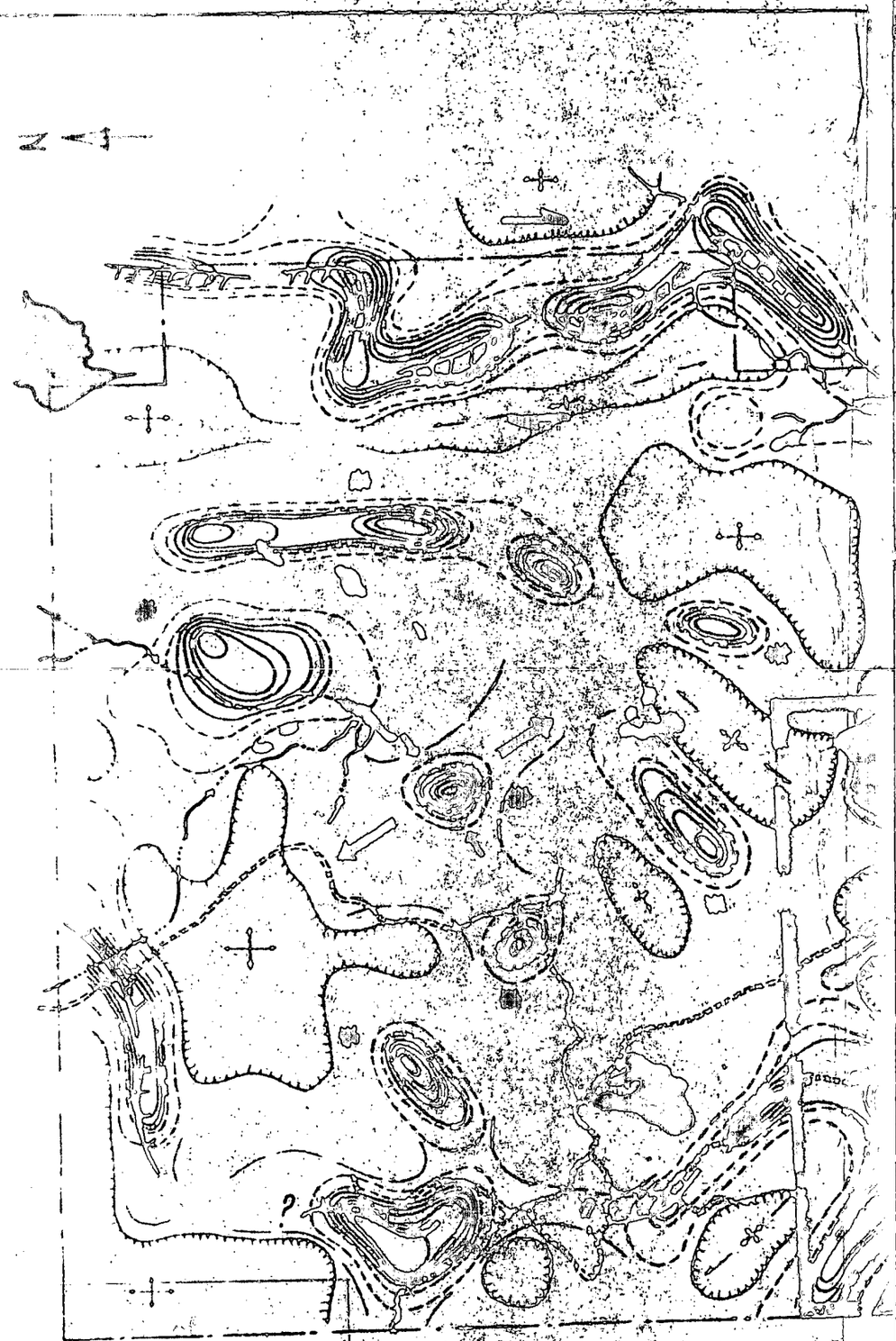
ELLA GROUP. HIGHLAND VALLEY AREA
KAMLOOPS MINING DIVISION. B.C.

D.A. Chapman

D.A.CHAPMAN & ASSOCIATES LIMITED
2/515 GRANVILLE ST. VANCOUVER 2 B.C.

MAY. - 1969

Redrawn by
BCMMaPR
Apr. 14/78



DEFORMATION STRESS: $(\mu = \frac{2\sigma}{E}(1+\nu))$

LEGEND

DEFORMATION STRESS ANOMALY

PRESSURE DOME

STRESS DOME

ARROW IN DIRECTION of RECORDED TENSILE STRESSES

ROAD

STREAM

BUILDING

LAKE

Interpreted Stress Contact of Stock

Recommended I.P. Survey Target Area

Localized Target within Stock and possible breccia zones.

Interpreted Shear

Chapman

2076

TECTONIC ANOMALY MAP.

HIGHLAND VALLEY MINES LTD. NPL

GULA GROUP, HIGHLAND VALLEY AREA
KAMLOOPS MINING DIVISION, B.C.

CHAPMAN & ASSOCIATES LIMITED
2/808 GRANVILLE ST. VANCOUVER B.C.

MAY. - 1980