"CROWN MOUNTAIN"
COAL EXPLORATION
1979
(TEXT) APRIL 30, 1980

CONTENTS

CROWN MOUNTAIN
COAL EXPLORATION, 1979

Kootenay Land District, Southeast British Columbia

Coal Licences: Group 31 - 308, 310, 312, 365, 366, 367, 371, 372, and 408
Group 32 - 305, 306, 307, 309, 311, 313

(15 licences total, 2,561 hectares grouped in 1980 into one new group, 265)

National Topographic Series: Toronado Mountain, 82 G/15
Crowsnest, 82 G/10

Latitude and Longitude: 49 degrees, 47 minutes north,
114 degrees, 44 minutes west

CNRL Maps: HH36D and HH36E

Owner: Shell Canada Resources Limited

Operator: Crows Nest Resources Limited

Consultant and Author: Dennis E. Bell, P. Geol. (Alberta)

Field Work: 14-July through 11-October-1979

Submission Date: April 30, 1980

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1.0 INTRODUCTION

1.1 General Introduction

1.1.1 Location (See Figures 1, 2, and 3)

The area is located in southeastern British Columbia and composes the southernmost 14 km of the 80 km-long Elk Coal Field. Line Creek Ridge lies is 10 km north. Further again to the north, the field also contains Kaiser Resources' proposed Greenhills mine, Cominco's Fording mine, and, most northerly, the proposed Elco mine in upper Elk Valley.

Other descriptions are:

1 Centered about 49 degrees, 47 minutes north latitude and 114 degrees, 44 minutes west longitude.

2 140 km by air south-southwest from Calgary.

3 5 km by air due east of Kaiser Resources' present Harmer Ridge open pit operation.

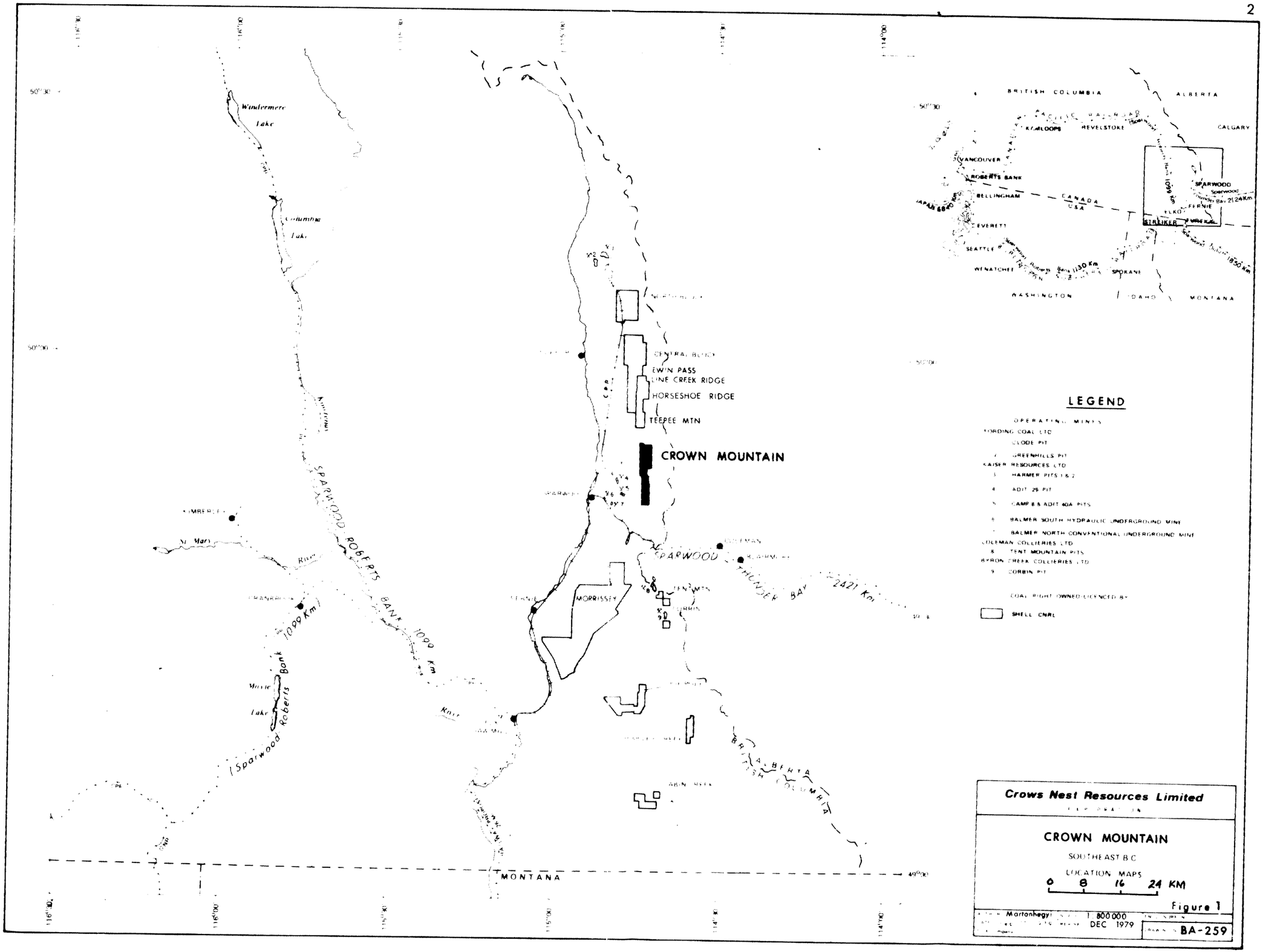
4 7 km by air northeast of Sparwood, B.C.

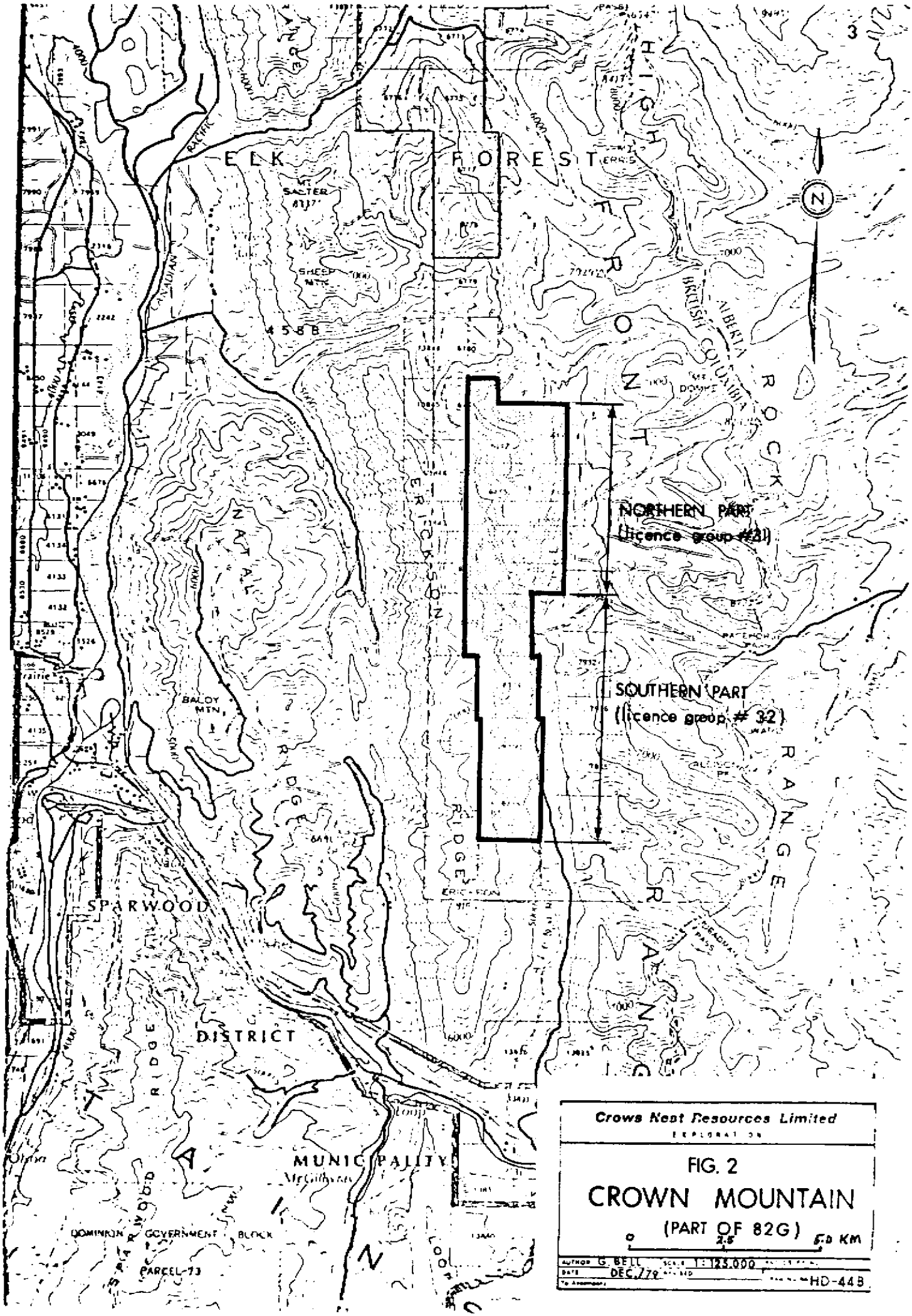
5 37 km by road and four-wheel-drive trail from Sparwood.

1.1.2 Shape and Limits of Area

The property is part of the broad north - south Alexander Creek Valley, located between two parallel lines of thrusted Paleozoic carbonates - spectacular mountains of High Rock Range forming the Continental Divide 5 km eastward and the massive Erickson Ridge 1 km west.

The coal measures are located under some of the higher ground of the west side of this valley. The structures containing the coal are erisional remnants on this group of licences. It is 1 1/2 km further north to the next "island" of Kootenay Formation, Teepee Mountain, and a further 8 1/2 km to Line Creek Ridge.


Windermere Lake
Columbia Lake
SPARWOOD ROBERTS BANK 1099 Km
Sparwood Roberts Bank 1099Km
CENTRAL BLOCK
EWIN PASS
LINE CREEK RIDGE
HORSESHOE RIDGE
TEEPEE MTN
CROWN MOUNTAIN
MORRISSEY
SPARWOOD
THUNDER BAY 2421 Km
MONTANA
BRITISH COLUMBIA
ALBERTA
KAMLOOPS
REVELSTOKE
CALGARY
VANCOUVER
ROBERTS BANK
BELLINGHAM
CANADA
U.S.A.
JAPAN 6840 Km
FERNIE
ELKO
STRIKER
EVERETT
SEATTLE
WENATCHEE
SPOKANE
1130 Km
1850 Km
WASHINGTON
IDAHO
MONTANA
LEGEND
OPERATING MINES
FORDING COAL LTD
1 CLODE PIT
2 GREENHILLS PIT
KAISER RESOURCES LTD
3 HARMER PITS 1 & 2
4 ADIT 25 PIT
5 CAMP 8 & ADIT 40A PITS
6 BALMER SOUTH HYDRAULIC UNDERGROUND MINE
7 BALMER NORTH CONVENTIONAL UNDERGROUND MINE
COLEMAN COLLIERIES LTD
8 TENT MOUNTAIN PITS
BYRON CREEK COLLIERIES LTD
9 CORBIN PIT
COAL RIGHT OWNED/LICENCED BY
SHELL CNRL
Crows Nest Resources Limited
CROWN MOUNTAIN
SOUTHEAST B.C.
LOCATION MAPS
0 8 16 24 KM
Figure 1
Martonhegyi 1:800 000
DEC 1979
BA-259



Crows Nest Resources Limited

EXPLORATION

FIG. 2

CROWN MOUNTAIN

(PART OF 82G)

0 2.5 5.0 KM

AUTHOR G. BELL SCALE 1:125,000

DATE DEC. '79

HD-448

Approximately one-third of the 1,265 hectares of this group is underlain by the coal-bearing Kootenay.

The southern, un-investigated group of licences (No. 32) is separated from Crown Mountain itself by the deeply-cut West Alexander Creek, which erodes beneath the Kootenay to older Fernie Formation shales. Basal Sandstone (the Moose Mountain Member) can be seen running in one cliff line south through these licences to a structural pinch-out 4 to 5 km distant. This line is located well up from the valley floor under difficult, steep, adverse topography, and it is unknown how much of the Kootenay may be present over the Basal Sandstone before both are overridden by the westerly-dipping carbonates of Erickson Ridge.

1.1.3 Access

Road access to Crown Mountain is presently limited to an all-weather four-wheel-drive truck trail that has no overly steep parts and can be driven with two-wheel-drive in dry conditions.

This trail leaves the Harmer logging road near the intersection of Grave and Harmer Creeks, proceeds east up Grave Creek past Erickson Ridge, then branches south and up Crown Mountain. It winds over the top of Crown, and down its south end to the bottom of Alexander Creek valley. The trail then becomes a road shown as a B.C. Secondary south to Highway 3 near the interprovincial border, but this stretch, while flat, is too deeply rutted to be useable. Table No. 1, following, lists the trail mileages.

Within the area there are numerous old trails and bulldozer cross-trenches, left from the work of ten years ago. These are partly overgrown and caved and were unreclaimed at the time of their con-

TABLE 1

ROAD MILEAGES

Elk Valley Road	0.0 km
Harmer/Grave Creeks intersection	7.5 km
Grave Creek - Crown Mountain intersection	5.4 km
Coal measures on north end of Crown	6.7 km
South end of coal measures on Crown	9.1 km
Bottom of valley, south end of Crown	2.6 km
Pavement at Highway 3 (new ANG Compressor Station)	17.0 km

struction. In 1979, 5 km of old trail were upgraded, usually by one pass by D7 to clear deadfall and bank caves. This was for drill site and trenching access; all other old surface disturbance was left untouched.

Helicopter time from Sparwood is only five minutes, and, due to the extensive old trench-trail network, landing sites are numerous.

1.1.4 Terrain and Relief

All of the area could be described as typically Rocky Mountain - pretty rough, pretty rugged. Crown Peak is 2266.5 m, and two subsidiary knobs are both over 2200 m. Elevation at the south end of the licences near Alexander Creek is approximately 1500 m. Total relief is thus 750 m.

Although much of the area is rocky and contains numerous cliff lines of sandstones, no part of it is above treeline, and so mining would not be disturbing a true alpine zone. The southern portion of the licences may contain part of the Erickson sheep range.

Most of the area is heavily forested by Lodgepole Pine. Engelmann's Spruce, Alpine Fir, Limber and Jack Pine are common. There are isolated groves of Lyall's Larch at higher elevations on the northeastern lee sides of the ridges.

North and west of the area, Grave Creek drainage is relatively isolated and has been logged in the past. Alexander Creek drainage, on the south and east, is readily accessible from Highway 3.

1.2 Summary

During the 1979 field season, Crows Nest Resources Limited spent approximately one hundred and fity thousand dollars in geological exploration on Crown Mountain, a physiographic unit of coal-bearing land in the coking coal belt of southeastern British Columbia. The property composes the southernmost part of the same Upper Elk Coal Field that contains Line Creek Ridge, the newly proposed Kaiser Greenhills mine, and the Fording mine.

The property, originally part of Crows Nest Industries holdings, is topographically rugged (the peak is 2266.5 m) and coal measures are "hung up" in the relief, so that they are like islands surrounded by a sea of air.

Geographically, the property may be divided into two parts: The southern part is a long rectangular string of single licences, approximately 8 km by 1 1/2 km. No ground work has been done on this stretch.

The northern part is a wider rectangular block, which contains Crown Peak. It is this part that is referred to as "Crown Mountain" through the remainder of this report. It is underlain by two occurrences of the coal sequence (i.e. one repetition), in an area approximately 5 km by 2 km. This was known from the 1969 drilling program of eleven rotary holes drilled by Crows Nest Industries. During 1979, CNRL drilled five new rotary holes for general geological information, cored two separate rotary holes targeted at particular seams, trenched seven specifically-selected stratigraphic sections. Detailed geological mapping at a scale of 1:5,000 was also carried out on this block.

The coal seams are part of the Kootenay Formation. The mapping-derived structural study indicates that no more than 170 to 200 m of the formation are left un-eroded above the Basal Sandstone (the Moose Mountain Member). In general conclusion, this thickness of coal measures has turned out to contain disappointingly thin coal beds. To compare to Line Creek Ridge and the other properties that are part of the same coal field:

Seam No. 10 is represented by a sequence of six to a dozen interfingering beds, none of them commonly thicker than 1 to 2 m, in a total section of 30 to 50 m overlying the Basal Sandstone.

Seam No. 9 is relatively-continuous laying 70 m above the Basal Sandstone, but averages only 3 m, in thickness.

Seam No. 8, approximately 150 m above the Basal, is left un-eroded in only one small area, where it consists of an upper 6 to 7 m bed underlain by two other beds of 2 to 3 m each, the mineable coal estimated as 10 m total thickness in a zone approximately 18 m thick.

Seam No. 8 reserve is estimated to be 627,000 tonnes at 2.0:1 overburden ratio. Seam No. 9 reserve is estimated as 1,665,000 tonnes at 12.2:1, 8,933,000 tonnes at 19.8:1, and considerably more at higher ratios. No reserve figure has been prepared for the thin, interfingering beds of No. 10 Seam. These figures are for basic, in-place coal.

The fifteen coal licences composing Crown Mountain, held by Shell Canada Resources Limited and operated by Crows Nest Reosurces Limited (a wholly owned subsidiary of the former), are set out in Table No. 2, B.C. Coal Licences Tenure Standing, Crown Mountain, following. Since writing this report, the fiteen licences have been grouped into one new group (No. 265), and this new group comprises, as before, 2,561 hectares. Table 2 lists all licences and shows pertinent land information.

CROWS NEST RESOURCES LIMITED EXPLORATION

B.C. COAL LICENCES TENURE STANDING

BLOCK: CROWN MOUNTAIN PROJECT: YEAR: 1979-80

GROUP: # 265 DATE: JAN. 31, 80

CROWN MTN. KOOTENAY LAND DISTRICT

Project Name	Project Lics. Total No.	Project Area Total Hectares	Block Name	Block Lic. Total No.	Block Area Total Hectares	Group No.	Group Lics. Total No.	Group Area Total Hectares	Group Year	Licence No.	Legal Description	Licence Area Total Hectares	Acquisit'n Year	Fees $10^3	Rentals Annual $	Rentals Total to Next Ann. $10^3	Req. Work Expired $10^3	Current Year Lic. Year	Current Year $	Credit Year	Credit $	Anniversary Date	Budget Current Year AFE	Budget Current Year $10^3	Exp Total $10^3	Potl Shell Class.	Commitments, J.V. Other than B.C. Gov't Description	Remarks
CROWN MTN	15	2,561	CROWN MTN	15	2,561	265	15	2,561	80				74 75	170.0	12,805	50.9	120.0	5	$631,585	2½	209,642	JAN. 31	4951E 4951C	140	550.5	Y		TWO LAND MAPSHEET
										305	LOT No. 8287	259	75					5										WORK REQMT FULFILLED
										306	LOT No. 8518	259	75					5										TO JAN 31/81 UNDER COAL
										307	W 1/2 8519	130	75					5										ACT '74 TO JAN 31/82
										308	W 1/2 8520	130	75					5										UNDER COAL ACT '76
										309	E 1/2 8521	130	75					5										
										310	E 1/2 8522	130	75					5										
										311	LOT No. 8290	259	75					5										
										312	LOT No. 6443	259	75					5										
										313	S. OF 8289	259	75					5										
										365	W 1/2 6440	130	74					6										
										366	W 1/2 6441	130	74					6										
										367	LOT No. 6442	182	74					6										
										371	E 1/2 6781	130	74					6										
										372	E 1/2 8520	130	74					6										
										406	S. OF 6440 & 6443	44	74					6										
																WORK DONE $	PRIOR TO '78 141,627		1978 23,520		1979 164,118							
CROWN MTN		2,561 ha. 6,317 ac.																										

GENERAL REMARKS: FILL NECESSARY LINES AND COLUMNS ONLY. SHELL'S DEVELOPMENT POTENTIAL CLASSIFICATION IS "Y" (PRIME) UNLESS OTHERWISE STATED. SHELL CANADA RESOURCES LIMITED IS THE HOLDER, CROWS NEST RESOURCES LIMITED IS THE OPERATOR OF ALL LICENCES UNLESS OTHERWISE STATED. THIS TABULATION SHOWS CROWN COAL LICENCES ONLY. FREE-HOLD LANDS ARE TABULATED SEPARATELY. IF SUMMARY OF EXPENDITURES SINCE THE LAST ANNIVERSARY IS AVAILABLE, IT IS ENTERED IN BRACKETS ( ) UNDER REQUIREMENT WORK-CURRENT YEAR AND IS INCLUDED IN THE TOTAL EXPENDITURES, OTHERWISE THE WORK REQUIREMENT IS SHOWN IN THIS COLUMN, WHICH IS NOT INCLUDED IN THE TOTAL EXPENDITURES. SHELL COAL EXPENDITURES ARE ENTERED ACCORDING TO ACCOUNTING AND TIME SHEETS ($125 PER MAN-DAY). THE ACQUISITION COST OF CNI'S COAL HOLDINGS IS ENTERED ACCORDING TO SHELL'S COAL PREMIUM ALLOCATION. CNI'S $800,000 INITIAL ACQUISITION COST OF CROWN MTN., CENTRAL BLOCK (EXCEPT CL.1299-1302 INC.) AND NORTH BLOCK LICENCES IS DISTRIBUTED ON AREA BASIS: $62.51 PER HECTARE. OTHER CNPOG/CNI EXPENDITURES PRIOR TO FEBRUARY 24,1978 (FINAL APPROVAL OF CNI'S TAKEOVER BY SHELL) ARE INCLUDED AS REPORTED TO THE B.C. GOVERNMENT. IF LICENCES WERE RE-ISSUED THE ORIGINAL ACQUISITION YEAR IS SHOWN IN BRACKETS ( )

Table 2

1.3 Summary of Work Done

No geochemical or geophysical surveys were performed on Crown Mountain in 1979.

901.3 m of rotary drilling in seven holes were completed. Two of these holes were short core holes. Further details are contained in Table No. 5, 1979 Drill Program. Bit sizes range from 4 3/4" to 5 1/2". Sizes to particular depths are printed on the geophysical log headings.

Geophysical logs were run in all holes. Types of logs run in each and further details are contained in Table No. 6, 1979 Geophysical Logging.

Detailed geological mapping at a scale of 1:5,000 was performed, on the northern part of the group, using North West Survey Corporation's topographic sheets as the base. Over 50 km of chain-and-compass traverses were conducted. Details are drawn on the geological map, contained in the enclosures.

Geodetic location survey of 33 points (drill holes, trenches etc) proved the chain-and-compass survey to have been resonably accurate.

No prospecting was performed other than that undertaken during the normal course of geologic mapping. No linecutting was done and a grid (Figure 15) was established on paper only.

No adits were constructed. Seven trenches were dug, using a combination of hand trenching and a back-hoe. These were placed on relatively level ground only, and were positioned in all cases as "cross-section" trenchs in order to look at specific rock units - they were not, in

other words, "wild-cat" trenches. 1,024 m total was trenched, averaging 1 m in depth. All trenches were surveyed, by means of stakes marking particular units, and these points are located on the geological map. Individual trench geological logs are included as Appendix E. These logs contain, in addition to geology, compass directions and inclinations. All geologic units were measured along the trenches by 50-m chain.

1.4 List of Licences on Which Work was Performed

(A) Drilling: 371, 366, 312, 308

(B) Geological Survey: 371, 376, 366, 312, 365, 408, 310, 308, 372, Geological Reconnaissance: 309, 307, 306, 311, 305, 313.

(C) Geodetic Location Survey: 308, 372, 408, 365, 313, 367

(D) Trenching: 371, 312, 408, 367, 365.

2.0 GEOLOGY

2.1 General Geology and Formational Terminology

Crows Nest Resources Ltd. had two basic sources of geologic information on Crown Mountain at the beginning of the 1979 field season.

One was Price's (Geological Survey of Canada Map 35-1961) one inch to two miles map sheet on which the 14-km length of Crown Mountain measures as three inches. It presents the coal-bearing Kootenay Formation as several isolated erosional remnants in the Lewis thrust sheet, below Erickson Thrust, which is the next major thrust to the west Present Kaiser Resources operations are in the Erickson thrust sheet, due west from Crown Mountain.

The other was a complete set of excellent gamma-neutron logs from the eleven rotary drill holes put down by Crows Nest Industries in 1969. On these the "Basal Sandstone" (basal to the coal sequence), otherwise known as the Moose Mountain Member, stands out clearly. Fortunately the staff of the time were obviously following a policy of drilling to a known horizon, in order to put a firm base on the sequence. This has meant that relatively easy identification and correlation of major lithologic units (including the coal seams) could be done, once the structural study was completed and 1979's survey crew had tied in the old sites. On these sites only three of the original holes were not found.

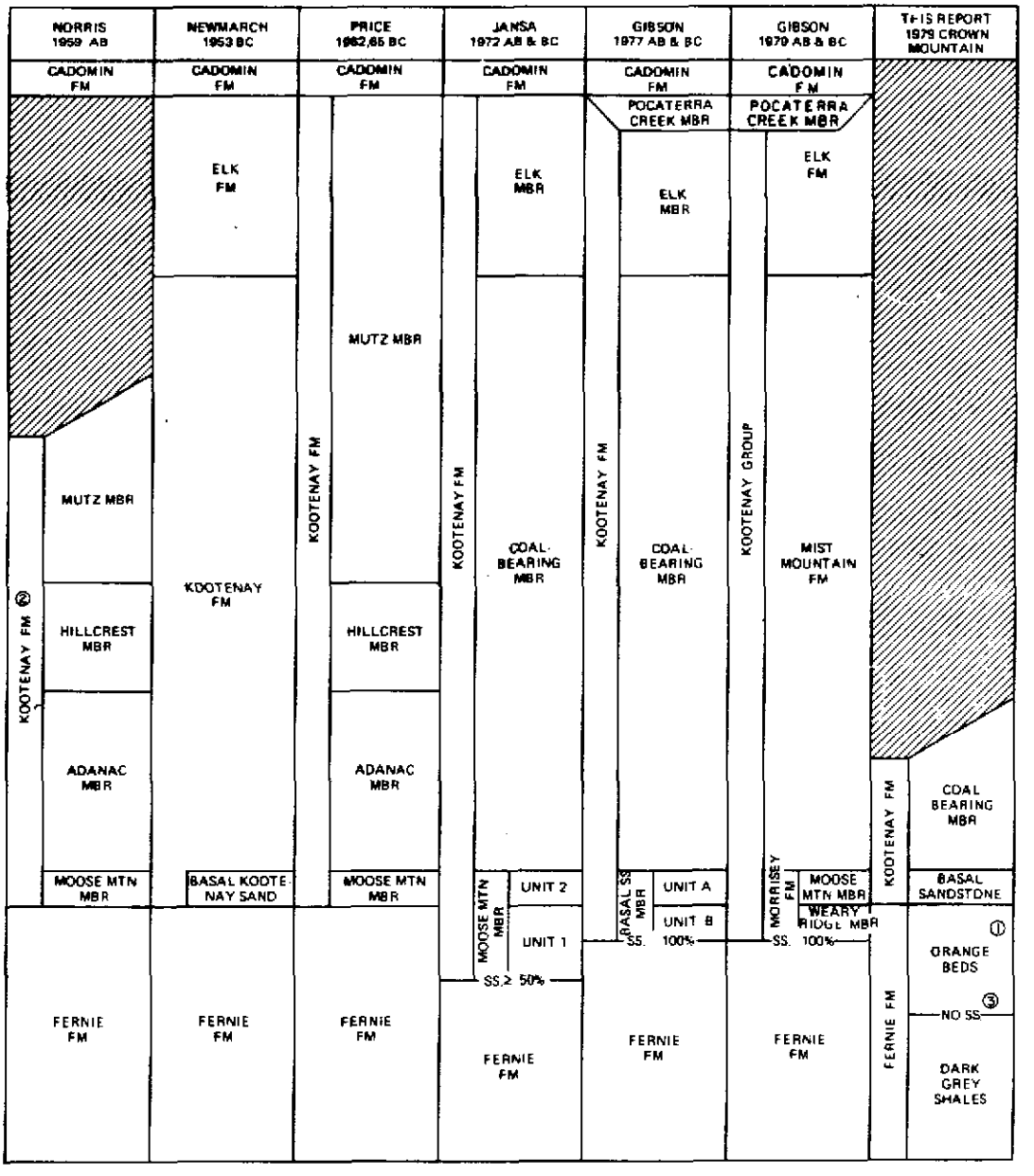
Prior to the field season, C.W. Drew of Sproule Associates prepared at a scale of 1:5,000, what turned out to be an excellent air photo interpetation showing the broad features of the Price map sheet better defined as to topography and detail.

Air reconnaissance quickly showed the basic interpretation to be correct. The Basal Sandstone stands out in prominent, lengthy cliff lines. Coal bloom showings are visible in the many kilometres of old, caving bulldozed trenching above the cliffs. The "Orange Beds" of the upper Fernie Passage Beds stand out distinctly in the cliffs beneath the Basal Sandstone and grade down into the darker lower shale section of the Passage Beds where the cliff bottoms merge into the talus slopes. Such Fernie sequence also stands out in two cliff lines which separate the Kootenay into two thrust-divided locations: the Top and Bottom Plates of the Crown Mountain Thrust, a local and not a regional movement.

The Formational Diagram, Figure 4, and the General Geologic Setting, Figure 5, both following, show general nomenclature and setting for this report.

2.2 Stratigraphic Section

The following (Figure 6) stratigraphic section of Crown Mountain combines essentially two rock unit characteristics - thickness and topographic prominence - and ties them to Gibson's 1977 and his new 1979 formational terminology through the coal belt of southeast British Columbia. As the emphasis in the mapping was structural the writer mapped those features of such quality and in such directions on the ground as would allow the construction of the structural cross-sections. Each of the units drawn on the stratigraphic section is identifiable on the gamma-neutron logs (view the correlation chart, enclosures).



① "Orange Beds" - Gibson (1977, pp 772) describes colour as "weathering to a distinctive orange to yellow-brown colour".

② Name "Kootenay" from Dawson, 1886.

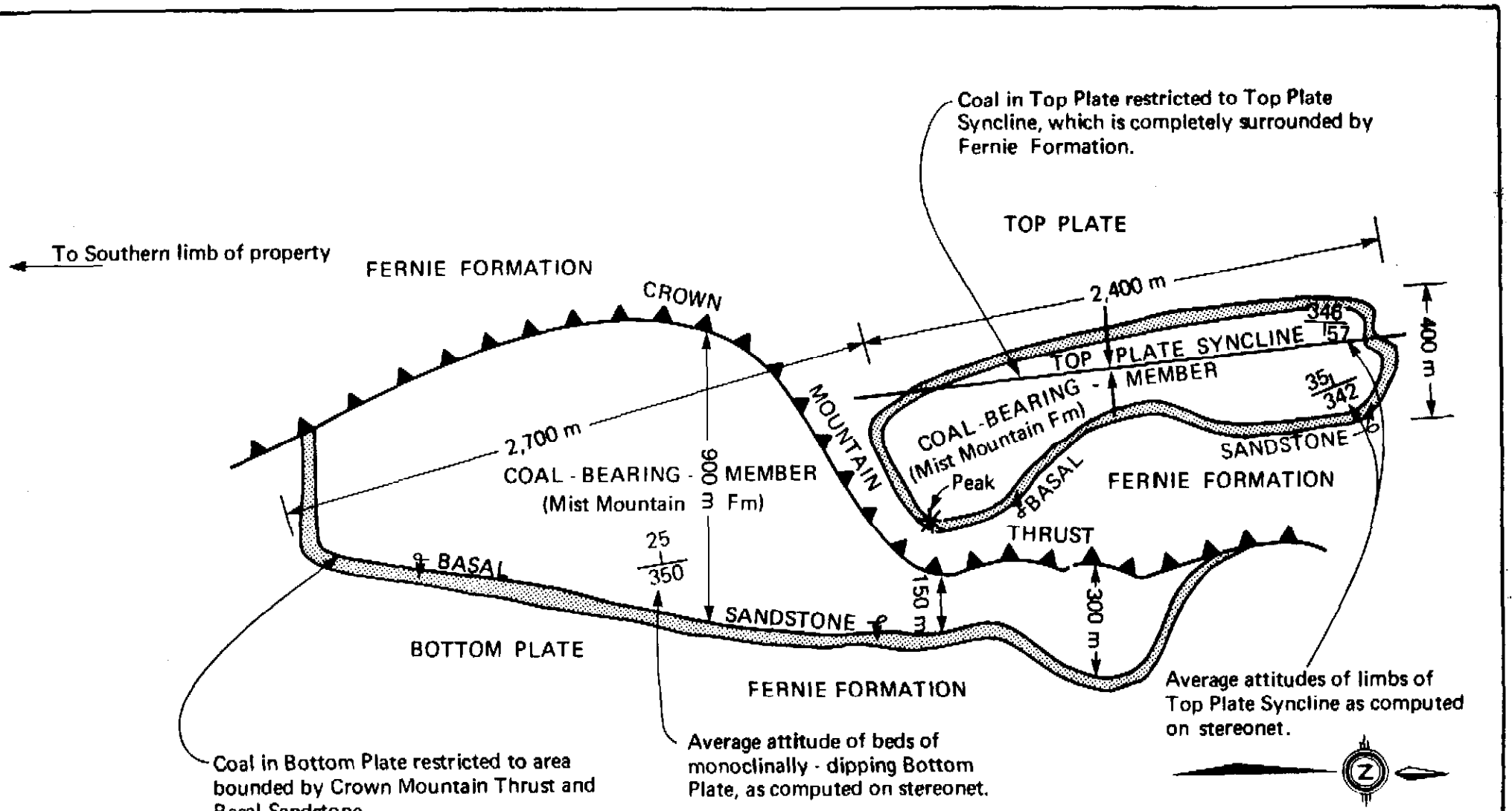
③ Contact between Orange Beds and dark grey shales taken where the colour on weathering changes from orange-brown to dark brownish-grey, which is approximately where interbedded fine ss, slt, and sh becomes entirely slt and sh.

Crows Nest Resources Limited
EXPLORATION
SE BRITISH COLUMBIA

FORMATIONAL DIAGRAM
CROWN MOUNTAIN

FIG. 4

AUTHOR D E BELL | SCALE N.T.S | ENCLOSURE No.
DATE DEC /79 | REVISED | DRAWING No. HF-42
TO ACCOMPANY



Crows Nest Resources Limited
EXPLORATION
SE BRITISH COLUMBIA

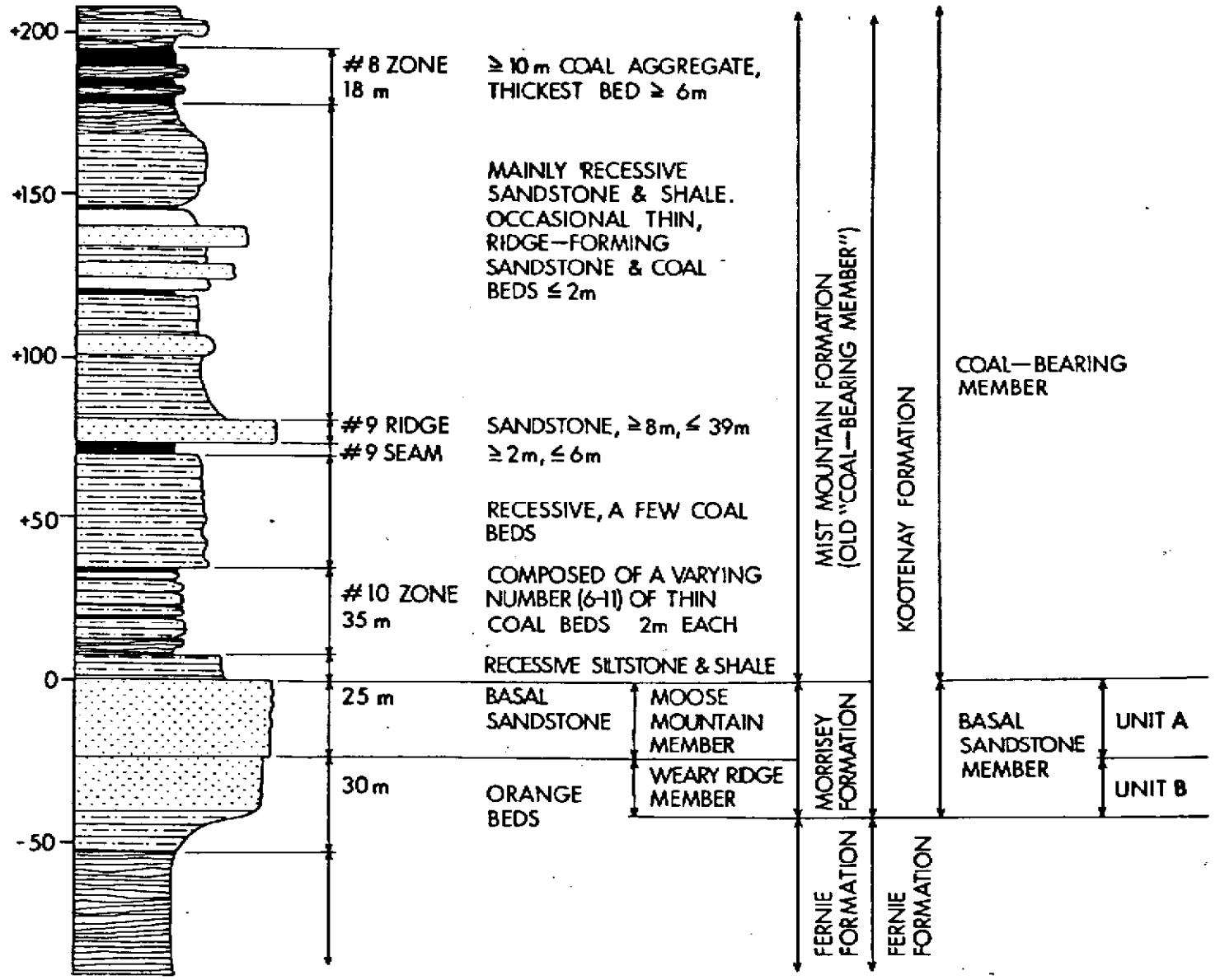
GENERAL GEOLOGICAL SETTING
CROWN MOUNTAIN

FIG. 5

AUTHOR D.E. BELL	SCALE N.T.S.	ENCLOSURE No.
DATE DEC '79	REVISED	DRAWING No. HF-42A
To Accompany		

STRUCTURAL CROSS SECTIONS
THIS REPORT

GIBSON, 1979 GIBSON, 1977



LEGEND

COAL

SANDSTONE; HARD, MASSIVE, & PROMINENT

FINE SANDSTONE, SILTSTONE, & SHALE INTERBEDDED

SHALE

FIG. 6

CROWN MOUNTAIN
STRATIGRAPHIC SECTION
D.BELL SCALE(VERTICAL)1:2000

80 03 03

2.2.1 Fernie Formation

This is labelled as "F sh" or "Fernie Shales" on the geological map and sections. It is Price's lower Passage Beds, and is a thick unit of medium-dark gray shales and siltstones. It is characterized by monotony and recessive, crumbly weathering. Wildly-oriented small-scale folds often show its incompetence. Bedding can be tricky to determine. It is distinctive and easily identifiable.

2.2.2 Orange Beds

The Orange Beds weather to an extremely distinct orange-brown hue. The colour starts appearing through approximately 30 m of the upper-most portion of the Passage Beds' grey shales and ends sharply against the light grey of the Basal Sandstone. This change is so abrupt that usually it can be placed to the centimeter. The Orange beds become increasingly resistant and are only slightly less resistant than the Basal beds at their contact. There is frequently an old erosional surface visible at this contact, but not always. Grain sizes start at very fine, and range occasionally to coarse at the contact. Due to the weathering pattern, it is usually impossible to knock off an orange bed thicker than about 3 cm, whereas with the overlying Basal, it is usually impossible to break it into beds at all.

2.2.3 Basal Sandstone

The Basal Sandstone is, in a sense, the "key" lithologic unit in the Crown Mountain section (as it is on many of Crows Nest's south-eastern B.C. properties). It is topographically the most visible and most widespread unit. It is consistent, and doesn't like to bend easily. It stands out in prominent cliff lines much of the time, and elsewhere usually it may be followed by close inspection of the rubble and the ground under the forest litter.

It is an extremely hard, light-grey (in both weathering and on fresh surface), fine to medium (occasionally coarse) sandstone. Individual beds range to 1.5 m. No pebbles were seen. It is so competent that the geologist's pick tends to bounce back from it with a loud ring. Rotary drills slow down to a meter or two an hour in it. It is easily identifiable in the cuttings. Cross-bedding is normally present but not in fine scale. Current structures are absent. Its general aspect is monolithic.

There are two common shaley intervals (the upper one coaly) which stand out as recessive breaks in the cliff lines. No coaly particles or fragments were seen within the sandstone itself. The gamma-neutron logs show it to be an extremely clean sandstone, relative to those sandstones above it with which it might at first be confused.

2.2.4 Recessive Unit Between Basal Sandstone and No. 10 Zone

This unit is 5 to 10 m of coal-less siltstone and shale.

2.2.5 No. 10 Zone

The Line Creek region's No. 10 seam is represented on Crown Mountain by a unit of dark and coaly shales containing, through its average thickness of about 35 m, usually from six to eleven (sometimes more) definite coal beds. They range in thickness from a few centimeters to about 2 m, rarely more. Total coal is usually about 7 m. This unit takes up much of the structural "slack" above the hard-to-bend Basal Sandstone and, in outcrop, is almost always seen to have been pushed around.

2.2.6 Recessive Unit Between No. 10 Zone and No. 9 Seam

This unit is a variously-hued section of siltstones, shales, and some fine sandstone. Bedding is usually 5 cm or less. Coaly fragments, blebs, and stringers are common. Rippling and other current structures are often outlined by wispy coal bedding. The unit is neither particularly prominent nor as recessive as the other shaly units. Occasionally, as both outcrop and the gamma-neutron logs show, there are one or more coal beds approaching 2 m in thickness in this unit, but none seem reliably continuous over more than a few hectares.

2.2.7 No. 9 Seam

No. 9 Seam stands out unmistakeably both on the gamma-neturon logs and in the field. Much of the old bulldozer work was placed to follow its hanging wall contact, where it touches abruptly the overlying No. 9 Sandstone. It is continuous through both Top and Bottom Plates.

No. 9 Seam thickness averages about 3 increasing to 4 or rarely 5 m towards the northerly half of the mountain, and decreasing to 1.5 m in the southern-most drill hole (no. 69-35). In the northern half of the area, gamma-neutron logs show a distinctive parting running up to 70 cm in thickness.

2.2.8 No. 9 Sandstone

No. 9 Sandstone is a light-grey weathering sandstone of appearance difficult to distinguish from the Basal Sandstone both at first and from a distance. This unit is less massive, hard and continuous than the Basal Sandston with one exception. The grain size is similar (fine to medium, occasionally coarse).

What does distinguish this unit from the Basal, infallibly, is the appearance (often faint, often prominent) of current structures (rippling, channeling) and coaly fragments, blebs, twig, and branch casts. Some of the these latter can be very striking. Often the geologist must search carefully for any of these features.

On the gamma-neutron logs the No. 9 Sandstone does not appear even remotely similar to the Basal Sandstone, and indeed does not look at all like a massively-prominent sandstone which forms its own boulder patches and small cliff lines. It looks rather like a hard siltstone on the logs.

The No. 9 Sand is about 10 m thick in the Bottom Plate, and at one point in the Top Plate is approaches 30 m. It fits the sedimentological description of a distributary, or river-channel sand.

2.2.9 Mainly Recessive Unit Between No. 9 Sandstone and No. 8 Zone

This unit is a mixed collection of interfingering sandstones, siltstones, and shales, of various colours and topographic expressions. Often individual sandstone units gain prominence and appear as hard and resistant as the No. 9 Sand, but they are neither as continuous nor as massive. One in particular occurs in the Top Plate and forms the "north peak." They were useful in mapping, as several of them are followable on the ground through a kilometer or more.

2.2.10 No. 8 Zone

The property's No. 8 Seam is, at a minimum, 5 m thick, but occurs only (because of erosion) in the Top Plate. There is a zone, however, containing 18 m of section (range: 15 to 25 m) enclosing at least 8 m and possibly as much as 14 m of coal in total. In backhoe trenches and in drill holes the zone never twice appeared quite the same,

but there is always one seam of at least 6 m in thickness with at least one more of 2 m or more. In the holes the dips are not certain, and so true thickness cannot be accurately stated at depth. The outcrop shows a great amount of sliding and cracking of the section containing the zone, a reflection of the zone's limited extent and position near the hinge of the Top Plate Syncline. The writer's structural drafting showed that the asymmetry of the syncline requires the beds near the axis to be under stress and it is his opinion that what was once probably a relatively simple bed now is to be found only as a system of pushed-about partial remnant beds. This may mean a "bulk" approach will have to be taken towards mining the zone.

2.2.11 Above No. 8 Zone

Section above No. 8 Zone is found only in a few outcrops and in one backhoe trench (No. 3), and only in the Top Plate. It is mainly brownish-grey fine sandstone and siltstone, somewhat prominent, and contains only a few thin coal beds, running to several centimeters in thickness. Its main exposure is where old bulldozed trenching followed No. 8 Zone's hanging wall contact with an overlying ledge-like 2-m sandstone for 100 m at the south end of Top Plate Syncline.

2.3 Geological Mapping Program

The mapping program was conducted on the 1:5,000 contour sheets provided by North West Survey Corporation. As a structural emphasis was to be placed on the mapping, very complete foot reconnaissance was carried out, in order that a series of chain-and-compass traverses could be conducted. Relief in these traverses was accounted for by using hand-

held clinometers and trigonometrically correcting chain measurements. Approximately thirty km of these traverses are presented on the base map. They, combined with the thirty-three surveyed points (drill holes, trench stakes, and several stakes marking important contacts) providing elevation control, form the basis of the twenty-three structural cross-sections prepared as part of this report.

Mapping policy was to initially chain one of two easily-followable contacts: the top bed of the Basal Sandstone, or the grey-orange contact between the Basal and the underlying Orange Beds. Measurement showed the Basal Sandstone to be approximately 25 m thick, and the Orange Beds to be approximately 40 to 50 m thick.

As Kootenay beds of both the Top and Bottom Plates occur as erosional remnants, this contact-mapping allowed a precise encirclement of the Kootenay to be drawn. It is estimated that any point on these two contacts drawn on the geological map is accurate to 20 m horizontally and 10 m vertically 75% of the time, and the remaining percentage will be out no more than double these figures.

Further chained traverses were done at selected locations to provide cross-sectional outcrop mapping. Seven trenches were dug, using a combination of backhoe and hand labour, to tie in the section visible in the many kilometers of old caved trenching.

Finally, all outcrops along the main trail, which winds up from the north then along and back down through the property, were chained in.

The combination of surveying and field chaining allow an accuracy of 10 m horizontally and 5 m vertically on most of the trail and trench information. Occasionally the range will be double these figures, rarely more. It is important to note that on the geological map the chained line along the trails often differs from the dashed line locating the trails on the contours; the chained line is correct, and not the dashed line as shown, which appears to be a North West Surveys Corp. hand sketch. Also to be noted here is that the writer encountered no inaccuracies in plotting the thirty-three surveyed points on the contours themselves - the surveyed elevations agreed in every case to within one contour line (5 m).

The theory embodied by the mapping of known section at well-determined elevations and locations combined with the angular information derived from the stereographs constitutes the basis for the structures and their positioning on structural cross-sections. Structures were drawn first, using the Basal Sandstone as the key unit. It was positioned in elevation by using many kilometers of chained top and bottom contacts. The contacts were extended away from these points by using angles determined by the stereographic analysis and formed into structures as determined again by the analysis. To do all this a grid and origin point were established (on paper only); this is described in a further section.

The basic positions and sequences of the coal seams were then drawn on the cross-sections. As a final step, the drill holes were added to check and balance the interpretation.

Happily, the coal seams (and the other major lithologic units) coincide to within 25 m in virtually every case. This figure is well

within the limits of the chaining and stereographic operations, and so it seems that there are no major structural problems or surprises of larger than that scale in store on Crown Mountain in the future.

A structural contour map of the 8 and 9 seams has been prepared from the cross-sections and is presented in the appendices.

2.3.1 Stereographic Analysis

To draw cross-sections in which the geologic units appear in their true positions, thicknesses, and dimensions it is necessary to known the structures involved,otherwise there is little chance that the information presented, even if interpreted correctly, will be anything more than a hand sketch. In addition, most of the angles will be to some extent apparent in nature, and probably in varying amounts.

Drawing the structures with no apparent aspect implies that the cross-sections must be drawn parallel to the direction from which the structures have come. To identify this direction, stereographic analysis was applied to the hundreds of strikes and dips collected along the kilometers of chained traverses. The procedure was as outlined in Golder and Associates' Line Creek Ridge Feasibility report. Their facilities were used to prepare computer-generated scatter diagrams and contoured point diagrams (both following).

The attitudes were run in four different sets. The first division was into Top Plate or Bottom Plate, and then the Basal and Orange Bed strikes and dips were separated in each plate and run as separate sets; that is, each plate had one run with <u>all</u> strikes and dips (trenchs, isolated outcrops, chained contacts - everything except Fernie),

and one run with everything removed except for Orange and Basal. The Basal and Orange were run separately as these competent units form the back-bones of the structures and are least disturbed.

2.3.1.1 Bottom Plate

The Bottom Plate structurally resembles a monocline. The Basal-only computer run (Figures 7 and 8, BBSS - Bottom Plate Basal Sandstone) had the "slash" or "averaging" option applied, which is effective in layer-cake monoclinal situations only, and so no judgement had to be applied in selecting the average strike and dip. The computer-generated scatter diagram has the average pole printed as a slash, and there is only one slash per data set run.

The run with all Bottom Plate atttiudes (Figures 9 and 10, BBSS + BPCM - Bottom Plate Sandstone plus Bottom Plate Coal Member) also has the slash printed. Although this set's strike differed by only 2.01 degrees, which doesn't have much effect on the sections, the dip decreased by 4.31 degrees, which is definitely significant on the sections, as it considerably thins the down-dip coal-bearing section available (i.e. un-eroded).

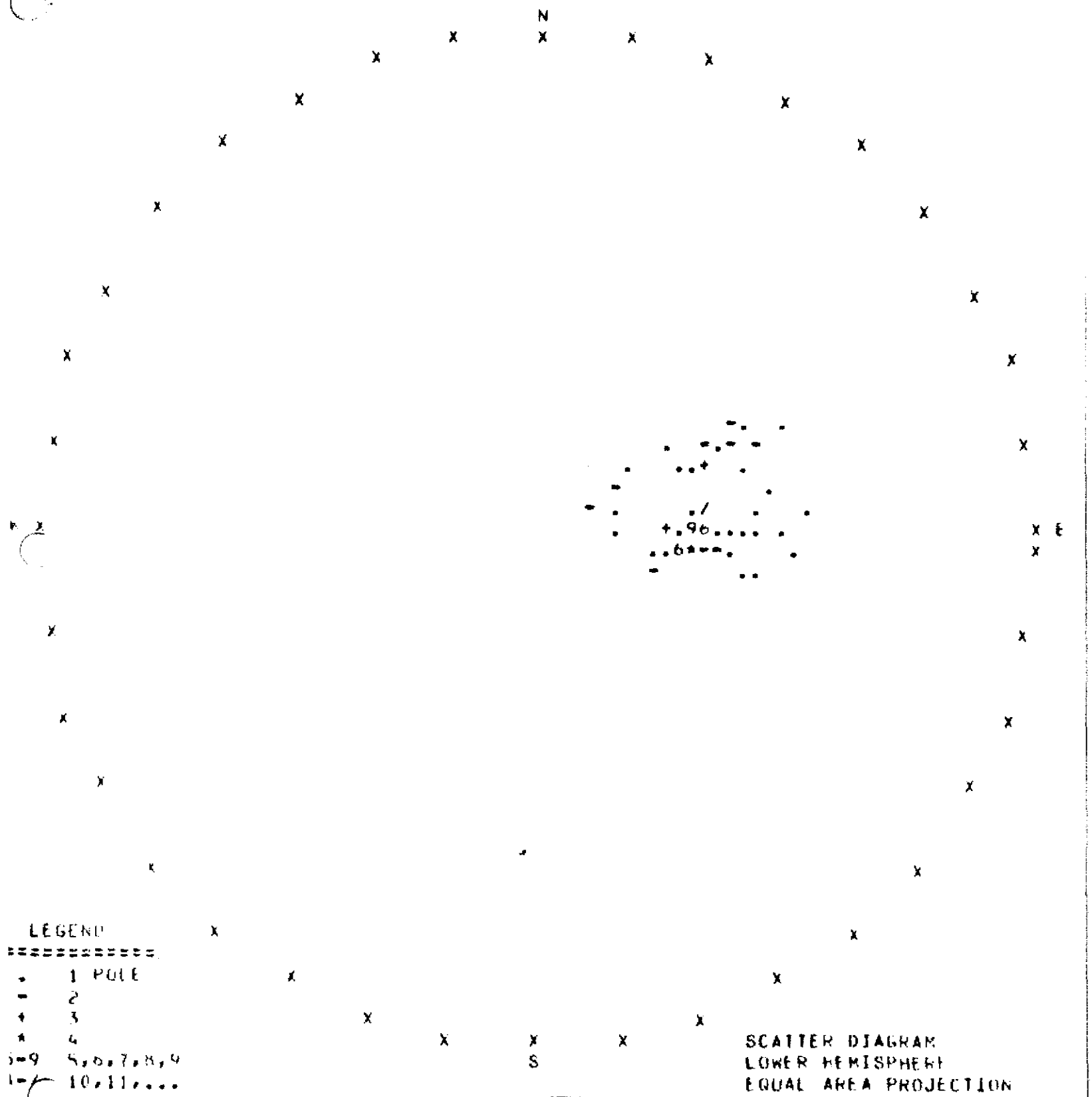
TABLE NO. 3 BOTTOM PLATE BEDDING ATTITUDES

	Basal Only (BBSS)	All Attitudes (BBSS + BPCM)
Average Strike	350 true	352 true
Average Dip	26.6 west	22.3 west
Strike Range	48 (332 - 020)	46 (334 - 020)
Dip Range	18 (16 - 34)	24 (10 - 34)

STEREO 7921454A -- CROWN MOUNTAIN 1979 BEDDING ATTITUDES.

TRAVERSE - BESS

76 ORIGINAL POLES



LEGEND

. 1 POLE
- 2
+ 3
* 4
5-9 5,6,7,8,9
1-/ 10,11,...

/ MEAN VECTOR = 63.43/ 80.17
-90.00 +270.00
26.57 350.17
AVERAGE DIP AVERAGE STRIKE

SCATTER DIAGRAM
LOWER HEMISPHERE
EQUAL AREA PROJECTION

FIG. 7

SCATTER (POLE) DIAGRAM
BOTTOM PLATE BASAL SANDSTONE

D. E. BELL, FEBRUARY, 1980

AA-4

STEREO 7921454A -- CROWN MOUNTAIN 1979 BEDDING ATTITUDES.

TRAVERSE - BBSS

AVERAGE STRIKE: 350°
AVERAGE DIP: 26.6°
STRIKE RANGE: 332°-020° (48°)
DIP RANGE: 16°-34° (18°)

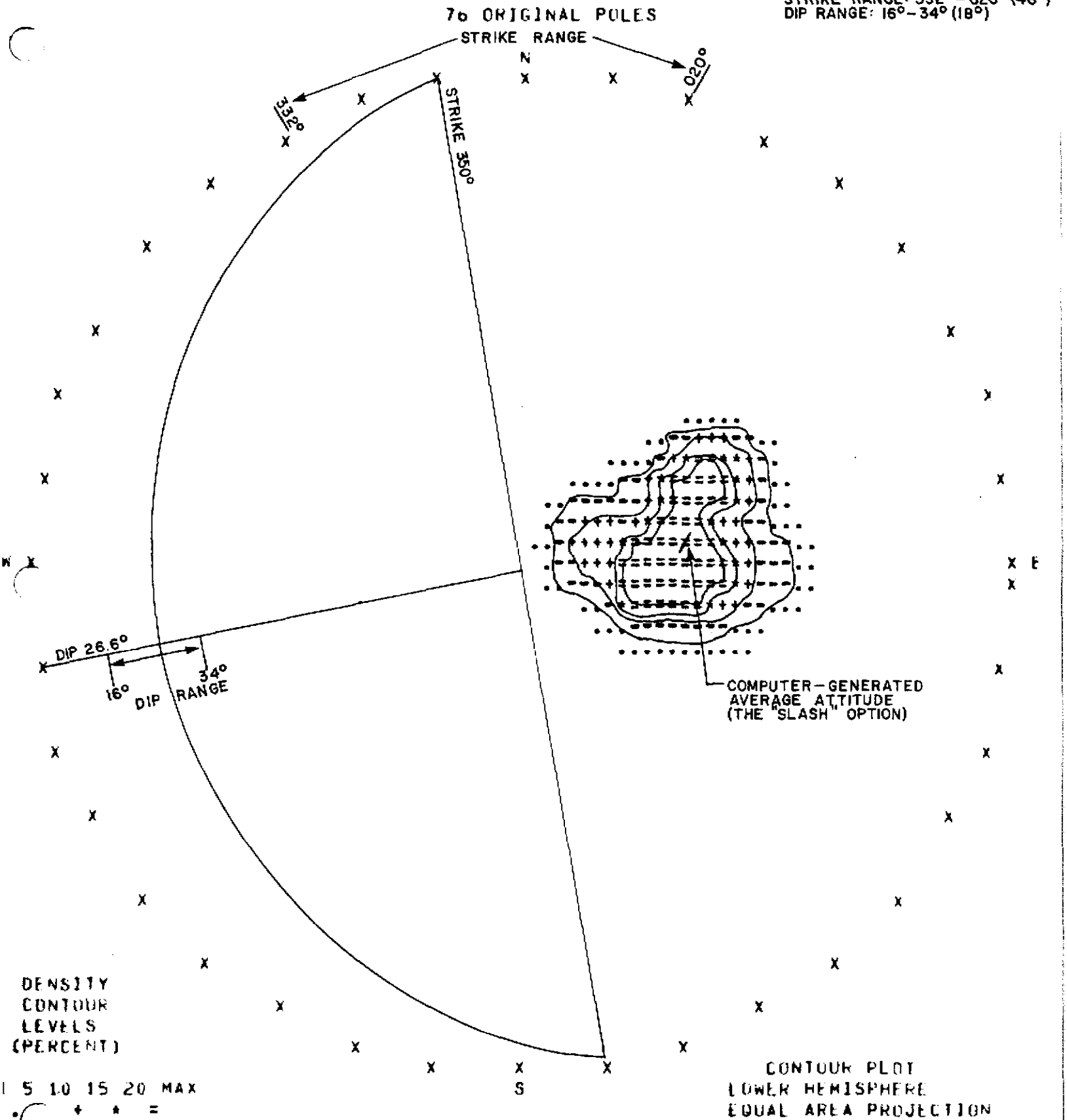


FIG. 8

CONTOURED POINT DIAGRAM
BOTTOM PLATE BASAL SANDSTONE

D. E. BELL, FEBRUARY, 1980

AA-430

-90.00
22.26°
AVERAGE DIP

+270.00
352.18
AVERAGE STRIKE

FIG. 9
SCATTER (POLE) DIAGRAM
BOTTOM PLATE
ALL ATTITUDES EXCEPT FERNIE FM

D. E. BELL, FEBRUARY, 1980

AVERAGE STRIKE: 352°
AVERAGE DIP: 22°
STRIKE RANGE: 334°–020°(46°)
DIP RANGE: 10°–34° (24°)

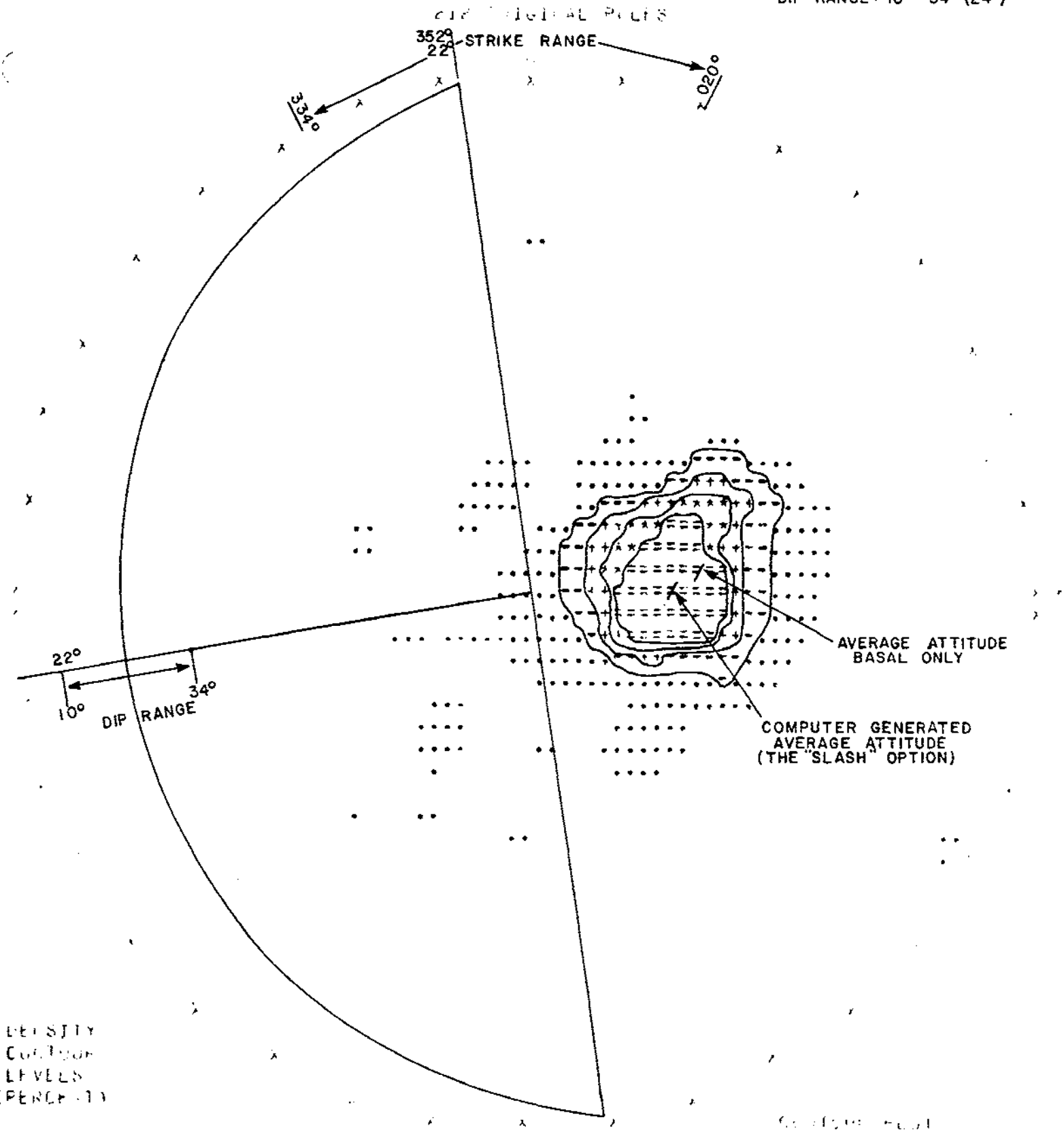


FIG. 10
CONTOURED POINT DIAGRAM
BOTTOM PLATE
ALL ATTITUDES EXCEPT FERNIE FM

D. E. BELL, FEBRUARY, 1980

The difference in dip may be accounted for in one of two ways that the writer can see. First, the Basal-only run had attitudes collected from, mostly, the cliff section along the east side of the plate, and they were certainly as steep as 26 degrees; but on the south edge of the plate where the Basal is eroded in an east-west line and runs almost to the west edge, the dips do gentle out to a figure much less. Cross-sections 3,000 South and 3,200 South show the dips to decrease to 19 degrees and then 16. In other words, the Basal attitudes were collected in a relatively restricted area, which happened to have steeper attitudes on the average.

Secondly, the second run with all strikes and dips included (BBSS + BPCM) - showing the 22-degree dip - included many attitudes from the topographic surface spread over the plate. That is, this set is more representative taken on the whole.

It should be noted that on the two scatter diagrams the print-outs in the lower left-hand corners for the "/ MEAN VECTOR" (dip and dip direction) express a programming error and the complement must be added to the dip (that printed is dip off vertical) and 180 must be added to the figure for compass direction true of the dip direction and either 90 or 270 for the strike.

2.3.1.2 Top Plate

The Top Plate is composed of one large structure overall - the Top Plate Syncline. The syncline is assymmetric, trends roughly north-northwest - south-southeast (true), and the west limb is steeper than the east limb.

The two sets of Top Plate diagrams (TBSS - Top Plate Basal Sandstone and TBSS + TPCM - Top Plate Basal Sandstone plus Top Plate

Coal Member) appear very similar, as do the two sets of diagrams for the Bottom Plate, except for again one significant difference: the syncline shows opposite plunge directions in the two sets.

TABLE 4 TOP PLATE BEDDING ATTITUDES
TOP PLATE SYNCLINE

	Basal Only (TBSS)	All Attitudes (TBSS + TPCM)
East Limb	strike 348, dip 34 west	strike 342, dip 35 west
West Limb	strike 342, dip 55 east	strike 347, dip 57 east
Plunge	02 degrees at 344 true	01 degree at 165 true

In interpreting the diagrams, it was decided to disregard the southern half of the syncline, as all section except Basal and Orange is eroded and missing, and the syncline is changing character as it nears the Crown Mountain Thrust.

The difference in plunge between the two sets is only three degrees, which is not of great significance in itself. The change in direction of this plunge, however, is interpreted to indicate a normal condition in folding in thrusted structures - plunges tend to reverse in a vertical sense as well as a horizontal sense. The structural contour map for No. 8 Zone shows that the syncline is indeed plunging southerly at No. 8's elevation, at perhaps four to five degrees. Had the set TBSS + TPCM been run without the Basal strikes and dips, a more precise determination may have been found.

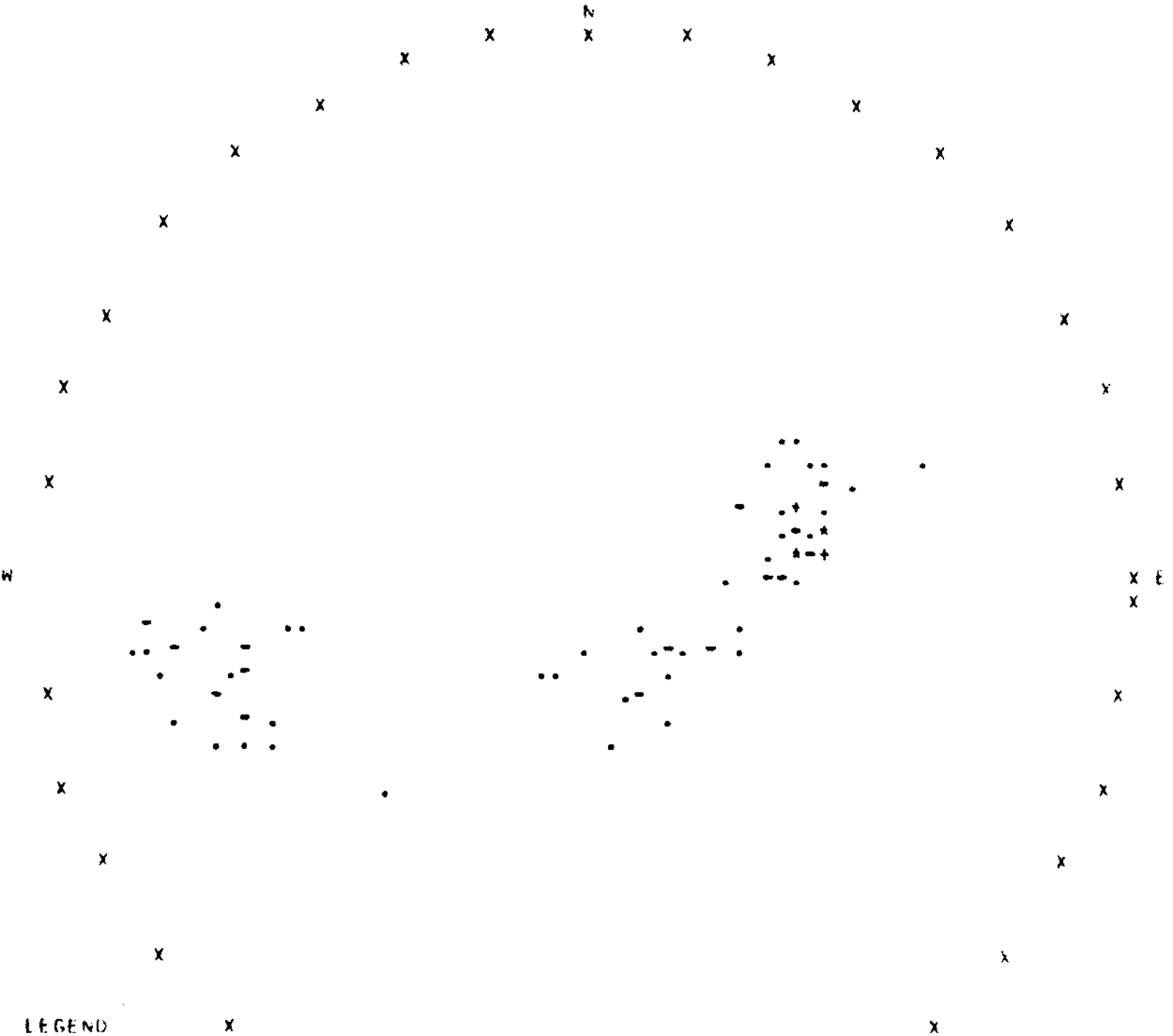
2.3.2 Choosing a Baseline

A baseline of 347 degrees true was chosen for the property, as this direction would most suit the upper elevations of the Top Plate

STEREO 7921454A -- CROWN MOUNTAIN 1979 BEDDING ATTITUDES.

TRAVERSE - TBSS (TOP PLATE, BASAL SANDSTONE ONLY)

84 ORIGINAL POLES



LEGEND

.	1 POLE
-	2
+	3
*	4
5-9	5,6,7,8,9
A-	10,11,...

SCATTER DIAGRAM
LOWER HEMISPHERE
EQUAL AREA PROJECTION

FIG. 11
SCATTER (POLE) DIAGRAM
TOP PLATE BASAL SANDSTONE

D. E. BELL, FEBRUARY, 1980

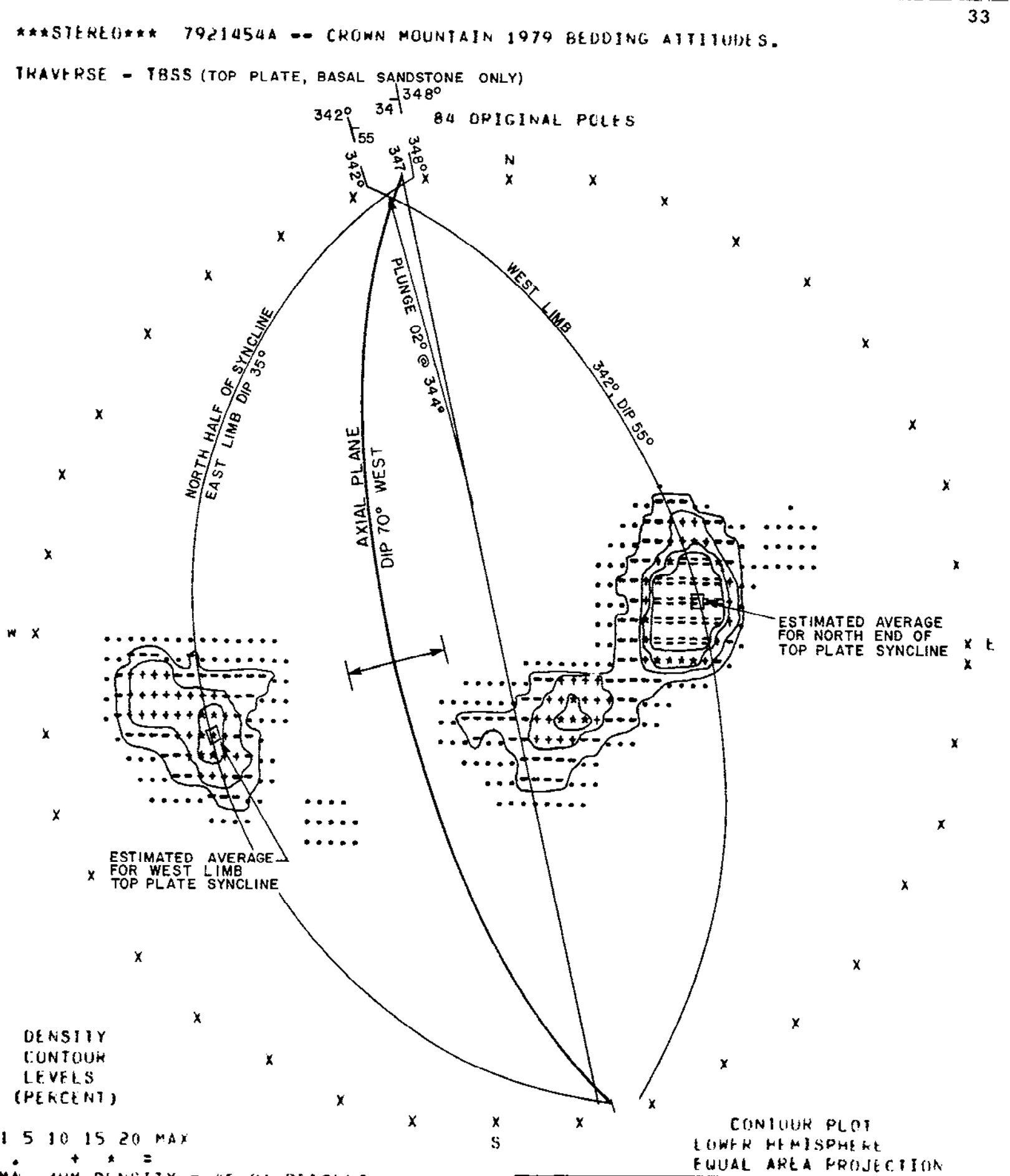


FIG. 12

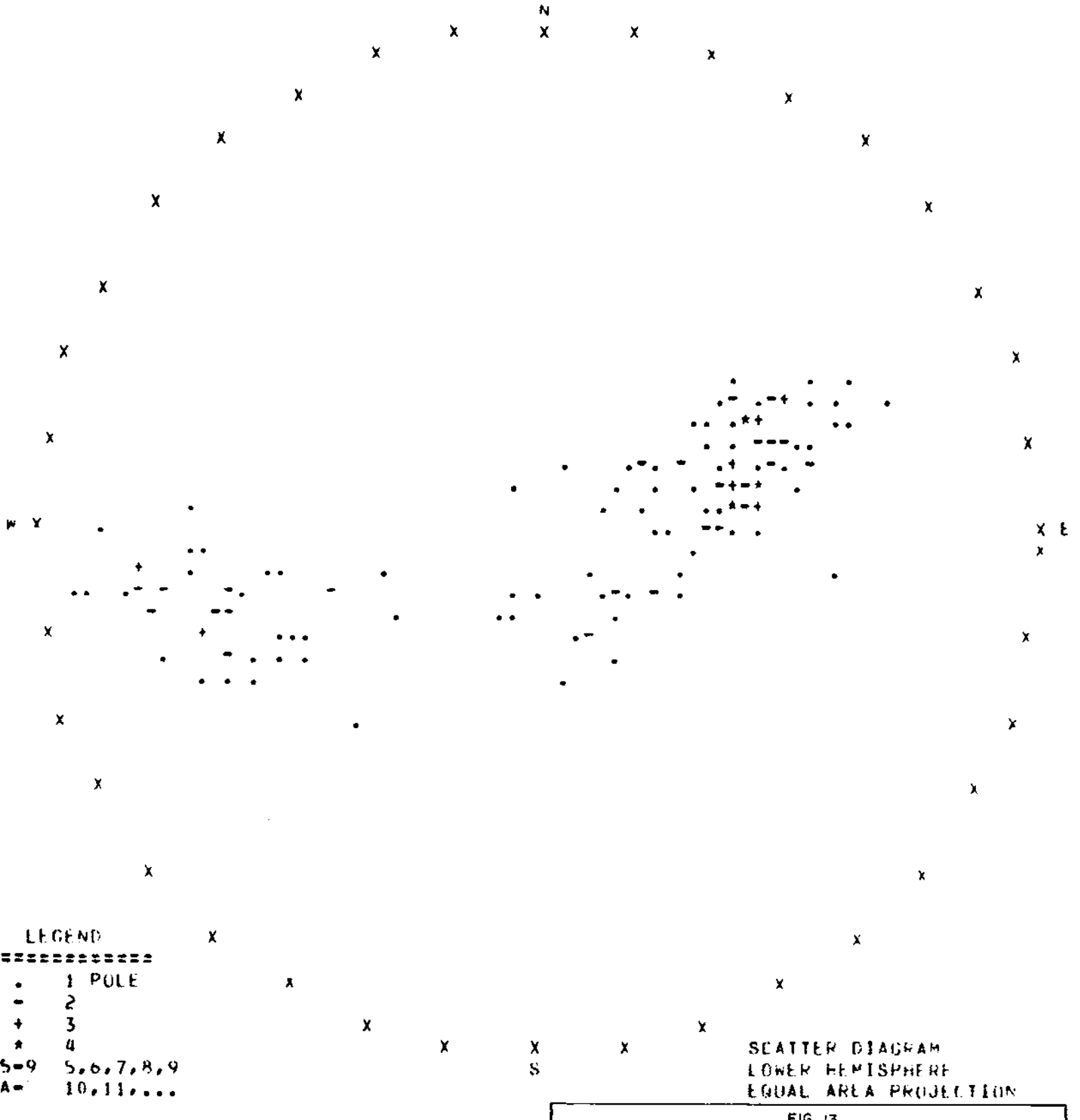
CONTOURED POINT DIAGRAM TOP PLATE BASAL SANDSTONE

D. E. BELL, FEBRUARY, 1980

STEREO 7921454A -- CROWN MOUNTAIN 1979 BEDDING ATTITUDES.

TRAVERSE - TBSS + TPCM (ALL ATTITUDES FROM TOP PLATE)

158 ORIGINAL POLES



LEGEND

.	1 POLE
-	2
+	3
*	4
5=9	5,6,7,8,9
A=	10,11,...

SCATTER DIAGRAM
LOWER HEMISPHERE
EQUAL AREA PROJECTION

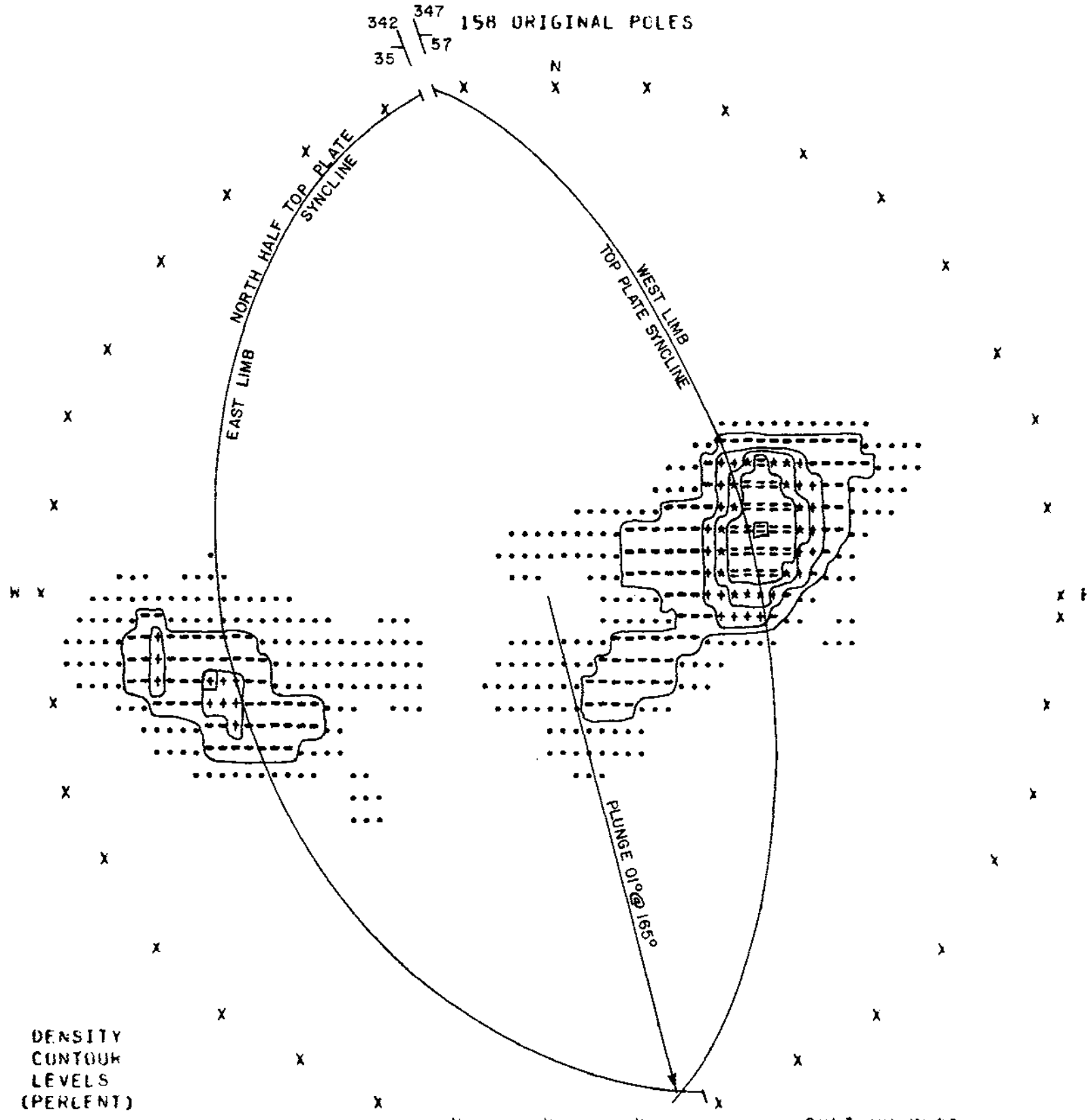
FIG. 13

SCATTER (POLE) DIAGRAM
ALL ATTITUDES EXCEPT FERNIE FM

D. E. BELL, FEBRUARY, 1980

STEREO 7921454A -- CROWN MOUNTAIN 1979 BEDDING ATTITUDES.

TRAVERSE - TBSS + TPCM (ALL ATTITUDES FROM TOP PLATE)



DENSITY CONTOUR LEVELS (PERCENT)

1 5 10 15 20 MAX

. + * =

MAXIMUM DENSITY = 30.37 PERCENT

CONTOUR PLOT
LOWER HEMISPHERE
EQUAL AREA PROJECTION

FIG. 14
CONTOURED POINT DIAGRAM
ALL ATTITUDES EXCEPT FERNIE FM

D. E. BELL, FEBRUARY, 1980

syncline. It is this portion of the syncline that contains No. 8 Zone, at present the best mining situation from the point of view of overburden ratios (see Reserves).

The best baseline direction for the Bottom Plate would be 352 degrees but it has been judged that the distortional effect of the five degrees' difference would not affect the sections greatly, as the dips are much lower than the Top Plate's and the overburden ratios are much higher for the thin No. 9 Seam.

2.3.3 Locating the Grid

Origin point for the grid was chosen at Crown Mountain's peak, 2266.5 m. as it is definable on the ground (i.e. it is not a "flat" peak) and it offers a commanding view of much of both plates.

2.4 Geological Map and its Legend

The geological map is a synthesis of lithologic, structural, and topographic detail. On it are all strikes and dips included in the sterographic study, except those clustered in too small an area to be legibly printed on the 1:5,000 scale.

The grid is overlaid on the geological map, and only those cross-sectional lines for which structural cross-sections have been prepared are presented.

The legend for the geological map is presented on the following pages, as it is too large to be printed on the map itself.

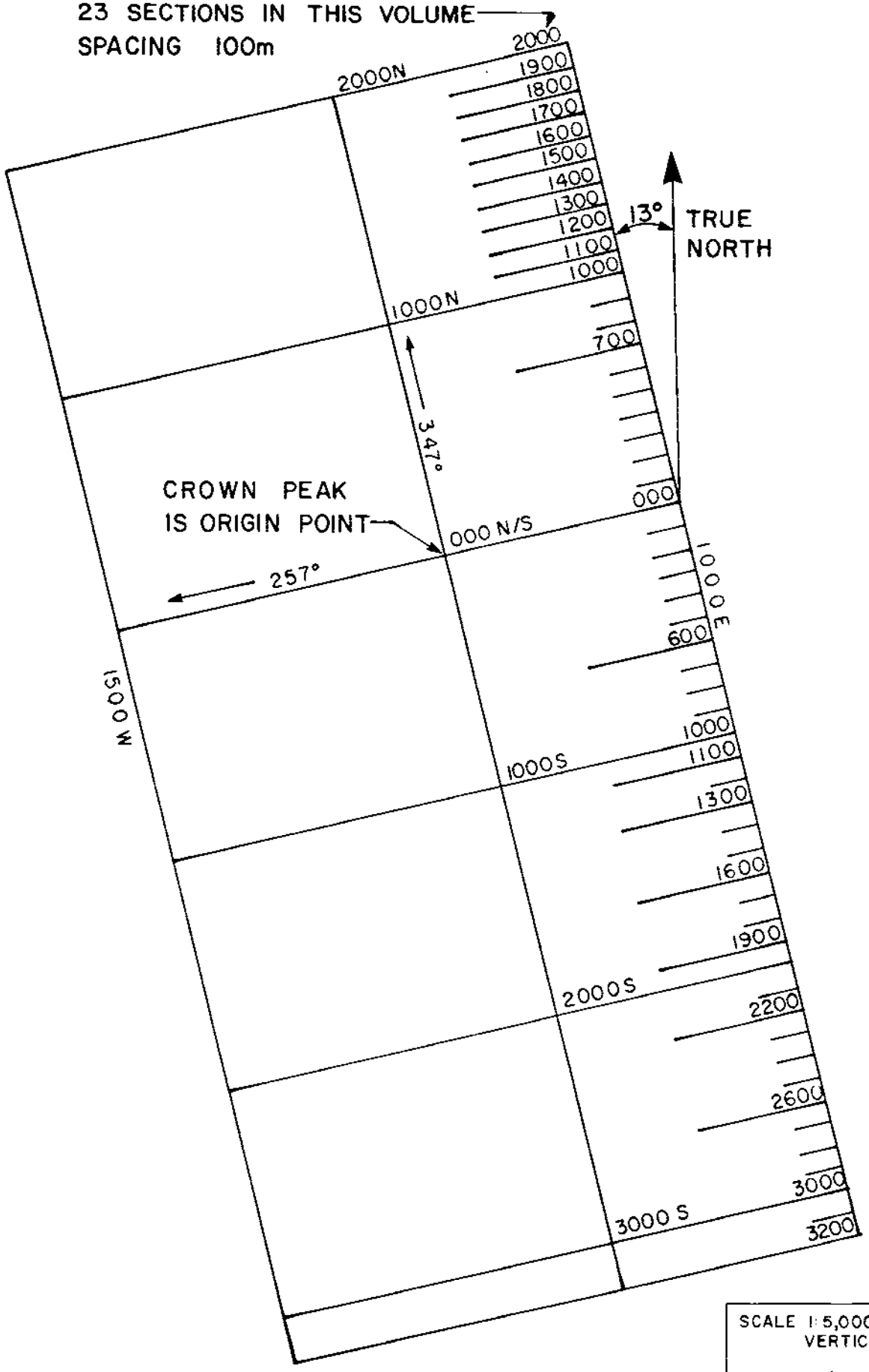


Fig. 15

LEGEND

SCALE 1:5,000
VERTICALLY & HORIZONTALLY

SECTIONS' STRIKE: 257° TRUE

SECTIONS' DIP: VERTICAL

BASE LINE: 347° TRUE

VIEW: NORTHWESTERLY

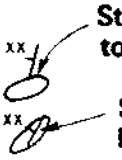
DENNIS E. BELL, FEBRUARY, 1980

LEGEND
CROWN MOUNTAIN
1979 FIELD BASE MAP

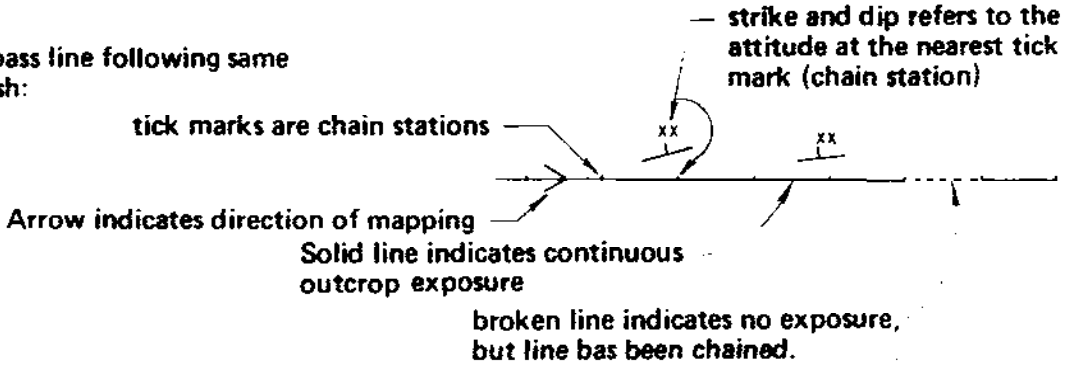
Scale: 1:5000
DENNIS E. BELL
JANUARY 1980

OUTCROP LOCATION:

A. Isolated outcrop, sketched to extent and size, and position chained from nearest chain line:

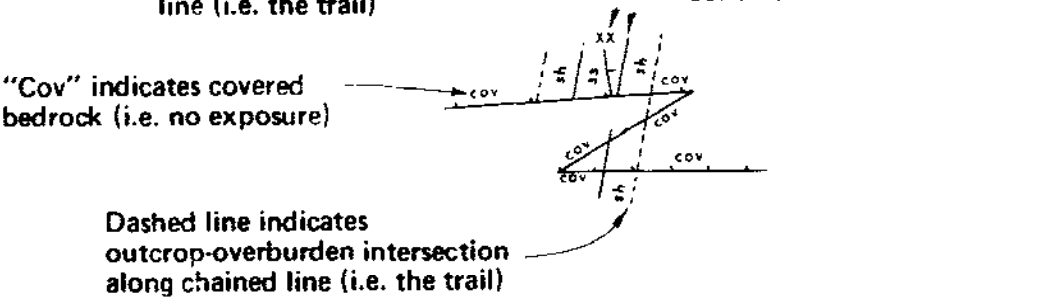


B. Chain and compass line following same bed through bush:

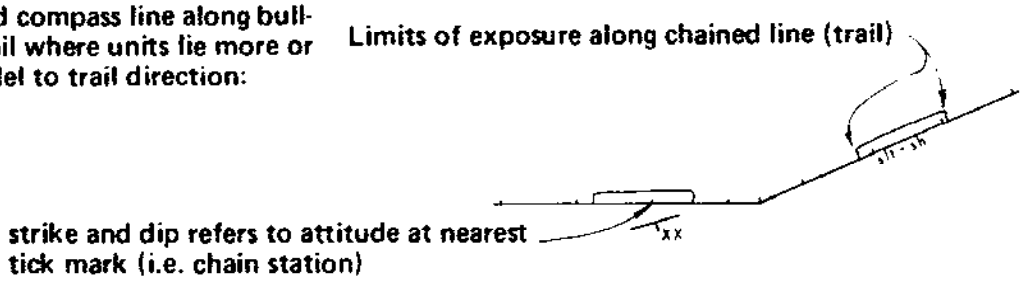


C. Chain and compass line along bulldozed trail, where units cross trail at high angle :

Where attitude symbol touches chained line: strike & dip is at the intersection of the strike line and the chained line (i.e. the trail)



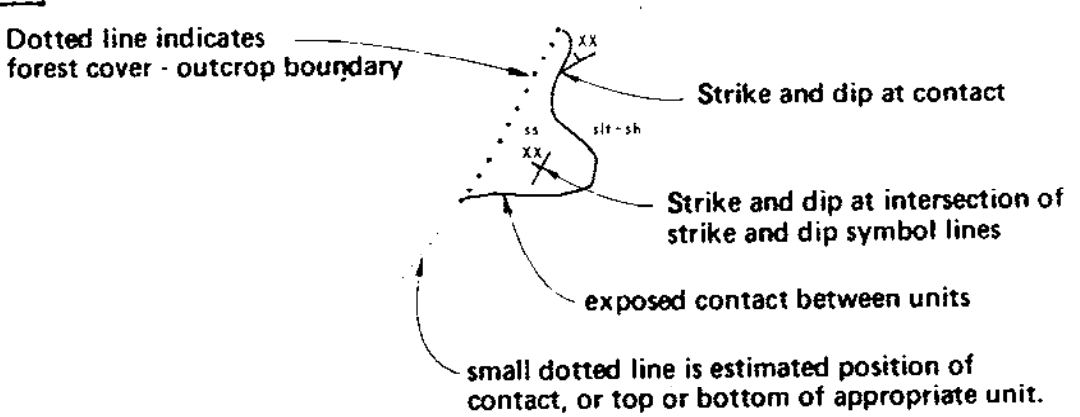
D. Chain and compass line along bulldozed trail where units lie more or less parallel to trail direction:



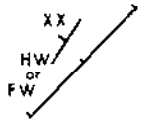
OUTCROP IDENTIFICATION & MEASUREMENT :

"otc"	outcrop
"ss"	sandstone
"ridge ss"	any particularly hard and massive sandstone, topographically prominent, and may thus be followed and outlined by chain and compass.
"slt"	siltstone
"sh"	shale
"slt-sh"	an interbedded siltstone and shale unit, usually topographically recessive
"5m"	outcrop exposes 5 meters true thickness; outcrop figures always indicate true thickness exposed (except where noted otherwise) – outcrop length is shown by extent along chained line.
"msv"	massive
"rcv"	recessive

OUTCROP OUTLINE:



COAL SEAM, CONTACTS, AND ATTITUDES:



Strike and dip of hanging wall (HW) or footwall (FW) of coal seam at tick mark (chain station).

"bloom"	coal in the unconsolidated overburden
"9 position"	surface line of Seam No. 9, as determined on structural cross-sections
" #8 "	top and bottom of seam No. 8 interval (i.e. No. 8 is composed of several closely spaced coal beds).

SURVEY POINTS:

Intersection of crosshairs indicates a surveyed point.

DRILL HOLES:

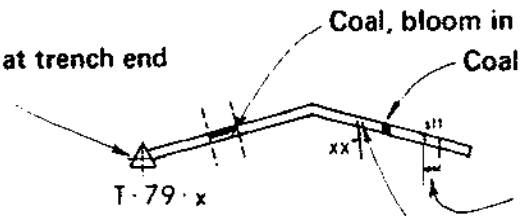
intersection of cross-hairs indicates drill collar position

RH·69 xx

"RH" rotary hole

"69" or "79" 1969 or 1979

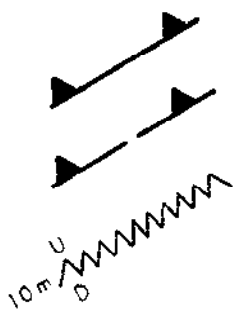
TRENCHES:



"T" hand or back-hoe trench

"79" 1979

FAULTS:



thrust fault, position exposed and chained

thrust fault, position approximate

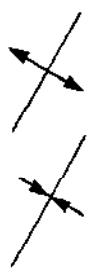
any fault trace other than a thrust

"U" upthrown side

"D" downthrown side

"10 m" visible displacement

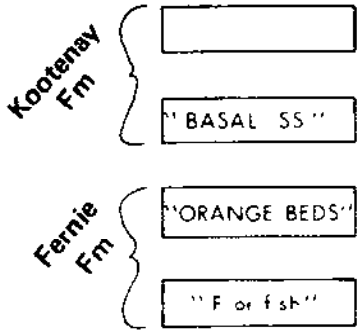
FOLDS:



anticline

syncline

LITHOLOGICAL UNITS :



(No particular designation) Coal-bearing member of the Kootenay Formation; interbedded sandstones, siltstones, shales, and coal:

Very prominent Moose Mountain Member sandstones; massive light grey-weathering; fine, medium, and coarse grained.

Upper Passage Beds of the upper Fernie Formation, distinctive orange-yellow weathering fine and medium sandstones.

Lower Passage Beds of the upper Fernie Formation; dark grey and brown soft shales with some interbedded siltstones. Often contorted.

2.5 Structural Analysis

2.5.1 The Structural Cross-Sections

Twenty-three structural cross-sections have been prepared. The basic spacing on the grid is 100 m, and these sections are located between 2,000 m north and 3,200 m south.

Individual sections were chosen so that all drill holes, both new and old, are to be found, and many sections were chosen to cover the more critical lithologic or structural details.

The following procedure was used in constructing the sections:

1. Chained positions were plotted (top or bottom of Basal, isolated outcrops, position of Crown Mountain Thrust, etc.).
2. Horizons were drawn at the appropriate dip angles for the points involved (35 and 57 degrees for Top Plate Syncline limbs, 26.5 and 22 degrees for Bottom Plate dips, etc.; the Crown Mountain Thrust was drawn at a constant 38 degrees west dip, as it must, by definition, be steeper than either Top or Bottom Plate west average dips - it could, however, be steeper).
3. Drill holes were added, and the positions of the various units, especially the top of the Basal Sandstone, were tied in to the average dips.
4. Surface profile was added as a last step, to provide a final balance and accounting.

The greatest difference that was encountered between the position of any horizon predicted on the sections and that actually found in the drill holes was 25 m vertically, which is judged to be small enough

that no major changes need to be made in interpretation.

All points that did not fall on the appropriate cross-sectional line were projected to the section using the average strike of 347 degrees, and the furthest distance projected was 50 m.

The shape of the Top Plate Syncline was constructed using a combination of the stereographic data and measurements on the ground. Section 2,000 North contains the particular construction and balance method for the shape used on all the sections. It is important to note that the structural cross-sections presented in this report are a first effort only; the writer feels that the shape for the syncline is approximately correct, but the drill hole intersections show that 37 or 38 degrees (rather than the 35 degrees used) would have been a better choice for the east limb, and rounding about the axis could be possibly 25% less smooth, and be 25 m or so deeper. Should development proceed, a second, "tuned" set of sections can be prepared, in order to get a closer fit.

It is also improtant to note that the elevations stated on the sections for top-of-Basal, position of particlar outcrops, etc., are regarded as accurate to 5 m vertically 75% of the time, and 10 m in the remaining cases. Horizontally, these points are accurate to 10 m 75% of the time, and 20 m otherwise.

It would appear, as a general conclusion from the cross-sections, that there are no further structural features to be determined (other than those presented) for Crown Moutnain which would cause any particular horizon to be found more than 25 m vertically from its predicted position at any point. In other words, the mining of Nos. 8 or 9 Seams would not encounter movements of more than 25 m up or down, including those ever-present

repetitions or ommissions which are found in all of the presently-operated open pits in the Kootenay coal belt.

Figure 15, following, presents the positioning and lay-out of the cross-sections for Crown Mountain.

2.5.2 The Structural Contour Map

A structural contour map for both No. 8 Zone and Seam No. 9 is included in the enclosures.

No. 8 contours are for the top of No. 8 Zone, at its position at the center of the Top Plate Syncline. This presentation is based on the information from three of the 1979 drill holes, two of the 1979 backhoe trenchs (stakes to mark the hanging wall of the thickest bed in each trench were surveyed as part of the surveying program), one of the 1969 drill holes, and several hundred meters of 1969 trenching exposing various parts of the syncline.

Seam No. 9 contours are drawn on the top of the seam, in both Top and Bottom Plates. The contours are meant to indicate the position of the seam in a structural, i.e. three-dimensional sense. The writer has made no attempt to include all of the small-scale repetitions, ommissions, and splittings of the seam, normal to coal beds in thrusted terrain, as most of the ones he saw would be difficult to represent adequately on a 1:5,000 scale. It is thought that the seam should rarely differ more than 20 m vertically from the position given. Should the time come when it is feasible to mine a 3 m seam at ratios of 12.2:1 (Top Plate) or 19.8:1 (Bottom Plate), greater detail work can be done.

The contours were constructed by projecting the chosen contour elevations upwards on the cross-sections, and then connecting the points on the base map, section to section. The westward extent of No. 9 Seam under the overhang of the Crown Mountain "Thrust is moot, and depends upon the angle of the thrust, which at present is unknown. The interpretation given by the writer is felt to be a maximum coal extent for the seam; any increase in dip of the fault beyond the 38 degrees used will decrease the reserve.

2.6 1979 Drill Program

During the field season of 1979, two rotary drilling companies, SDS Ltd. and Garrity and Baker provided services on Crown Mountain. Each had one rig working on Crows Nest Resources' southeast British Columbia properties throughout the season, and they came to Crown Mountain as their last project for the company on their schedules.

TABLE 5 1979 DRILL PROGRAM

Hole No.	Type	Depth (m)	Inclination	Plate	Contractor
RH-79-101	single wall	201.3	vertical	Top	G & B
RH-70-101B	core	34.0	vertical	Top	G & B
RH-79-102	double wall	266.0	vertical	Bottom	SDS
RH-79-103	single wall	138.0	vertical	Bottom	G & B
RH-79-104	single wall	142.0	vertical	Bottom	G & B
RH-79-105B	core	66.5	vertical	Bottom	G & B
RH-79-106	single wall	53.5	250 true/60°	Top	G & B
		901.3 Total			

Hole 101 was placed so that it would penetrate the top of No. 8 Zone on the east limb of the Top Plate at a shallow depth, and continue

down through No. 9 Seam into the Basal Sandstone. It is, in a sense, a duplicate of old hole 69-25, but further south along the limb. We do not know exactly where 69-25 is (i.e. the actual old hole was not found), but we do know its site, which is as surveyed.

Hole 101B was a shallow core hole, meant to sample the No. 8 Zone. Mixed results were obtained (not with the coal, but with the coring). The core description is in Appendix B. The hole was located on the same site as 101, and the rig moved over a few meters from it to 101B.

Hole 102 was the double wall rotary hole drilled by SDS Ltd. It was positioned to penetrate the maximum section available geologically on the Bottom Plate. It was stopped well-anchored into the Basal Sandstone. None of the old holes were located to drill the total section available, and it appears they were placed to drill out what is the best dip slope situation available. The nearest old hole is considerably further south. This hole was meant, specifically, to check the possbility of No. 8 Zone existing under a small area near the peak, yielding a small-scale low-ratio reserve of this coal on the plate. Structural calculations indicated that there could just barely be enough section available to have the zone appearing.

It was not found, and there is no indication in the plentiful outcropping cliff-section nearby that it is there. The conclusion is, therefore, that on the Bottom Plate erosion has removed all section from a horizon slightly below No. 8's position in the stratigraphic section.

Hole 103 and Hole 104 were placed in the central area of the main dip slope on the Bottom Plate, as were eight of the eleven 1969 holes. 103 was placed to add continuity to No. 9 Seam's existence, and 104 was placed both for this reason and to check on the existence of the seam further west, down-dip, on the slope than had been proved by any of the 1969 holes. Both of these holes penetrated expected section and ended in or near the Basal Sandstone.

Hole 105B (there is no hole 105) was a short hole drilled to core No. 9 Seam on the Bottom Plate, and is, in effect, a re-drill of old hole 69-32. The core log is in Appendix B.

Hole 106 was drilled to prove the existence of No. 8 Zone on the west limb of the Top Plate Syncline. Crown Mountain drilling was done at the end of the season, and by this time the general shape and dimensions of the syncline were known. None of the old, caving trenching or the 1979 trenching had exposed the seam on the west limb, and none of the old 1969 drilling had been positioned to find it. It was deemed prudent to actually prove its existence. The hole was aligned to penetrate the west limb in approximately the center of its length, and at the same time to check the section above it. The hole provided expected results: No. 8 Zone is present in approximately the correct position and thickness, and the small amount of section above it - that is, the rock at the top of the Crown Mountain stratigraphic section - contains no significant coal.

2.7 1979 Geophysical Logging

Many difficulties were encountered with BPB's logging on Crown Mountain during the 1979 program, and only a partial

suite was collected. Of those logs run, many are incomplete. In addition Davies Exploration Logging ran logs, some of which duplicated BPB's work, in several of the holes. The following table summarizes the results.

TABLE 6 1979 GEOPHYSICAL LOGGING

Hole No.	Logged Depth (m)	Open/ Pipe	Gamma	LSD	G/N	Caliper	BRD	Neut	Res	Quality
RH-79-101	200.1	pipe	X			X			X	
RH-79-101B	29.0	open		X	X	X	X			X
RH-79-102	264.4	pipe	X	X		X	X	X	X	X
RH-79-103	133.0	pipe	X	X	X					
RH-79-104	139.0	pipe	X	X						
RH-79-105B	65.5	pipe	X		X					
RH-79-106	52.6	pipe	X	X	X		X	X		X

The geophysical logs obtained, though unfortunately not as complete or as numerous as would be liked, were nonetheless effective when interpreted with the 1979 chip logs and the eleven 1969 gamma-neutron logs in hand. Copies of the 1979 logs are in Appendix D.

2.8 1969 Drill Program

The only surviving drilling data from the 1969 exploration program by Crows Nest Industries are contained in a set of copies of excellent gamma-neutron logs from eleven rotary holes. The holes were placed, smartly and fortunately, with an obvious philosophy of penetrating all section down to the Basal Sandstone, and this they did. The Basal stands out clearly on the logs, as do the units and seams above.

TABLE NO. 7 1969 DRILL HOLES

Hole No.	Plate	Depth (m)	Seams Tested
RH-69-25	top	152.7	8, 9
RH-69-26	top	147.2	9, 10
RH-69-27	bottom	141.4	9, 10
RH-69-28	bottom	126.8	9, 10
RH-69-29	bottom	121.6	9, 10
RH-69-30	bottom	134.1	9, 10
RH-69-31	bottom	189.6	9, 10
RH-69-32	bottom	140.2	9, 10
RH-69-33	top	189.6	9, 10
RH-69-34	bottom	164.0	9, 10
RH-69-35	bottom	161.2	9, 10
		1,668.4 Total	

Eight of the holes were placed in the central region of the main dip slope on the Bottom Plate, and appear to have been testing the possibility of a thick, mineable seam occuring under the slope. The other three were located on the east limb of the Top Plate Syncline, and one of them was positioned such that No. 8 Zone was tested.

2.9 Coal Quality

Results of testing coal from the cuttings and core from the 1979 drill holes have not yet been received from the laboratory. They will be included when available. -- Where are they?

The following is a summary of the 1979 dip sample analysis:

MT	4 - 8%
ASH	18 - 20%
VM	18 - 20%
FC	52 - 60%
S	0.6%
CAL	6,500 KCal/Kg
FSI	0 - 2
RANK	mvb ASTM

It appears also that coal buried deeply enough is indeed at a higher FSI, but this would exclude most of No. 8 Zone, only a small part of which is located deeper than 50 m.

2.10 Reserves

Three sets of figures for reserves have been calculated: No. 8 Zone and No. 9 Seam in the Top Plate, and No. 9 Seam in the Bottom Plate.

TABLE NO. 8 GEOLOGICAL IN-PLACE RESERVES

Plate	Seam No.	Thickness (m)	Area (ha)	Raw coal in place (tonnes)	Overburden Ratio (tonnex/m^3)
top	8	10	44	627,000	2.0:1
top	9	4	289	1,665,000	12.2:1
bottom	9	3	2,068	8,933,000	19.8:1
				11,225,000	

Notes:

(1) A coal density of 1.44 has been used in all calculations.

(2) No. 8 tonnage and ratio are based on a thickness of 10 m. The thickness could be as high as 12 m (yielding 753,000 tonnes) or a very conservative low of 6 m (yielding 376,000 tonnes). Seam 8 is

drawn on the sections as a "zone," composed of several seams separated by coaly shales. The author considers the total zone to be about 18 m in true thickness, with an aggregate coal thickness of 10 m. Trenching showed the minimum thickness of the thickest bed to be 6.0 m.

(3) Seam 9 ratio of 12.2:1 assumes No. 8 Zone has already been removed.

(4) No. 8 Zone does not exist on the Bottom Plate; it is missing through erosion.

(5) Seam No. 9 figures on the Bottom Plate are for the area south of 600 South; north of this line the effect of a dip slope is largely lost and the ratios rise dramatically. The seam varies in thickness from 1.5 m to 4 m, and is considerably faulted (variously split, repeated, or missing). Table 8 figures are based on No. 9 Seam's position beneath the dip slope, as drawn on the sections. In addition, the tonnage and area is based on a maximum possible westward extent of the seam as allowed by the position (at present only sketchily known) of the Crown Mountain Thrust. A conservative approach would be to reduce Table 8 figures by 10%.

(6) Reserves are calcutaled for area from the base map and for thickness from the estimated average seam thicknesses. Overburden is taken from the cross-sections.

2.11 Recommendations

Considering that this report summarizes an analysis of eighteen drill holes, detailed mapping on a 1:5,000 scale, 1,024 m of trenching, and stereographic analysis of the structures involved, it could be stated that basic exploration is through, and any further work should be considered as development.

From this viewpoint, the dip-slope overlying No. 9 Seam in the Bottom Plate would require considerable in-filling by drilling, especially along the down-dip western edge, where the position of the Crown Mountain Thrust is only sketchily known. Trenching would be of minimal use, except along the eastern and southern edges, where the seam's position is already relatively well known.

On the Top Plate, drilling could be oriented to spacing designed to outline the two synclinal limbs in better detail. Considerable trenching would be useful to pin down the surface intersections of both No. 8 Zone and No. 9 Seam. Attention could be directed also to determining the actual amount and effect of cracking and sliding the coal has undergone at its position near the hinge of the steep-sided asymmetric Top Plate Syncline. There is quite a bit of disturbance visible in the old, caving trenching, and it may have a detrimental effect on mining.

3.0 Itemized Cost Statement

The following Application to Extend Term of Licence for Crown Mountain contains detailed cost figures.

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

APPLICATION TO EXTEND TERM OF LICENCE

1. I, BOLTON AGNEW (Name) agent for CROWS NEST RESOURCES LIMITED (Name)
P.O. BOX 2699 Stn. "M" (Address)
CALGARY ALBERTA T2P 2M7 (Address)

Valid FMC No. 187621

hereby apply to the Minister to extend the term of Coal Licences No(s) 305 to 313 incl., 365, 366, 367, 371, 372, 408 for a further period of one year.

2. I have performed, or caused to be performed, during the period February 1, 1979 to January 31, 19 80, work to the value of at least $ 164,118 on the location of coal licences as follows:

CATEGORY OF WORK	Licence No(s).	Apportioned Cost
Geological mapping	305 to 313 incl., 365, 366,367,371,372,408	40,539
Surveys: Geophysical		
Geochemical		
Other	308,372,408,365,313,367	8,118
Road construction geodetic location	312,367 + upgrading on 371, 366,365,408,372,308,310,307	10,700
Surface work	312, 367	8,268
Underground work		
Drilling	312, 367	72,668
Logging, sampling, and testing	312,367	8,620
Reclamation	312,367,371,366,365,408, 372,308,310,307	2,280
Other work (specify) Geol. Report	307,309,372,308,310, 408,365,312,366,367,371	12,925

3. I wish to apply $ 164,118 of this value of work on Coal Licence(s)* 305, to 313 incl., 365, 366, 367, 371, 372, 408

4. I wish to pay cash in lieu of work in the amount of $ _____ on Coal Licence(s) No(s). _____

5. I wish to apply $ _____ of this value of work to claim a refund of cash in lieu of work in the amount of $ _____ which was paid to extend the term of Coal Licence(s) No(s). _____ from _____ to _____, 19____. Mining Receipt No. _____ for prior payment of cash in lieu of work *is attached* for adjustment.

6. The work performed on the location(s) is detailed in the attached report entitled Crown Mtn. Project
- Annual Reclamation Report, 1979
- Geological Report, 1979 will be submitted under separate covers in less than ninety days.

January 22, 1980 (Date) _____ (Signature and position)

* Applications on group licences may be filed to apportion costs on a maximum of 10 licences.

(FORMS TO BE SUBMITTED IN DUPLICATE)

FOR DEPARTMENTAL USE ONLY

Value of work reported $ _____ Value of work applied on licences $ _____

Value of work approved $ _____ Value of credit remaining $ _____

Work performed. Yes [X] No [ ]

The program of operations detailed hereunder was carried out during the period from Feb. 1, 1979 to January 31, 1980. Total costs are $ 164,118, an average of $ 64.08 per HECTARES

GEOLOGICAL MAPPING Yes [X] No [ ] Cost $ 40,539

	Area (Acres)	Scale	Time
Reconnaissance			
Detail: Surface	1,300	1:5,000	110 man-days
Underground			
Other (specify)			

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes [ ] No [X] Cost $

Method Line miles

OTHER SURVEYS Yes [X] No [ ] Cost $ 8,118

Grid Topographic location survey Other

ROAD CONSTRUCTION Yes [X] No [ ] Cost $ 10,700

Length: On Licences 75 m + upgrading Access (off licences) upgrading only

SURFACE WORK Yes [X] No [ ] Cost $ 8,368

	Length	Licence Number(s)
Trenching	500 m backhoe trenching	312, 367
Seam tracing		
Crosscutting		
Other		

UNDERGROUND WORK Yes [ ] No [X] Cost $

Test adits: Number Average length Total footage

Other workings: Area Total footage

DRILLING Yes [X] No [ ] Cost $ 72,668

	Hole Size	Number of Holes	Total Footage
Core: Diamond [ ] Wireline [X]			
Rotary: Conventional [ ]	10 m		631 m
Reverse circulation [ ]	10 cm	1	266 m
Other			

Contractor Where core stored CNRL Lab, Fernie, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes [X] No [ ] Cost $ 8,620

Lithology: Drill samples [X] Core samples [X] Bulk samples [ ] to date

Logs: Gamma-Neutron [X] Density [X] Other [X]

Testing: Prox. analysis [X] FSI [X] Washability [X]

in progress Carbonization [ ] Petrographic [ ] Plasticity [ ] Other [ ]
cost not included

OTHER WORK (specify details) Cost $

REPORTS:

Reclamation work (Permit No. C-54) Detail of work* backfillling trenches, re-contouring drill sites, seeding & fertilizing $ 2,280

Geological Report $12,925

Cost $ 15,205.

OPERATIONS:

Work was supervised by Dennis E. Bell Frank Martonhegyi Position P. Geol. (Alberta) Sr. Staff Geologist

Is this person a registered or licensed Professional Engineer in British Columbia? Yes [ ] No [X]

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (c), a supplemental plan of operations is to be attached.

* If reclamation work reported in annual report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg 436/75)

ON-PROPERTY COSTS: For period from June 14 to October 22, 19 79

1. OPERATOR'S FEES, SALARIES, AND WAGES:

	Average Number of Employees	Average Rate	Average Number of Days	Amount
Professional and technical	1	125	64	8,000
Machine operators and support				
Miners				
Other				

Total operator's costs $ 8,000

2. CONTRACTORS AND CONSULTANTS:

Name	Service	Contract Amount
Max Air	Geological Consultant	22,230
SAL, B. & R.	Supervising Machinery work	2,163
SCRL Surveying Dept. incl. its subcontractor Midwest Survey	Geodetic Location Survey	8,118
Drain Bros. Construction	Earth Moving (Bulldozer, etc.)	14,525
SDS Drilling	Rotary Drilling	10,535
Garritty & Baker Drilling	Rotary Drilling	20,921
BPB Instruments	Downhole Geophys. Logging	4,770
Davis Logging	Downhole Geophys. Logging	3,850
Gallant Trucking	Water Hauling	4,755

Total: $ 91,867

4. FIELD CAMP COSTS:

		Amount
Food		
Accommodation		11,430
Fuel	incl. helicopter and machinery	6,489
Other	Communications	1,110

Total field camp costs $ 19,029

5. SAMPLING, ANALYSIS, AND TESTING:

Service	Performed by	Amount
Samples taken and sent for analysis and tests,		
will be completed in the subsequent term		

Totals, samplings, analysis, and testing $

6. SUPPLIES AND MATERIALS COSTS:

	Amount
Process supplies	
Operating and maintenance supplies	12,523
Office and technical supplies	
Other supplies and materials	

Total, supplies and materials $ 12,523

7. TRANSPORTATION COSTS (Ground transportation details):

Vehicles	Owner	Rental Rate	Amount
one to two			
4x4 trucks	Rent Rite	$1000/m, 6 months	6,000

Air support details:

Aircraft Type	Owner	Charge
Helicopter 206-B	Kenting	9,565

Total transportation costs $ 15,565

8 RECLAMATION WORK:

$ 2,280

9. TRAVEL EXPENDITURES (operator's costs only):

Number of Personnel	Number of Trips	Amount
1	6	1,199

Total travel expenditures $ 1,199

Total costs $ 150,463

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from February 1, 1979 to January 31, 1980

		Amount
(a) Logistics and field support		$
(b) Technical and feasibility studies	Photogeology	730
(c) Preparation of reports	Drafting	2,325
(d) Supplies and services	Max Air Consultants	10,600
(e) Mobilization and demobilization of equipment		
(f) Travelling expenses		

(Items)

Total $ 13,655

Supporting Cost Statements Attached

Total supporting costs $

SUMMARY

On-property costs $ 150,463

Off-property costs $ 13,655

Total costs $ 164,118

Statement of costs verified by W.S. Kowalski

Jan 29/80
(Date)

W.S. Kowalski
(Signature and position)

Chief Accountant

4.0 SELECTED BIBLIOGRAPHY

(1) Bell, D.E., and Sloan, G, 1979, "1979 Reclamtion Report, Crown Mountain Project", Crows Nest Resources Limited.

(2) Gibson, D.W., 1977, "The Kootenay Formation of Alberta and British Columbia - a Stratigraphic Summary": Geol. Surv. Canada, Paper 77-1A.

(3) Gibson, D.W., 1977, "Sedimentary Facies in the Jura-Cretaceous Kootenay Formation, Crowsnest Pass Area, Southwestern Alberta and Southeastern British Columbia": Bull. Canadian Petroleum Geol., v. 25 no. 4, pp 767 - 791.

(4) Gibson, D.W., 1979, "The Morrisey and Mist Mountain Formations - Newly Defined Lithostratigraphic Units of the Jura-Cretaceous Kootenay Group, Alberta and British Columbia": Bull. Canadian Petroleum Geol. v. 27, no. 2, pp 183 - 208.

(5) Golder Associates, 1976, "Stage 1 Geotechnical Assessment, Line Creek Project": internal Crows Nest Resources Ltd.

(6) Hamblin, Anthony P., and Walker, Roger G., 1979, "Storm-Dominated Shallow Marine Deposits: the Fernie - Kootenay (Jurassic) Transition, Southern rocky Mountains": Can. J. Earth Sci., 16, 1673 - 1690

(7) Jansa, L., 1972, "Depositional History of the Coal-Bearing Upper Jurassic - Lower Cretaceous Kootenay Formation, Southern Rocky Mountains, Canada": Geol. Soc. America Bull., v. 83, pp 3199 - 3222.

(8) Newmarch, C. B., 1953, "Geology of the Crowsnest Coal Basin, with Special Reference to the Fernie Area": B.C. Dept. Mines, Bull. 38

(9) Norris, D. K., 1959, "Type Section of the Kootenay Formation, Grassy Mountain, Alberta": Alberta Soc. Petroleum Geol. J., v. 7, pp 223 - 233.

(10) Price, R. A., 1962, "Fernie Map-Area, East Half, Alberta and British Columbia, 82 G E1/2": Geol. Surv. Canada, Paper 61-24.

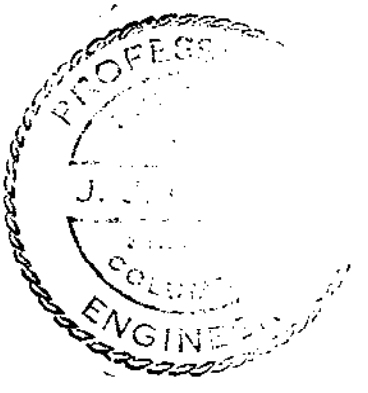
5.0 PROFESSIONAL VERIFICATION OF REPORT

Entitled: Crown Mountain Coal Exploration, 1979
Kootenay Land District,
Southeast British Columbia
B.C. Coal Licences
Nos. 308, 310, 312, 365, 366, 367,
371, 372, 408, 305, 306, 307, 309, 311
and 313

Mr. Dennis E. Bell carried out the 1979 geological field program on Crown Mountain, British Columbia coal licences held by Shell Canada Resources Ltd. and operated by Crows Nest Resources Limited.

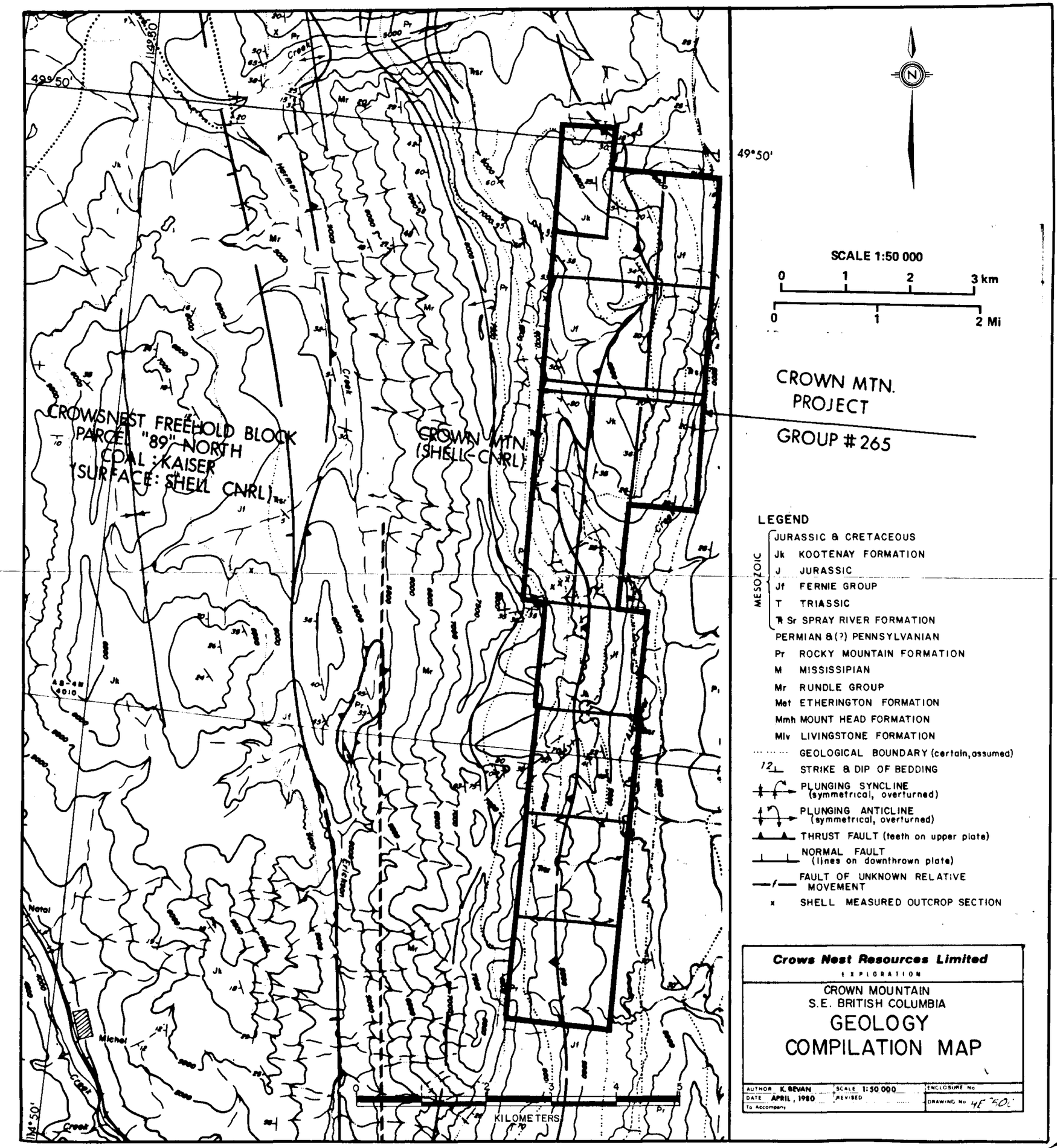
Dennis Bell, B.S.c., graduated in Geology from Dalhousie University in 1965. Since 1968 he has specialized in basic field mapping, structural interpretation, and exploration equipment supervision in the coking coal belt of British Columbia and Alberta. He has worked on projects similar to Crown Mountain for such major coal companies as Manalta Coal Ltd., Luscar Ltd., Petrocan, and Fording Coal Ltd. Mr. Bell is registered as a Professional Geologist Association of Professional Engineers, Geologists, and Geophysicists of Alberta.

I consider the aforementioned Geologist to be well qualified to undertake responsibilities he was assigned for this project. I am satisfied that the attached report dated April 30, 1980 has been competently prepared and justly represents the information obtained from this project.



J. J. Crabb, P.Eng.

April 30, 1980


49°50'
114°30'
CROWSNEST FREEHOLD BLOCK
PARCEL "89" NORTH
COAL: KAISER
SURFACE: SHELL CNRL)
CROWN MTN.
(SHELL-CNRL)
Natal
Michel
Creek
SCALE 1:50 000
0 1 2 3 km
0 1 2 Mi
CROWN MTN.
PROJECT
GROUP # 265
LEGEND
MESOZOIC
JURASSIC & CRETACEOUS
Jk KOOTENAY FORMATION
J JURASSIC
Jf FERNIE GROUP
T TRIASSIC
Tr Sr SPRAY RIVER FORMATION
PERMIAN & (?) PENNSYLVANIAN
Pr ROCKY MOUNTAIN FORMATION
M MISSISSIPIAN
Mr RUNDLE GROUP
Met ETHERINGTON FORMATION
Mmh MOUNT HEAD FORMATION
Mlv LIVINGSTONE FORMATION
GEOLOGICAL BOUNDARY (certain, assumed)
STRIKE & DIP OF BEDDING
PLUNGING SYNCLINE (symmetrical, overturned)
PLUNGING ANTICLINE (symmetrical, overturned)
THRUST FAULT (teeth on upper plate)
NORMAL FAULT (lines on downthrown plate)
FAULT OF UNKNOWN RELATIVE MOVEMENT
SHELL MEASURED OUTCROP SECTION
0 1 2 3 4 5
KILOMETERS
Crows Nest Resources Limited
EXPLORATION
CROWN MOUNTAIN
S.E. BRITISH COLUMBIA
GEOLOGY
COMPILATION MAP
AUTHOR K. BEVAN
DATE APRIL, 1980
To Accompany
SCALE 1:50 000
REVISED
ENCLOSURE No
DRAWING No 49°50'

(1) 39 1/5

K-SHELL CROWN MNT. 79(2)A

APPEN. A. - REPORT ON GEODETIC SURVEY (map)
APPEN C - DRILL HOLE CHIP LOGS (graphic)
APPEN E - HAND and BACKHOE TRENCH LOGS (GRAPHIC)

APPENDIX A

INTER-OFFICE CORRESPONDENCE

Date DECEMBER 18, 1979

To CROWSNEST RESOURCES LIMITED (C.N.R.L.)

From D.C. Poulsom
SHELTECH CANADA

Subject LOCATION SURVEYS
CROWN MOUNTAIN - SPARWOOD AREA
S.E. BRITISH COLUMBIA 4951E

Three major control points (Sheep, 103, 201) were used to set up a network of four additional control points (TL, 23, Saddle, South Erickson).

Seven new drill holes, eleven old drill holes and seven trenches were surveyed in this area.

Conventional survey methods using 1" theodolite for the control network and a 10" theodolite for locating drill holes and trenches as well as electronic distance measuring equipment were used to obtain coordinates and elevations for the various stations. Calculations were done in the U.T.M. system with distances and bearings converted to plane (reference meridian was 117°W) and results were reported to C.N.R.L. in both tabular and plan form.

The survey cost attributed to this area for the 1979 field season is approximately $8,118.

D.C. Poulsom Sr. Surveyor

Dave Poulsom

Enclosure

DPcw

Drill Holes

Control	N	E	Elev.
101	5521587.41	662666.99	2151.81
102	5520353.51	663889.06	2215.77
103	5518350.20	663733.08	1963.48
104	5518891.16	663312.36	1918.24
105B	5519281.61	663478.68	1987.70
106	5521688.57	662558.74	2140.85
101B	5521591.40	662664.36	2151.84
*25	5521683.60	662582.71	2148.02
*26	5521484.19	662828.92	2167.15
*27	5519215.63	663796.69	2057.13
*28	5518744.84	663864.69	2012.42
*29	5518694.42	663703.20	1953.49
*30	5519160.13	663587.45	2004.32
*31	5519100.02	663357.83	1960.60
*32	5519303.72	663484.25	1987.36
*33	5521833.65	662665.21	2203.62
*34	5518416.45	663518.20	1931.82
*35	5518080.71	663532.11	1901.32

Crown Mountain

Control	N	E	Elev.
103	5533523.85	662278.84	2157.46
201	5539874.88	659007.28	2180.80
Sheep	5524886.08	658928.47	2418.00
TL	5525021.50	665970.49	2523.87
23	5521333.25	666323.17	2062.53
Saddle	5519499.61	661251.44	2435.83
South Erickson	5515226.65	662208.41	2478.86

Fd. Iron plug
201 NLC in Concrete

Assumed 292°26'13"
3539.63

660 000 mE

Fd. Iron plug
103 in Concrete

180°27'02"
9989.11

21°12'00"
9264.77

336°31'46"
9269.26

88°53'54"
7043.32

Sheep Mtn.
Fd. I.P.
Built
Rock Cairn

TL
Rock Cairn

5 524 000 mN

174°32'16"
8705.08

295°39'40"
8203.99

658 000mE

5 522 000mN

336°40'04"
5866.21

161°14'27"
10201.29

347°22'35"
4378.81

213°58'00"
7363.19

23 I.S.
Rock Cairn

70°07'23"
5393.02

Saddle I.S.
Rock Cairn

South Erickson I.S.
Rock Cairn

CL 371
CL 367
CL 312
CL 366
CL 365
CL 408
CL 310
CL 308
CL 372
CL 305
CL 307
CL 306

CMT 79-4W
CMT 79-3S
CMT 79-1
CMT 79-2
CMT 79-5W
CMT 79-6W
CMT79-7E
GMT 79.2

DH106
DH101B
DH 101
DH101
DH102
DH105B
DH104
DH103

TO SADDLE N.T.S.

30-05-49
2765.90
30-50-48
2549.62
34-08-16
2522.44
33-58-34
2550.29
35-43-06
2492.90
41-55-25
2629.39

326-36-30
4.78
33-58-34
2550.29
34-08-16
2522.44

95-35-25
2237.88
106-26-54
2148.86
114-51-07
2734.90

248-04-30
2623.89
231-46-66
3129.57
223-43-21
3354.28
219-53-44
3537.86

LEGEND

Monument

I.P. Foun

Drill Holes

Trenches --

Bearings a
the Line j
Distances
117th Long

Distances

STATION	LATITUDE	
103	49°56'02.364"	
201	49°56'49.242"	
Sheep	49°51'26.131"	
TL	49°51'23.639"	
23	49°49'23.961"	
Saddle	49°48'29.619"	
S. Erickson	49°46'10.441"	

DRILL HOLE	NORTHINGS	
101	5 521 587.41	6
101B	5 521 591.40	6
102	5 520 353.51	6
103	5 518 350.20	6
104	5 518 891.16	6
105B	5 519 281.61	6
106	5 521 688.57	6
TRENCHES		
CMT 79-1	5 521 455.97	6
CMT 79-2	5 521 523.59	6
CMT 79-3 SOUTH	5 521 614.49	6
NORTH	5 521 859.84	6
CMT 79-4 WEST	5 521 892.60	6
EAST	5 521 925.60	6
CMT 79-5 WEST	5 519 396.48	6
EAST	5 519 437.30	6
CMT 79-6 WEST	5 518 912.50	6
EAST	5 518 918.63	6
CMT 79-7 EAST	5 518 618.98	6
WEST	5 518 582.45	6

00291 3/5 1(a)

LEGEND

Monuments Planted ----- △

I.P. Found ----------- ●

Drill Holes ---------- ○

Trenches ------------ ⬡

Bearings are Grid and are derived from the Line joining #201 NLC and #103 (Shell Oil). Distances are U.T.M. and are referred to the 117th Longitude.

Distances shown are in metres and decimals

SCALE 1:20 000

0 500 1000 m

0 2000 4000 ft.

GALS - CO-ORD.

STATION	LATITUDE	LONGITUDE	NORTHING	EASTING	ELEVATION	NORTH	EAST
103	49°56'02.364"	114°44'19.411"	5 533 523.85	662 278.84	2157.46m		
201	49°56'49.242"	114°47'01.389"	5 534 874.88	659 007.28	2180.80m		
Sheep	49°51'26.131"	114°47'20.132"	5 524 886.08	658 928.47	2418.00m		
TL	49°51'23.639"	114°41'27.523"	5 525 021.50	665 970.49	2523.87m		
23	49°49'23.961"	114°41'15.570"	5 521 333.25	666 323.17	2062.53m		
Saddle	49°48'29.619"	114°45'31.942"	5 519 499.61	661 251.44	2435.83m		
S. Erickson	49°46'10.441"	114°44'50.517"	5 515 226.65	662 208.41	2478.86m		

DRILL HOLE	NORTHINGS	EASTINGS	ELEVATION
101	5 521 587.41	662 666.99	2151.81
101B	5 521 591.40	662 664.36	2151.84
102	5 520 353.51	663 889.06	2215.77
103	5 518 350.20	663 733.08	1963.48
104	5 518 891.16	663 312.36	1918.24
105B	5 519 281.61	663 478.68	1987.70
106	5 521 688.57	662 558.74	2140.85
TRENCHES			
CMT 79-1	5 521 455.97	663 008.24	2164.39
CMT 79-2	5 521 523.59	662 706.80	2142.90
CMT 79-3 SOUTH	5 521 614.49	662 676.66	2158.35
NORTH	5 521 859.84	662 309.56	2099.76
CMT 79-4 WEST	5 521 892.60	662 638.40	2205.20
EAST	5 521 925.60	662 721.20	2208.42
CMT 79-5 WEST	5 519 396.48	663 864.77	2095.92
EAST	5 519 437.30	663 939.02	2082.63
CMT 79-6 WEST	5 518 912.50	664 001.28	2058.31
EAST	5 518 918.63	664 035.14	2058.74
CMT 79-7 EAST	5 518 618.98	664 053.98	2020.18
WEST	5 518 582.45	664 026.35	2021.70

TL
Rock Cairn

5 524 000 mN

170°32'16"
3705.08

23 I.S.
Rock Cairn

CROWS NEST RESOURCES LIMITED

CROWN PROJECT
B.C.

CONTROL TRAVERSE & DRILL HOLE & TRENCH LOCATIONS

391 2/5

Author:	Scale - 1: 20,000	Enclosure No: (1)(b)
Date:	Revised:	Drawing No.: H[illegible]
To Accompany		

MIDWEST SURVEYS

Date: October 8, 1979
Prepared by: MIDWEST SURVEYS & SERVICES LTD.

C-883-79-1

APPENDIX C

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②

STRATIGRAPHIC SECTION

DESIGNATION:	RH - 79 - 101	PART ____ OF ____	
PROJECT:		AUTHOR: PANCHY / BELL	DATE: 19
AREA:	CROWN MOUNTAIN	SOURCE OF DATA: ROTARY CHIP LOG, 2m SAMPLES	
LOCATION:			

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE

Chip log 2m samples
Eric Panchy

Overburden, sandstone

Sandstone, minor coal

Sandstone & coal

Sandstone, trace coal

Sandstone, minor shale

Coal, minor sandstone

Carbonaceous shale & coal

Coal often trace shale

Sandstone, minor coal

Sandstone, shale

Sandstone, trace coal

Sandstone

Coal, minor shale

Coal

Siltstone, minor coal & shale

Sandstone

Sandstone, trace coal

Sandstone

Shale & sandstone

Sandstone, minor shale

Carbonaceous shale, minor sandstone

Sandstone & shale

Sandstone, trace shale

Sandstone & shale

Sandstone

Sandstone, shale

Sandstone

Sandstone, siltstone, shale

Sandstone, shale

Siltstone, sandstone

Shale, minor sandstone

Sandstone, minor shale, trace coal

Shale, trace coal

Shale, coal

Sandstone, siltstone

Sandstone

Sandstone, siltstone

Sandstone, shale

Missing

Sandstone, shale trace coal

Shale, coal

Carbonaceous shale minor coal

Coal & shale

Sandstone, siltstone shale

Sandstone, siltstone

Shale, siltstone

Shale, siltstone

Shale, trace coal

Shale, coal

Shale, trace coal

Shale

Coal, trace shale

Shale, coal

Coal

Coal, shale

Coal

Coal, shale

Shale, trace coal

Coal, shale

Shale

Shale, minor siltstone

Carbonaceous shale

Coal

Sandstone

Carbonaceous shale

Shale, minor coal

Sandstone shale

Sandstone, trace shale

Shale, coal

Coal, sandstone

Sandstone, shale, trace coal

Carbonaceous shale & sandstone

Sandstone, trace coal

Sandstone, shale, trace coal

Sandstone trace Coal

Sandstone, coarse-grained

TD 201.3

FILE NO. HF-47A

③ 391 2/5

STRATIGRAPHIC SECTION

DESIGNATION:	RH - 79 - 102
PART ___ OF ___	
PROJECT:	
AUTHOR:	PANCHY / BELL
DATE:	1980
AREA:	CROWN MOUNTAIN
LOCATION:	
SOURCE OF DATA:	ROTARY CHIP LOG, 2m SAMPLES

INTERVAL [m]	DESCRIPTION – AMPLIFIED
0	Chip log on 2m Samples (Eric Panchy)
	Shale, minor siltstone
19	Siltstone, minor shale
29	Sandstone, fine grain
45	Sandstone minor siltstone & shale
49	Shale & coal
52	Missing
54	Sandstone, siltstone, minor shale
64	Missing
66	Sandstone minor siltstone & shale
80	Missing
82	Sandstone
84	Missing
86	Sandstone, minor siltstone
116	Shale & coal
118	Coal
119	Shale & coal
120	Shale, minor siltstone & sandstone
128	Sandstone
130	Missing
133	Siltstone & sandstone
137	Shale & coal
139	Shale, trace coal
	Sandstone, siltstone & shale
177	Coal
179	Coal & shale
	Coal & Carbonaceous shale
181	Shale
186	Shale & siltstone
	Coal, shale
192	
196	Siltstone & shale
201	Coal, shale
202	Carbonaceous shale
203	Shale
204	Carbonaceous shale, trace coal
206	Coal, shale
208	Siltstone, sandstone
209	Carbonaceous shale
210	Shale
211	Coal, shale
212	Coal
214	Shale, siltstone
218	Shale, coal
219	Siltstone, minor coal
221	Coal
223	Shale, siltstone & sandstone
230	DATUM
	Sandstone, med. gr.
236	Shale, minor coal
238	Sandstone, salt & pepper med. gr.
266	T.D. 266

FILE No- HF-

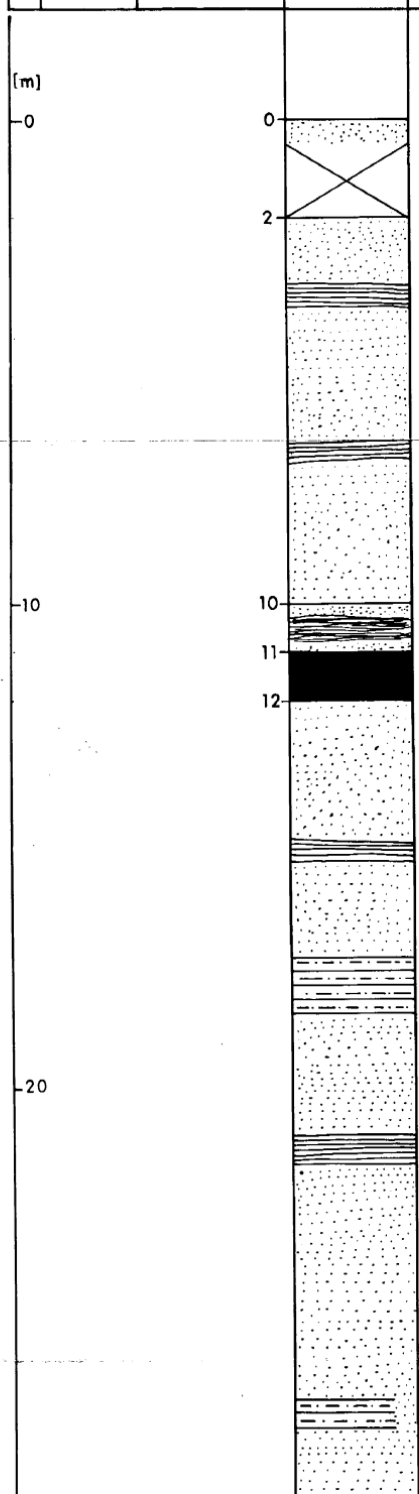
391 2/5

(4)

STRATIGRAPHIC SECTION

DESIGNATION:	RH-79-103
PART	_____ OF _____
PROJECT:	
AUTHOR:	D. BELL
DATE:	1979
AREA:	CROWN MOUNTAIN
SOURCE OF DATA:	ROTARY CHIP LOG, 2m SAMPLES
LOCATION:	

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE



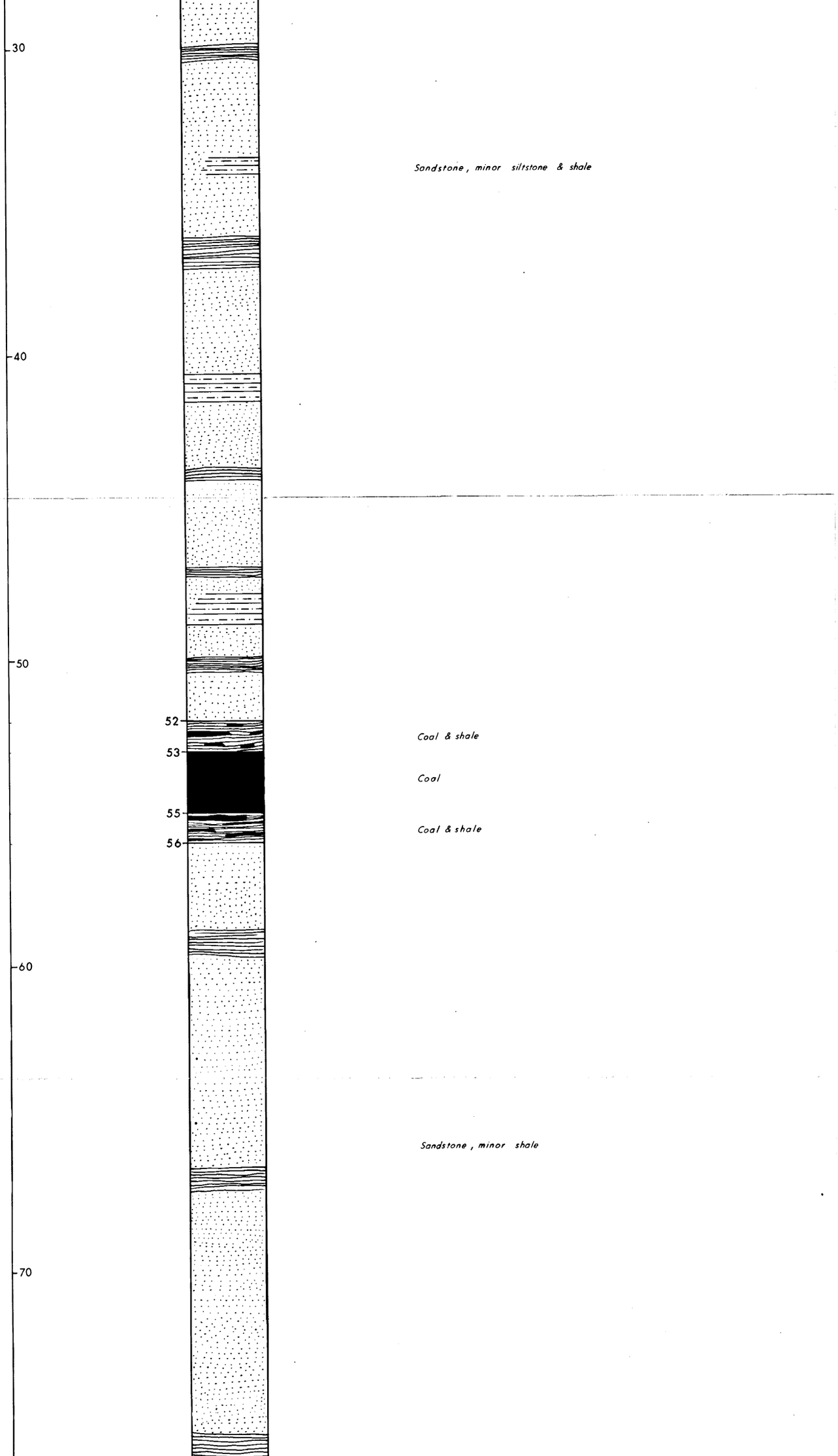
Chip log
2m. samples
Logged by Eric Panchy

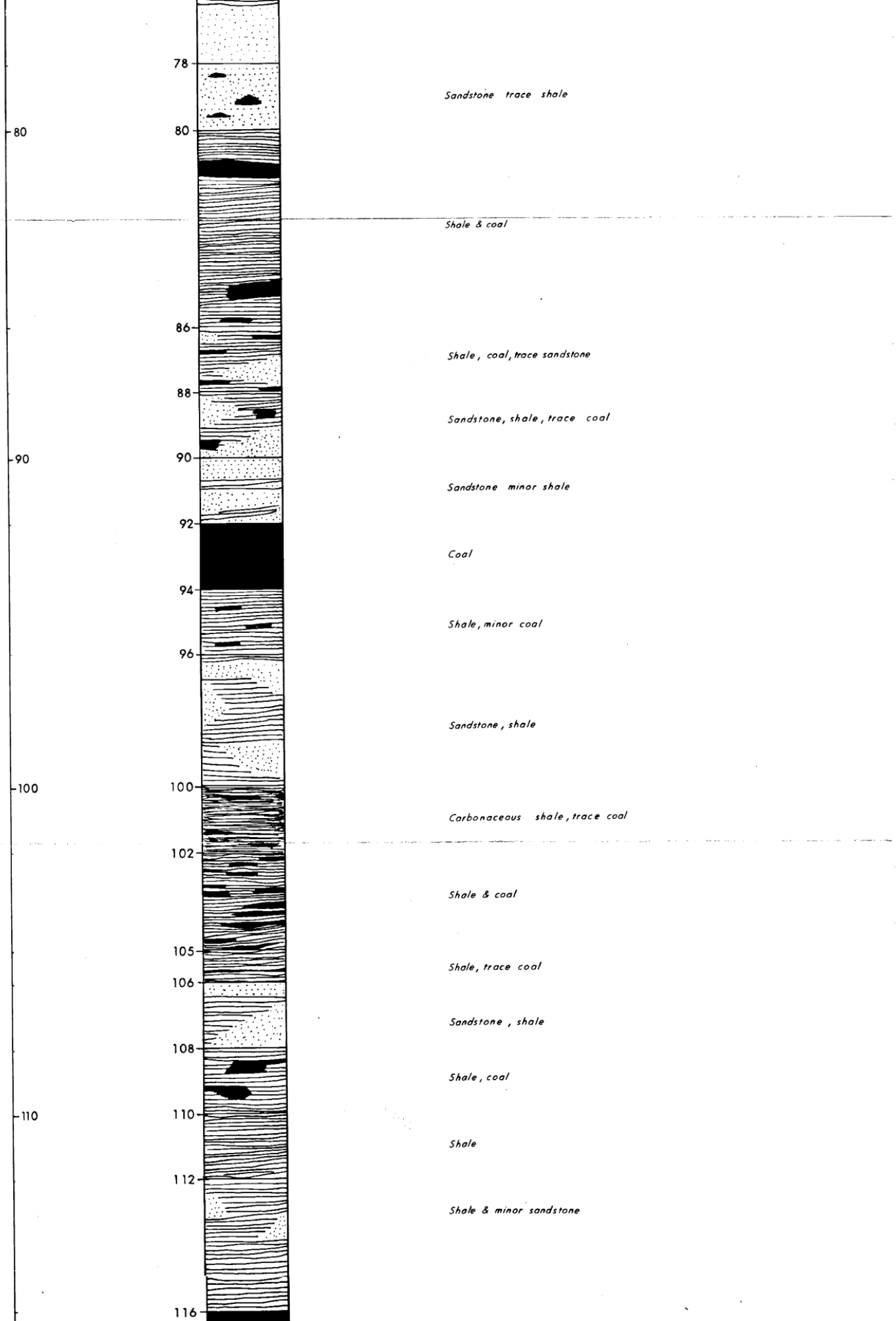
Overburden & Sandstone

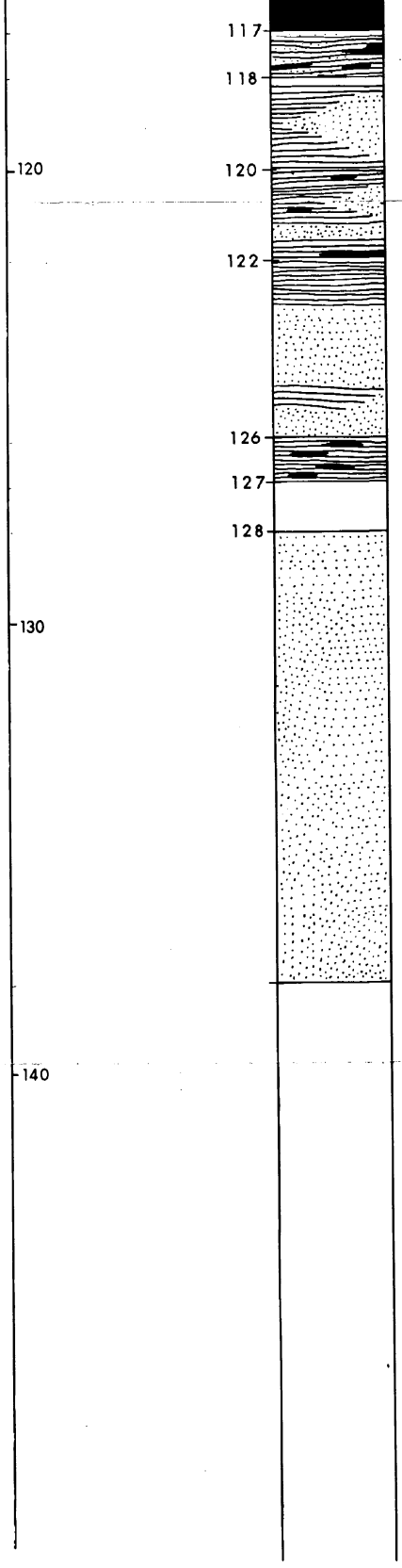
Sandstone, minor shale

Sandstone & carbonaceous shale

Coal


30
40
50
52
53
55
56
60
70
Sandstone, minor siltstone & shale
Coal & shale
Coal
Coal & shale
Sandstone, minor shale


78
80
80
Sandstone trace shale
Shale & coal
86
Shale, coal, trace sandstone
88
Sandstone, shale, trace coal
90
90
Sandstone minor shale
92
Coal
94
Shale, minor coal
96
Sandstone, shale
100
100
Carbonaceous shale, trace coal
102
Shale & coal
105
Shale, trace coal
106
Sandstone, shale
108
Shale, coal
110
110
Shale
112
Shale & minor sandstone
116



Coal

Sandstone, shale, trace coal

Sandstone, shale

Sandstone, shale, trace coal

Sandstone, shale

Shale, coal

Missing
Top basal

Sandston, medium grained
salt & peppes

T.D. 138.0

FILE No. HF 47E

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(5)

STRATIGRAPHIC SECTION

DESIGNATION: RH - 79 - 104	PART ____ OF ____
PROJECT:	AUTHOR: D. BELL
AREA: CROWN MOUNTAIN	DATE: 1979
LOCATION:	SOURCE OF DATA: ROTARY CHIP LOG, 2m SAMPLES

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE

Much of this interval (6 - 15m) probably caved as the driller lost a down-hole hammer and was stuck blowing out coal & shale for several days.

Single wall chip log
2m samples
(logged by Eric Panchy)

Interval (m)	Description
12 – 15	Coal
15 – 50	Sandstone, minor shale
50 – 54	Coal
54 – 64	Coal & sandstone
64 – 66	Sandstone, trace coal
66 – 68	Sandstone & shale
68 – 70	Sandstone & shale, trace coal
70 – 72	Sandstone & shale
72 – 78	Sandstone, trace coal
78 – 80	Sandstone & shale, trace coal
80 – 82	Shale & sandstone
82 – 86	Shale & coal
86 – 88	Carbonaceous shale
88 – 90	Sandstone, shale & coal
90 – 92	Shale, coal trace sandstone
92 – 98	Shale & coal
98 – 100	Shale, sandstone, coal
100 – 102	Sandstone, siltstone, coal
102 – 104	Shale, sandstone, coal
104 – 106	Sandstone
106 – 108	Siltstone, sandstone, trace coal
108 – 110	Sandstone, shale
110 – 114	Sandstone, shale, trace coal
114 – 118	Sandstone, shale
118 – 120	Shale, sandstone, coal
120 – 128	Sandstone, shale, trace coal
134 – 136	Sandstone, shale, trace coal

128 - 142 Drillers report
hard sandstone
(ie basal sandstone)

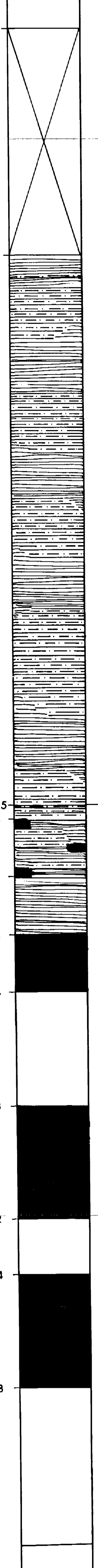
TD 142

FILE NO: HF-47G

391 2/5
(6)

STRATIGRAPHIC SECTION

DESIGNATION:	RH - 79 - 106
PART ___ OF ___	
PROJECT:	
AUTHOR:	D. BELL
DATE:	1979
AREA:	CROWN MOUNTAIN
LOCATION:	
SOURCE OF DATA:	ROTARY CHIP LOG, 2m SAMPLES



SCALE	CONTROL POINT	INTERVAL	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE
0		0			*CHIP LOG (from 2m samples collected &saved by driller Logged by D.E. Bell)*	
					Unconsolidated O.B.	
10		8				
20					*Medium-brown slt & sh, a few drk grey slt chips*	
		27.5			WATER LEVEL	
		28			*Some coal some medium-brown slt. some medium-dark grey shale*	
30		30			*sh, medium-dark grey*	
		32			*Coal, 1/2 bright 1/2 dull possibly high-ash*	
		34			*No Samples*	
		38			*Coal*	
40		42			*No Sample*	
		44			*Coal*	
50		48			*No Sample*	
					T.D 53.5	

FILE NO: HF-47 1

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(7)

STRATIGRAPHIC SECTION

DESIGNATION: CMT-79-1 | PART 1 OF 1

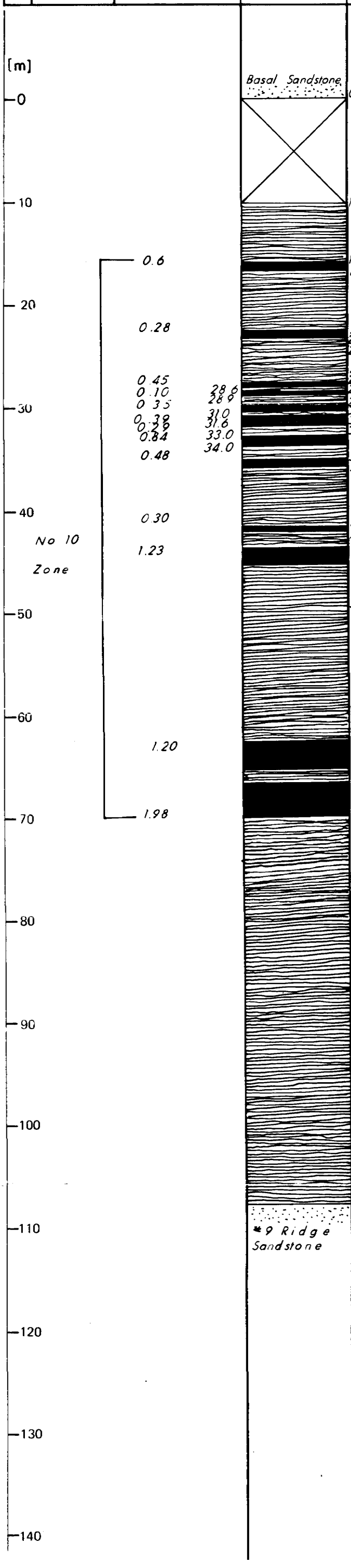
PROJECT: CROWN MOUNTAIN | AUTHOR: D. BELL | DATE: 1979

AREA: TOP PLATE | SOURCE OF DATA: BACKHOE TRENCH

LOCATION: EAST LIMB TOP PLATE SYNCLINE

SCALE	CONTROL POINT	COAL TRUE THICKNESS (m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE

(1) Stratigraphic Direction from bottom up-section
(2) Trench Direction 246° true from survey stake
(3) Trench inclination +4° from stake at 0.00 to top-of-trench (ie west end)



	0.00	344/10W	0.00 is top of basal sandstone
	10.0	353/44W	
Shale			Blocky, grey
Coal	15.6–16.5		Very high ash (chippy, grey shale)
Siltstone			Blocky, grey
Coal	22.5		
Shale	23.3–24.6		Blocky, grey
Shale	26.5		Very coaly, possibly much high ash coal
Shale	27.7		Slightly coaly
Coal	28.4		Then shale, blocky grey
Coal	29.9		
Shale	30.6		Then shale
Coal	31.7		Then shale
Coal	32.0		With 3cm shale parting
Shale	35.1		Blocky, brown-grey
Coal	36.9		Much slicken sided, one parting 8cm thick, possibly high ash upper 10 cm.
Shale			Grey, blocky
Coal			Dull possibly high-ash, especially upper 10 cm
Shale	41.8		grey and brown, a few cm coaly
Coal	42.3		Dull, slickensided
Shale	42.9		Grey, blocky, coaly partings
Coal, Shale	45.5		Parting 5cm thick 88 cm above base dull above parting
	50.0	345/45W	
Shale			Brown, blocky, a few coaly streaks
	62.6	344/38W	
Coal	65.5		Clean, powdery, bright, except upper 20cm dull and possibly high-ash
Shale	66.8		Grey
Coal	70.2		Lower 60cm bright and powdery, remainder is either very high ash coal or very coaly black shale, author favours mostly shale.
Shale			Mostly brown, some grey & very few coaly bands ≤ 10 cm
			Note: No.9 Seam is missing
	108.0	346/35W	
Sandstone			Prominent, medium to course, cross-bedded, light grey, this base of No. 9 ridge Sandstone

HC-51

3 11 2/5

(8)

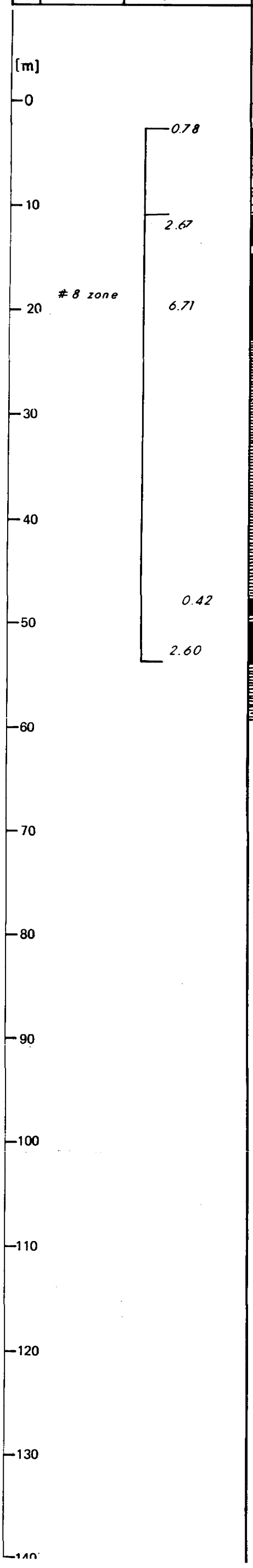
STRATIGRAPHIC SECTION

DESIGNATION: CMT-79-2 | PART 1 OF 1

PROJECT: CROWN MOUNTAIN | AUTHOR: D BELL | DATE: 1979

AREA: TOP PLATE

LOCATION: EAST LIMB, TOP PLATE SYNCLINE | SOURCE OF DATA: BACKHOE TRENCH



CONTROL POINT	COAL TRUE THICKNESS (m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION MAIN	DESCRIPTION AMPLIFIED	SAMPLE
			0.00 324/48W	Sandstone	Fine to medium, grey, relatively hard, beds ≤ 10 cm.	
			2.5			
			4.8	Coal	Clean, bright, well-bedded	
				Siltstone-shale	Soft, well-bedded, slightly coaly bands	
			8.0 331/44W	Siltstone	Hard, prominent, well-bedded	
			10.2	Shale	coaly, chippy	
				Coal	Bright, clean, chippy texture, 5 partings ≤ 2 cm	
			Small thrustlet	Siltstone-shale	Siltstone is massive, grey ash is very coaly	
			331/47W			
				Coal	3 shale partings 3cm thick, 3 shale partings 1cm thick, otherwise bright, chippy texture, some slickensides	
			23.1			
				Shale	Silty, coaly, 2 coal beds 10 cm, many coal beds ≤ 2cm	
			30.0 321/45W			
				Shale	20% silty, many coal beds ≤ 5cms, several coal beds to 30 cm	
			47.0	Coal	Powdery, bright	
			49.0	Shale		
			341/45W	Coal	Bright, powdery, often dirty, 3 shale partings ≤ 2cm	
				Shale	Soft, multi-coloured lands ≤ 2 cm	

Notes (1). Stratigraphic Direction down-section
(2) Trench Direction 088° true from survey stake, which is the top of the 6.71m coal bed
(3) Trench Inclination +2° from stake

HC-5

3?? 2/5 (9)

STRATIGRAPHIC SECTION

DESIGNATION:	CMT 79.3	PART 1 OF 1	
PROJECT: CROWN MOUNTAIN		AUTHOR: D BELL	DATE: 1979
AREA: TOP PLATE		SOURCE OF DATA: BACKHOE TRENCH	
LOCATION: EAST & WEST LIMBS TOP PLATE			

Notes (1) Stratigraphic Direction : up-section on east limb to synclinal axis then downsection to Basal Sandstone across west limb

SCALE [m]	TRENCH DIRECTION & INCLINATION	COAL TRUE THICKNESS (m)	STRIKE & DIP	DESCRIPTION – MAIN	DESCRIPTION – AMPLIFIED	SAMPLE
	322° - -3°	0.68		Coal	Bright, blocky-breaking, this bed only 0.68 true thickness, as trench is almost along strike	
80	302°--3°	0.35 80.07	328/41W	Shale	Coaly	
		77.0	340/43W	Coal	Bright, chippy	
70				Shale	Dark with coaly & high-ash coal lands ≤10 cm one 10 cm bed clean coal	
60		60.5		Siltstone	Dark Gray resistant	
		0.10 59.0	338/40	Coal	Po wery, Bright, near-vertic A	
		52.1	334/58	Shale-coal	60% shale 40% coal, interbedded in beds ≤10cm contorted and near-vertical at base	
50		1.72 48.8		Coal	Somewhat high-ash, chunky breaking, slickensided	
40	# 8 Zone			Shale	Soft, dark 6 coal beds ≤ 10 cm much of unit is coaly	
30		0.30 29.1	337/54W	Coal		
		28.0		Shale		
		0.64 26.4		Coal	Bright, tending to platey, top 10 cm high-ash	
				Shale	Soft dark, many coal and coaly beds ≤5cm	
20		0.44 17.1 16.2		Coal & Shale	Each 50%	
		14.7	320/42W	Shale		
10		5.88		Coal	Bright, small blocky breaking, tending to powdery, much slickensiding 3 Shale partings ≤10 cm	
0	294°- 6°	Survey stake 0.0	338/64W	Siltstone-shale	Beds ≤5cm, 50% siltstone, 50% shale, very slightly coaly	
		1.00	7.9 9.8 332/57W	Coal	Bright, clean, small-blocky breaking	
10				Siltstone	Resistant beds ≤ 5cm	
			15.5	Shale	Coaly, soft	
20		1.05	18.1 21.1	Coal	Clean, small blocky breaking, tending to powdery 5cm shale parting 10cm below top	
30	314°, -6°		37.7	Siltstone-shale	Siltstone 70%, shale 30% not coaly	
40			42.0 334/55W			
50			50.0			
60						
70	304°, -18°		76	Shale-siltstone	Not at all coaly	
80						
90						
100	319°- 5°		100.0 330/51W			
			104.0	Covered	Trench not deep enough	
110			117.0 321/31W			
120			123	Siltstone	Beds 5cm, finely laminated	
130						
140						
150						
160				Covered	Trench not deep enough Axis of top plate Syncline in this unit	
170						
180						
190						
200			200			
210			214.0 338/42E	Siltstone-shale	Shale slightly coaly, siltstone soft brown + grey bed ≤10 cm	
220			218.0	Covered	Trench not deep enough	
			224.0			
230	302°, -8° No 8 Zone		234	BLOOM	Covered interval but almost 100% coal bloom	
240			246.0	Coverd	Trench not deep enough	
250			252	Covered	Sandstone rubble unit, medium-coarse, massive, light grey, some wood clasts	
260			265	Covered	Trench not deep enough	
270			279			
280			281	Bloom	Covered, trench not deep enough	
290				Covered	Trench not deep enough	
			293.0 338/46E	Shale	Grey	
			294.0	Covered	Trench not deep enough	
300			302.0 345/57E	Shale	Grey	
310						
320						
330				Covered	Trench not deep enough	
340						
350			350			
360						
370						
380			377.0 356/68E			
390						
400				Sandstone Siltstone, Shale	Soft grey, this unit is 50% exposed and shows interbedded sandstone, siltstone mostly platey all recessive.	
410			406.0			
420			422.0 351/69E			
430	No 10 Zone			Covered	Trench not deep enough	
			435.0	Shale	Grey	
440			438.0 439.0	Coal	Possibly high ash, top gradiational to shale	
				Sandstone, Siltstone Shale	Interbedded, multicoloured	
450			447.0 005/57E	Basal Sandstone	Survey Stake is top of Basal sandstone	
460						

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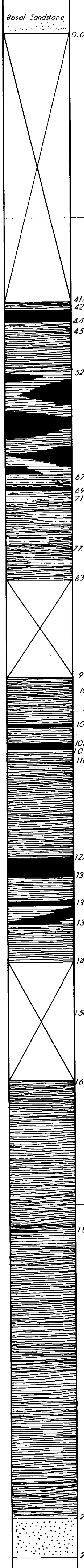
(10)

STRATIGRAPHIC SECTION

DESIGNATION: CMT 79 4	PART 1 OF 1
PROJECT: CROWN MOUNTAIN	AUTHOR: D. BELL
AREA: TOP PLATE	DATE: 1979
LOCATION: EAST LIME	SOURCE OF DATA: HAND & BACKHOE TRENCH

Notes. (1) Stratigraphic Direction: Up-section (from top of Basal Sandstone)
(2) Hand-trenched to 150 m, then backhoe trenched to finished.



SCALE [m]	TRENCH DIRECTION & INCLINATION	COAL TRUE THICKNESS (m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION MAIN	DESCRIPTION AMPLIFIED	SAMPLE
			Basal Sandstone				
0	235°, -7°			0.00 355/35W		Survey stake is top of Basal Sandstone	
20						Covered	
40	230°, +15°	1.90		41.0			
				42.0 344/42W	Shale	gray	
					Coal	With 45cm, grey shale parting: coal bright, powdery, some dull	
				44.0			
				45.0	Shale	Grey, small-blocky breaking	
				52.0			
60	No. 10 Zone				Bloom	Section to deep here to expose well by hand. But much of unit coal or high ash coal.	
				67.0	Shale-siltstone	Various colours	
70				69.0	Coal	10 cm. powdery	
				71.0	Siltstone-shale	Not coaly	
				77.5			
80	207°, +7°			83.0			
90					Covered.	This is a topographic ridge, and must be underlain by sandstone	
				98.0			
100	228°, +21°			100.0	Shale		
		0.30		105.0 337/21W	Coal		
					Shale	Coaly	
110		0.40		108.0	Coal	High-ash, difficult to see	
				109.0	Shale	Very coaly	
				110.2	Shale	Grey, minor siltstone	
		0.90		127.2 328/20W	Coal	Mostly bright, clean, powdery, slickensided	
130				130.0	Shale	Grey chippy	
		0.20		133.9	Coal	Mostly, bright	
				137.0 327/15W	Shale-coal	Difficult to see, certainly high-ash	
140					Shale	Grey chippy	
				143.0			
150	249°/-1°			150.0	Covered	This is the crossing of an old trail. Backhoe trenching along it starts at 161.1. This unit is underlain by shale, as can be seen around corner and it cannot be underlain by coal.	
160				161.1 328/22W	Shale	Mostly brown-grey monotonous, nodule-like breaking, not coaly, minor siltstone with fine laminations	
				184.0 327/20W	Shale	25% Siltstone all still monotonous and regular, A very few coaly streaks, and at 226.0, 4cm high ash coal.	
230				229. 344/33W	Sandstone	This is the hard, light-grey, resistant channel sandstone which forms the North Peak nearby and comes down on a dip slope from it. The west survey stake is at 235.0	
				235.0			

ORIGINAL FILE
VG-2..

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(11)

STRATIGRAPHIC SECTION

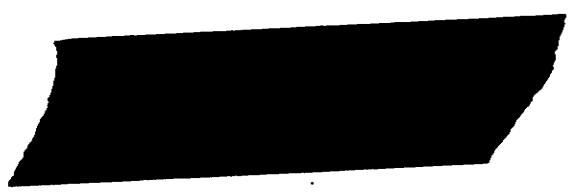
DESIGNATION: CMT.79.5 | PART 1 OF 1

PROJECT: CROWN MOUNTAIN | AUTHOR: D BELL | DATE: 1979

AREA: BOTTOM PLATE | SOURCE OF DATA: BACKHOE TRENCH

LOCATION:

SCALE	TRENCH DIRECTION & INCLINATION	COAL TRUE THICKNESS (m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION: MAIN	DESCRIPTION: AMPLIFIED	SAMPLE
[m]							
0	211°, +23°		No 9. Sandstone	0.00 352/25W		0.00 is east survey stake, the top of the No. 9 Sandstone overlying No. 9 seam	
						Covered	
10	211°, +11°			8.2			
			Sandstone			A. medium-hard, medium-dark grey sandstone unit, beds ≤ 10 cm with slightly wavy banding and many coaly flecks. Note opposite dips. Unit is fractured and distorted	
20				18.5		thrustlet at 18.5	
				335/11E 318/10W			
30			Shale			This shale unit is smeared and slickensided. Many small faults visible. There is much smeared, dirty coal of no particular bedding	
40	255°, +4°			37.0 315/10W			
50			Shale			With much smeared and polished coal	
						Thrustlet at 51.8	
				354/43W			
	0.68			55.8 Coal 56.5 Shale		Bright, polished, broken	
60	<2m		Coal			Shale overlies powdery and broken coal. Coal is at different attitude to shale, and thickness is impossible to determine. Could not be more than 2m.	
				63.0 340/43W			
			Shale				
70	275°, +2°			70.0 003/20W			
			Siltstone			Brown, some fine ss.	
				73.9			
80				82.0 360/20W			
			Shale			Minor siltstone, grey, not coaly except two beds 3cm and 12cm	
90							
				94.0 359/24		West survey stake at 94.0, trench end.	
100							
110							
120							
130							



HC-5

STRATIGRAPHIC SECTION 379 2/5 (12)

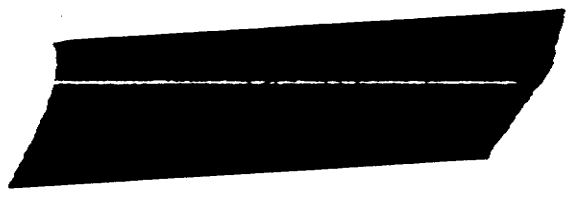
DESIGNATION: CMT 79 6 | PART _ OF _

PROJECT: CROWN MOUNTAIN | AUTHOR: D. BELL | DATE 79.9

AREA: BOTTOM PLATE | SOURCE OF DATA: BACKHOE TRENCH

LOCATION:

SCALE	TRENCH DIRECTION & INCLINATION	COAL TRUE THICKNESS(m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION MAIN	DESCRIPTION AMPLIFIED	SAMPLE
[m]						Note: Stratigraphic section of section 1	
0	259°, +2°			000 351/23 W		East-end survey stake, 00	
10					Slt-Sh	Mostly slt, but much shale and some fine sandstone dark, recessive, regular a few coaly bands, many coaly streaks and fragments Upper 1m graduational to coal	
20				21.0			
30		4.0 No. 9 Seam			Coal	Bright, well-bedded, small and medium-blocky breaking	
40				35.5 360 / 18W	Sandstone	35.5 is west survey stake No. 9 sandstone, hard, massive, coaly	
50							
60							
70							
80							
90							
100							
110							
120							
130							
140							



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STRATIGRAPHIC SECTION

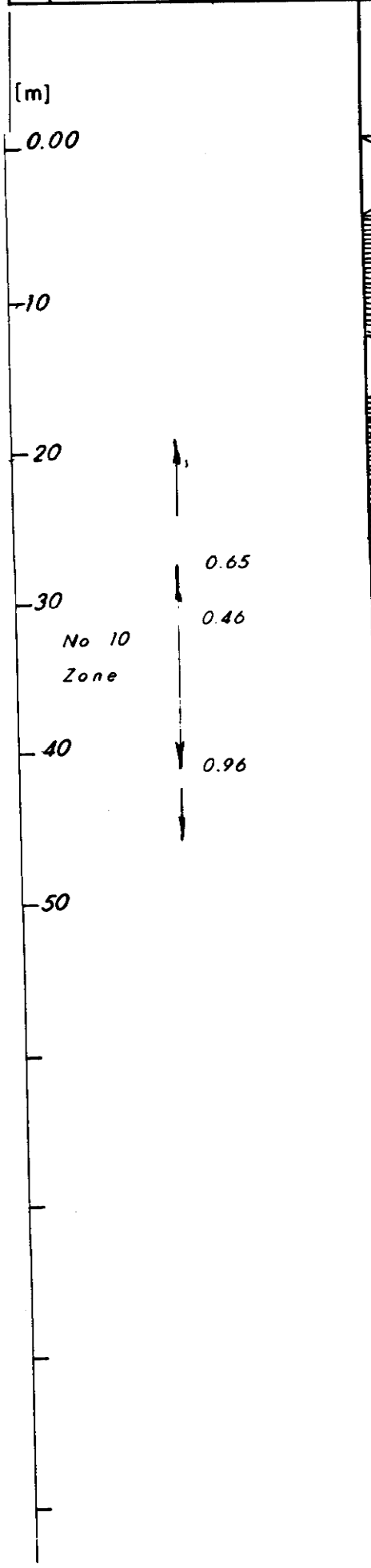
DESIGNATION: CMT 79-7 | PART 1 OF 1

PROJECT: CROWN MOUNTAIN | AUTHOR: D. BELL | DATE: 1979

AREA: BOTTOM PLATE | SOURCE OF DATA: BACKHOE TRENCH

LOCATION:

SCALE	TRENCH DIRECTION & INCLINATION	COAL TRUE THICKNESS (m)	LITHOLOGY	STRIKE & DIP	DESCRIPTION MAIN	DESCRIPTION AMPLIFIED	SAMPLE



Notes (1) Stratigraphic Direction Up-section

Covered

0.00 is East end survey stake

Covered

5.0 271/58W

Shale — Dark, recessive, chippy

13.0 280/52W

Covered

17.0 338/17W

Shale — Dark, recessive, minor siltstone

26.9 335/25W

Coal — Bright, clean, well-bedded

28.9

Shale — Dark, recessive

Coal — Bright, clean, chippy

31.4 010/42W

32.0

Shale — Recessive, dark, coaly

Siltstone — Medium, hard, brown

40.0 354/29W

Coal — Bright, clean, chippy

41.4

Shale — Dark, recessive

46.7

46.7 is west end survey stake

Covered

HC-5

CROWN MOUNTAIN
COAL EXPLORATION
1979 DRILLHOLES
COAL SAMPLE
ANALYSES

CONFIDENTIAL

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CONFIDENTIAL

APPENDIX F

1979 DRILL HOLE COAL SAMPLE ANALYSES

The drill core samples following were taken by rotary core, in three shallow holes in 1979. Descriptions of the holes are found in the 1979 report under the "1979 Drill Program," pp 45, and the core logs form 1979 Appendix B.

The analyses are included in this 1980 report as they were not available in time for the 1979 report.

App. F

K-Shell Crown Mtn 80(4)A *(1)

CROWS NEST RESOURCES - ANALYSIS REPORT

AREA: CROWN MOUNTAIN HOLE NO. CM 101B DATE: March 28/80 ANALYST Bernie Hudyma

LAB. NO.	SAMPLE NO.	SEAM	INTERVAL (METRES)	FRACTION	% AIR DRY LOSS	% MOISTURE	% ASH	% V.M.	% F.C.	F.S.I.	SULFUR	% YIELD	BTU/ LB	CALC. BASIS
79-709	Top of Seam	Upper Plate	12.4-17.2	RAW	4.78	.95	16.50			0				AD3
														ARB
							16.66							DB
				1.6 FLOAT		.70	6.91	20.17	72.22	0		75		ADB
							6.96	20.31	72.73					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
79-710	Lower half of Seam		17.2-20.7	RAW	1.28	.67	19.54			1				ADB
														ARB
							19.67							DB
				1.6 FLOAT		.39	6.25	21.08	72.28	1½		76		ADB
							6.27	21.16	72.57					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				RAW										ADB
														ARB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB

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CROWS NEST RESOURCES - ALYSIS REPORT App F

K-Shell Crown Mtn 80(1)A

EA: CROWN MOUNTAIN HOLE NO. CM-105B DATE: March 28/80 ANALYST Bernie Hudyma

LAB. NO.	SAMPLE NO.	SEAM	INTERVAL (METRES)	FRACTION	% AIR DRY LOSS	% MOISTURE	% ASH	% V.M.	% F.C.	F.S.I.	SULFUR	% YIELD	BTU/ LB	CALC. BASIS
79-711		Lower Plate	53.5-57.1	RAW	1.11	.46	26.48			1				ADB
														ARB
							26.60							DB
				1.6 FLOAT		.31	8.52	18.25	72.92	1½		69		ADB
							8.55	18.31	73.14					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				RAW										ADB
														ARB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				RAW										ADB
														ARB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB

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App. F

K-Shell Crown Mtn 80(c)(4)

CROWS NEST RESOURCES - ANALYSIS REPORT

AREA: CROWN MOUNTAIN HOLE NO. CM-RH106 DATE: March 28/80 ANALYST Bernie Hudyma

LAB. NO.	SAMPLE NO.	SEAM	INTERVAL (METRES)	FRACTION	% AIR DRY LOSS	% MOISTURE	% ASH	% V.M.	% F.C.	F.S.I.	SULFUR	% YIELD	BTU/ LB	CALC. BASIS
79-712			28-30	RAW	6.76	.41	33.50			2½				ADB
														ARB
			Drill Cuttings				33.64							DB
				1.6 FLOAT		.41	6.24	22.56	70.79	7		50		ADB
							6.27	22.65	71.08					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
79-713			38-40	RAW	9.29	.25	24.21			1				ADB
														ARB
							24.27							DB
			Drill Cuttings	1.6 FLOAT		.68	9.94	20.65	68.73	1		67		ADB
							10.01	20.79	69.20					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
79-714			40-42	RAW	18.58	.35	12.21			2½				ADB
														ARB
							12.25							DB
			Drill Cuttings	1.6 FLOAT		.65	9.94	20.49	68.92	3		74		ADB
							10.00	20.62	69.38					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB

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CROWS NEST RESOURCES - ANALYSIS REPORT App. F

K. Shell Crown Mtn Sol(4)A (1)

AREA: CROWN MOUNTAIN HOLE NO. CM-RH106 DATE: March 28/80 ANALYST Bernie Hudyma

LAB. NO.	SAMPLE NO.	SEAM	INTERVAL (METRES)	FRACTION	% AIR DRY LOSS	% MOISTURE	% ASH	% V.M.	% F.C.	F.S.I.	SULFUR	% YIELD	BTU/ LB	CALC. BASIS
79-715			44-46 Drill Cuttings	RAW	18.03	.33	16.12			2½				ADB
														ARB
							16.17							DB
				1.6 FLOAT		.81	7.74	21.07	70.38	4		70		ADB
							7.80	21.24	70.96					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
79-716			46-48 Drill Cuttings	RAW	17.92	.33	32.44			5½				ADB
														ARB
							32.55							DB
				1.6 FLOAT		.71	7.20	23.76	68.33	8		46		ADB
							7.25	23.93	68.82					DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				RAW										ADB
														ARB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB
				FLOAT										ADB
														DB

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=K-SHELL-CREDON MNT 77(2)A.

Maps

'ENCLOSERS'

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5 of 5

ENCLOSURES

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 391

OPEN FILE

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 391

RH-69-35 | RH-79-103 | RH-69-34 | RH-69-29 | RH-69-28 | RH-79-104

GRD. ELEV. 1901.32 m | GRD. ELEV. 1963.48 m | GRD. ELEV. 1931.82 m | GRD. ELEV. 1953.49 m | GRD. ELEV. 2012.42 m | GRD. ELEV. 1918.24 m

BOTTOM PLATE

DEPTH m. | GAMMA | NEUTRON

DEPTH m. | GAMMA | L.S.D.

#9 SEAM

#10 ZONE

DATUM LINE
TOP OF BASAL SANDSTONE

00391 5/5 1(a)

RH-69-28 | RH-79-104 | RH-69-31 | RH-69-27 | RH-69-32 | RH-79-102

GRD. ELEV. 2012.42 m | GRD. ELEV. 1918.24 m | GRD. ELEV. 1960.60 m | GRD. ELEV. 2057.13 m | GRD. ELEV. 1987.36 m | GRD. ELEV. 2215.77 m

BOTTOM PLATE

DEPTH m. | GAMMA | L.S.D.

DEPTH m. | GAMMA | NEUTRON

?

?

#9 SEAM

#10 ZONE

DATUM LINE

TOP OF BASAL SANDSTONE

CROWN MOUNTAIN THRUST

00391 5/5 ②(b)

-32

EV.
m

RH-79-102

GRD. ELEV.
2215.77 m

RH-69-26

GRD. ELEV.
2167.15 m

RH-79-101

GRD. ELEV.
2151.81 m

RH-69-33

GRD. ELEV.
2203.62 m

TOP PLATE

DEPTH m. | GAMMA | L.S.D.

NEUTRON

DEPTH m. | GAMMA | L.S.D.

DEPTH m. | GAMMA | NEUTRON

DEPTH m. | GAMMA | NEUTRON

#8 ZONE

#9 SEAM

#10 ZONE

CROWN MOUNTAIN THRUST

DATUM LINE
TOP OF BASAL SANDSTONE

391 5/5, 2(c)
FIGURE 16

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN
S.E.B.C.

DRILL HOLE CORRELATION CHART

AUTHOR: D BELL	SCALE: 1:500 (VERTICAL)	ENCLOSURE No:
DATE: APRIL 1980	REVISED:	DRAWING No: HG-51
To Accompany		

5 524 000 mN
5 523 500 mN
5 523 000 mN
5 522 500 mN
5 522 000 mN
5 521 500 mN
5 521 000 mN
5 520 500 mN
460500E

TOP PLATE SYNCLINE
STRUCTURAL CONTOUR NOTES
SEAM #8 CONTOURS ON SEAM TOP WHICH DOES NOT REACH DOWN TO 2050
SEAM #9 THE SEAM TOP MAY JUST BARELY REACH DOWN TO 2000 PHT

CL 366
CL 367
CL 371
#9 SURFACE
#8 SURFACE
2150
2100
2050
2000
1950
CROWN MOUNTAIN THRUST
347 TRUE
MAXIMUM
WESTWARD
SEAM #9 CROWN MOUNTAIN THRUST
1500N
1600N
1700N
1800N
1900N
2000N
2100N
2200N

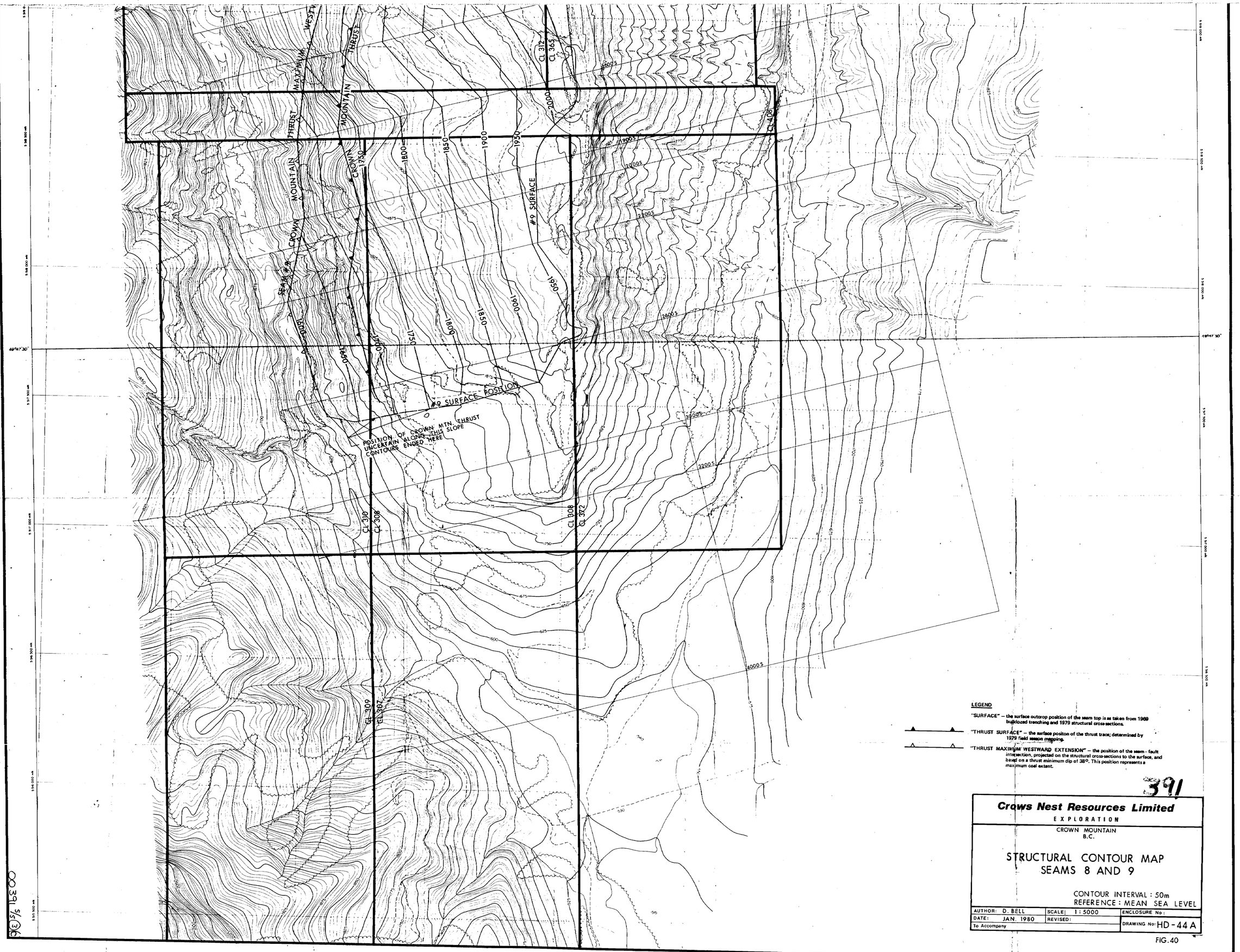
00391 5/5 ③(a)

5 520 500 mN
5 520 000 mN
5 519 500 mN
5 519 000 mN
5 518 500 mN
5 518 000 mN
5 517 500 mN

#9 SURFACE
CROWN MOUNTAIN THRUST
347 TRUE
257 TRUE
MAXIMUM WESTWARD EXTENSION
#9 SURFACE
CL 312
CL 365
#9 SURFACE
CROWN MOUNTAIN THRUST
MAXIMUM WESTWARD EXTENSION
#9 SURFACE
CROWN MOUNTAIN THRUST
SEAM #9
#9 SURFACE POSITION OF CROWN MTN THRUST SLOPE BURIED HERE
POSITION OF CROWN MTN THRUST SLOPE BURIED HERE UNCERTAIN CONTOURS

STRUCTURAL CONTOUR NOTES.
SEAM #8 CONTOURS ON SEAM TOP WHICH DOES NOT REACH DOWN TO 2000
SEAM #9 THE SEAM TOP MAY JUST BARELY REACH DOWN TO 2000 BUT IS PROBABLY NOT

00391 5/5 ③(b)



LEGEND

"SURFACE" – the surface outcrop position of the seam top is as taken from 1969 bulldozed trenching and 1979 structural cross-sections.

"THRUST SURFACE" – the surface positon of the thrust trace; determined by 1979 field season mapping.

"THRUST MAXIMUM WESTWARD EXTENSION" – the position of the seam - fault intersection, projected on the structural cross-sections to the surface, and based on a thrust minimum dip of 38°. This position represents a maximum coal extent.

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Crows Nest Resources Limited

EXPLORATION

CROWN MOUNTAIN
B.C.

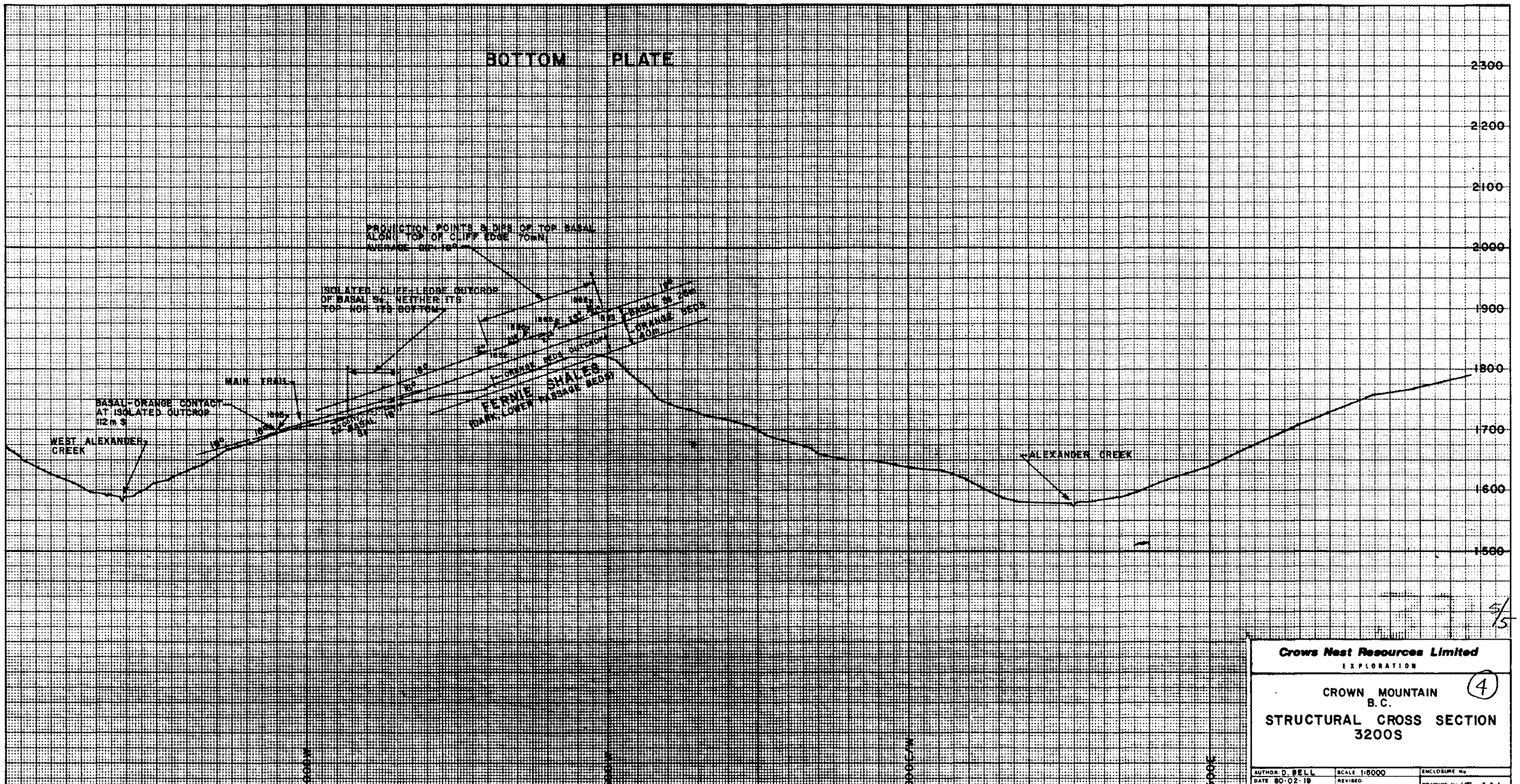
STRUCTURAL CONTOUR MAP SEAMS 8 AND 9

CONTOUR INTERVAL : 50m
REFERENCE : MEAN SEA LEVEL

AUTHOR: D. BELL	SCALE: 1 : 5000	ENCLOSURE No :
DATE: JAN. 1980	REVISED:	DRAWING No: HD - 44 A
To Accompany		

FIG. 40

00391 (3)(5)



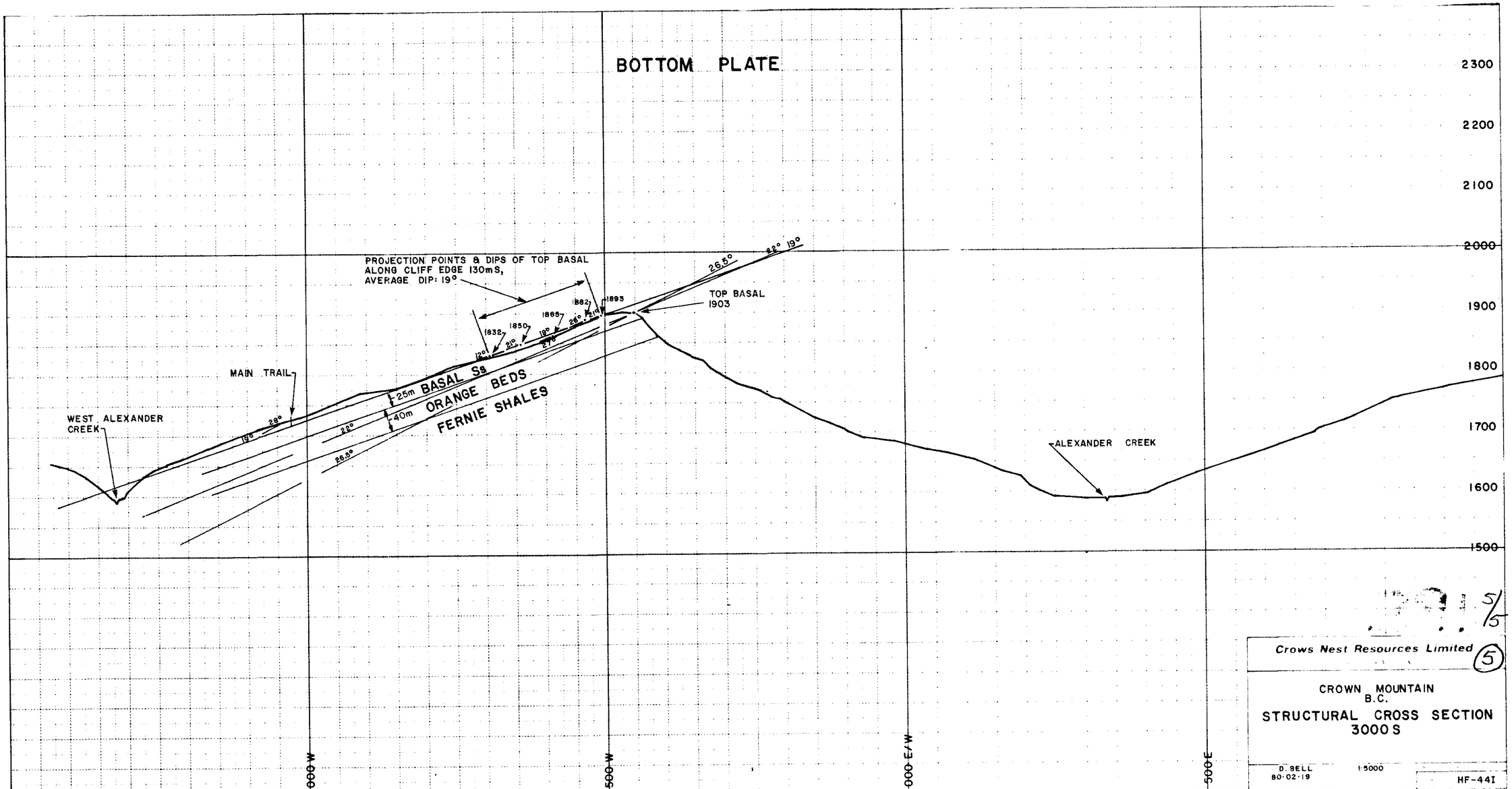
4/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN
B.C.
(4)

STRUCTURAL CROSS SECTION
3200S

AUTHOR: D. BELL	SCALE 1:5000	ENCLOSURE No
DATE 80-02-19	REVISED	DRAWING No HF-44J
To Accompany		



Crows Nest Resources Limited (5)

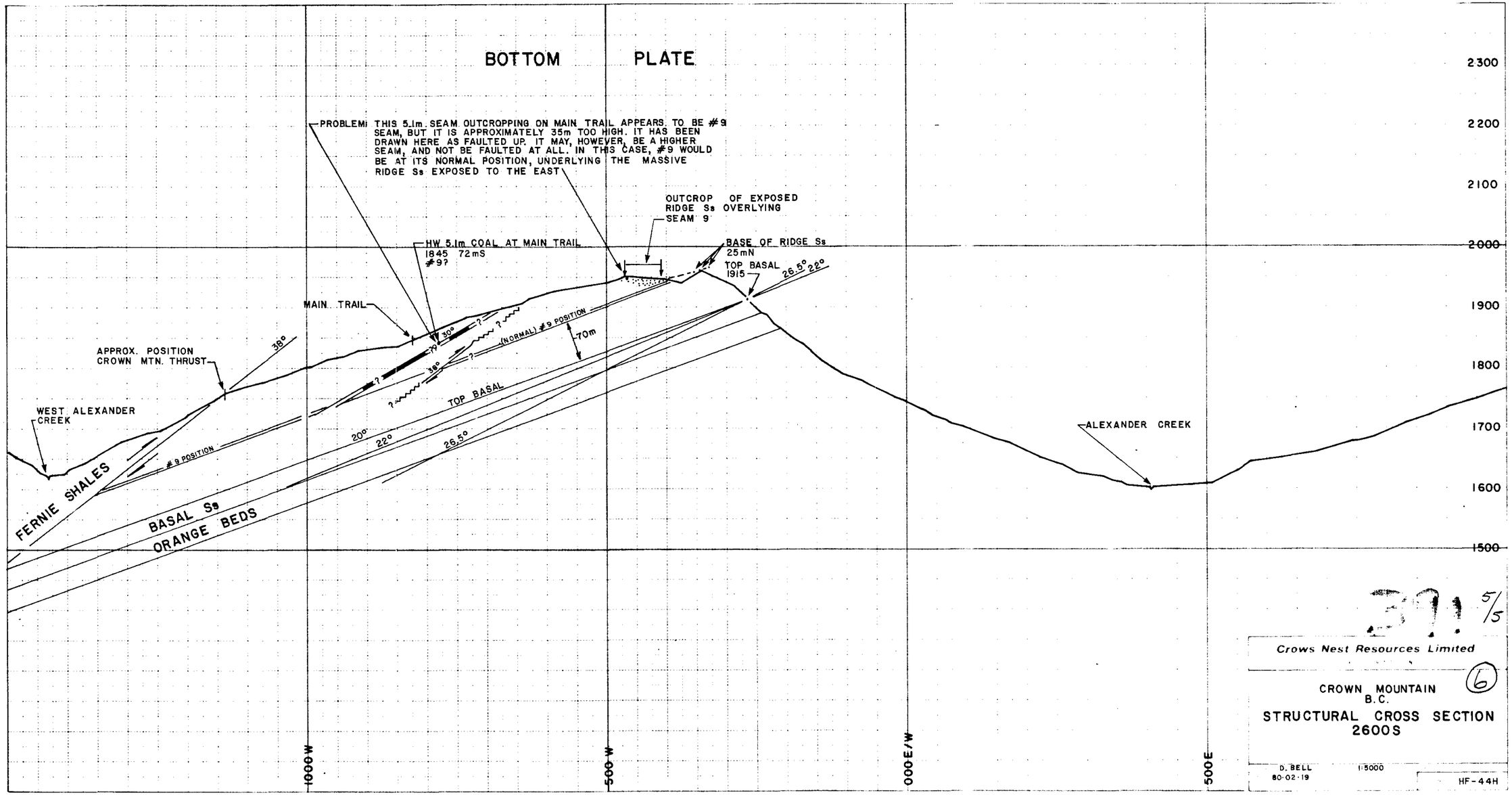
CROWN MOUNTAIN
B.C.

STRUCTURAL CROSS SECTION
3000 S

D. BELL
80-02-19

1:5000

HF-441



5/5

Crows Nest Resources Limited

CROWN MOUNTAIN
B.C.

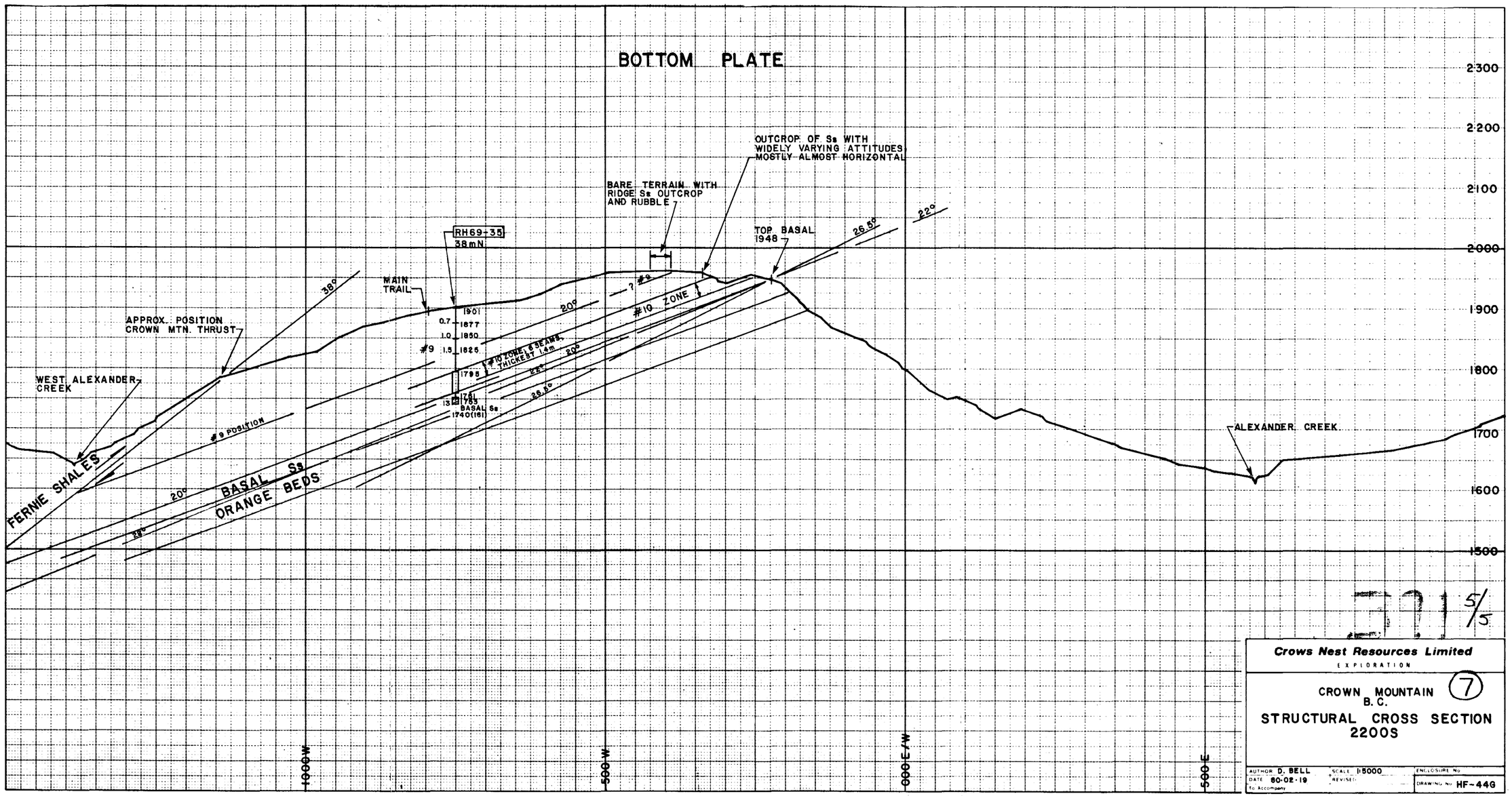
STRUCTURAL CROSS SECTION
2600S

(6)

D. BELL
80-02-19

1:5000

HF-44H



5/5

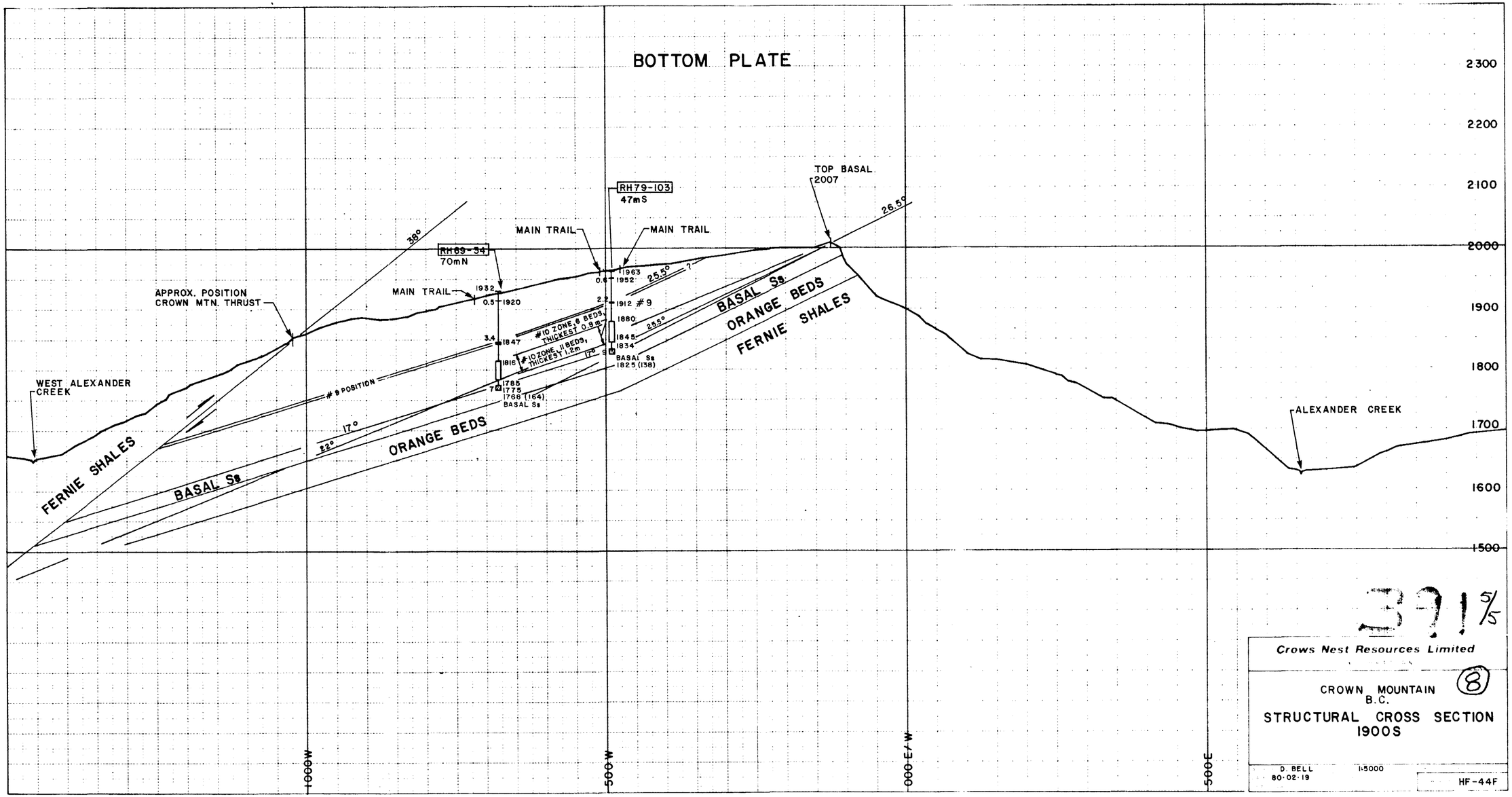
Crows Nest Resources Limited

EXPLORATION

CROWN MOUNTAIN (7)
B. C.

STRUCTURAL CROSS SECTION
2200S

AUTHOR D. BELL | SCALE 1:5000 | ENCLOSURE No.
DATE 80-02-19 | REVISED: | DRAWING No. HF-446
To Accompany



391 5/5

Crows Nest Resources Limited

CROWN MOUNTAIN
B.C.

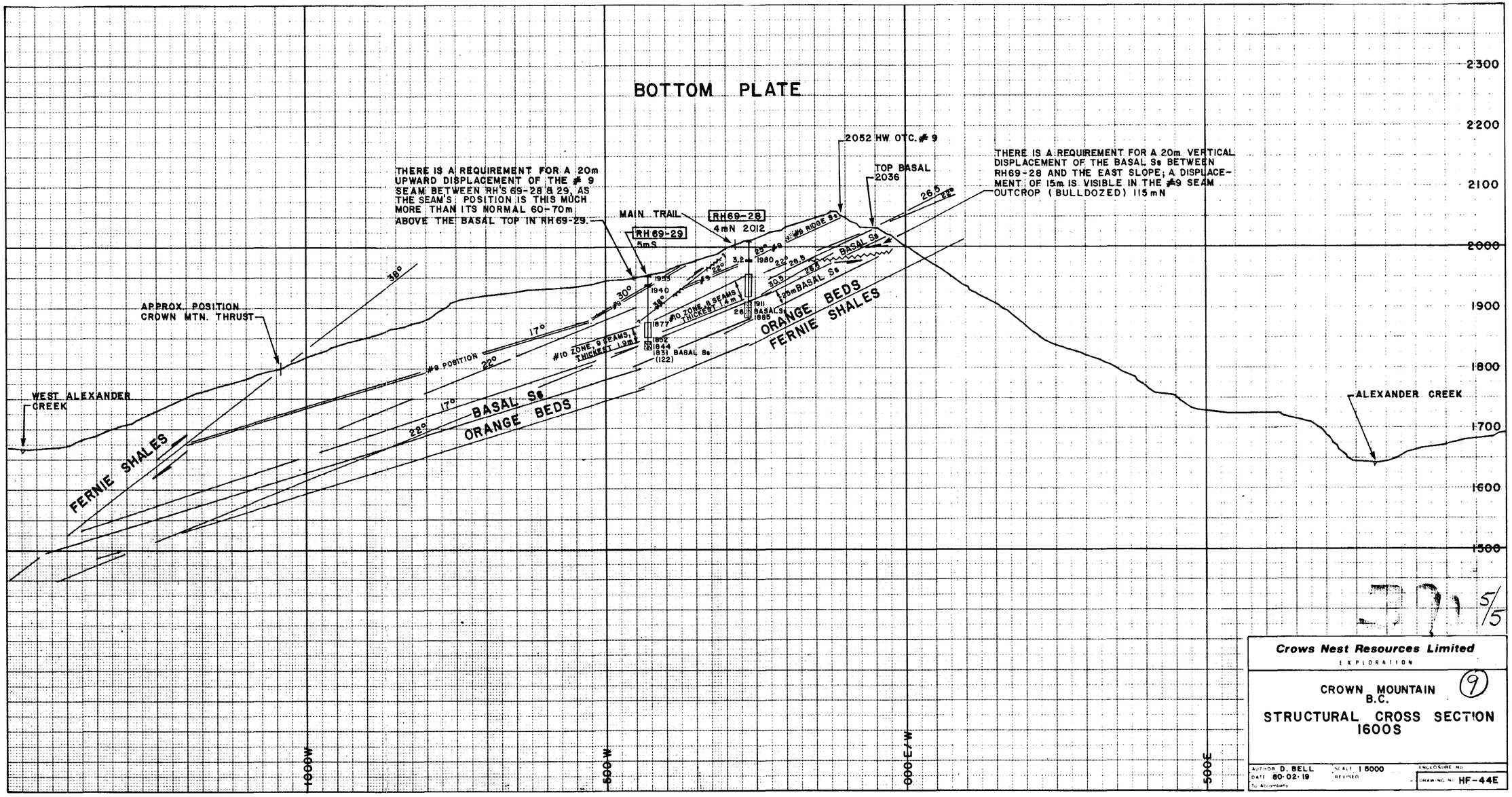
STRUCTURAL CROSS SECTION
1900S

(8)

D. BELL
80-02-19

1:5000

HF-44F



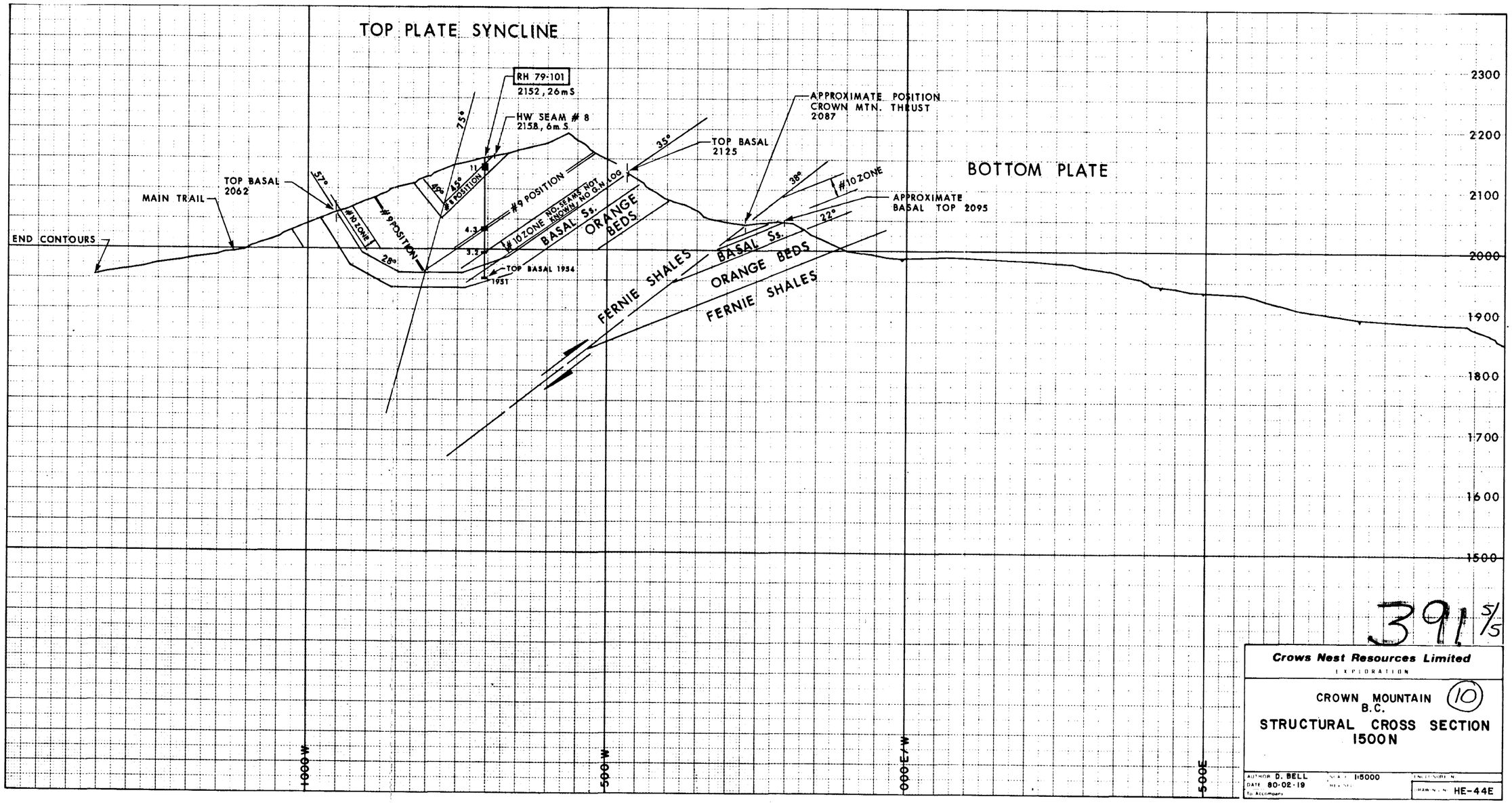
5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (9)
B.C.

STRUCTURAL CROSS SECTION
1600S

AUTHOR D. BELL | SCALE 1:5000 | ENCLOSURE No.
DATE 80-02-19 | REVISED | DRAWING No. HF-44E
To Accompany



391 5/5

Crows Nest Resources Limited
EXPLORATION

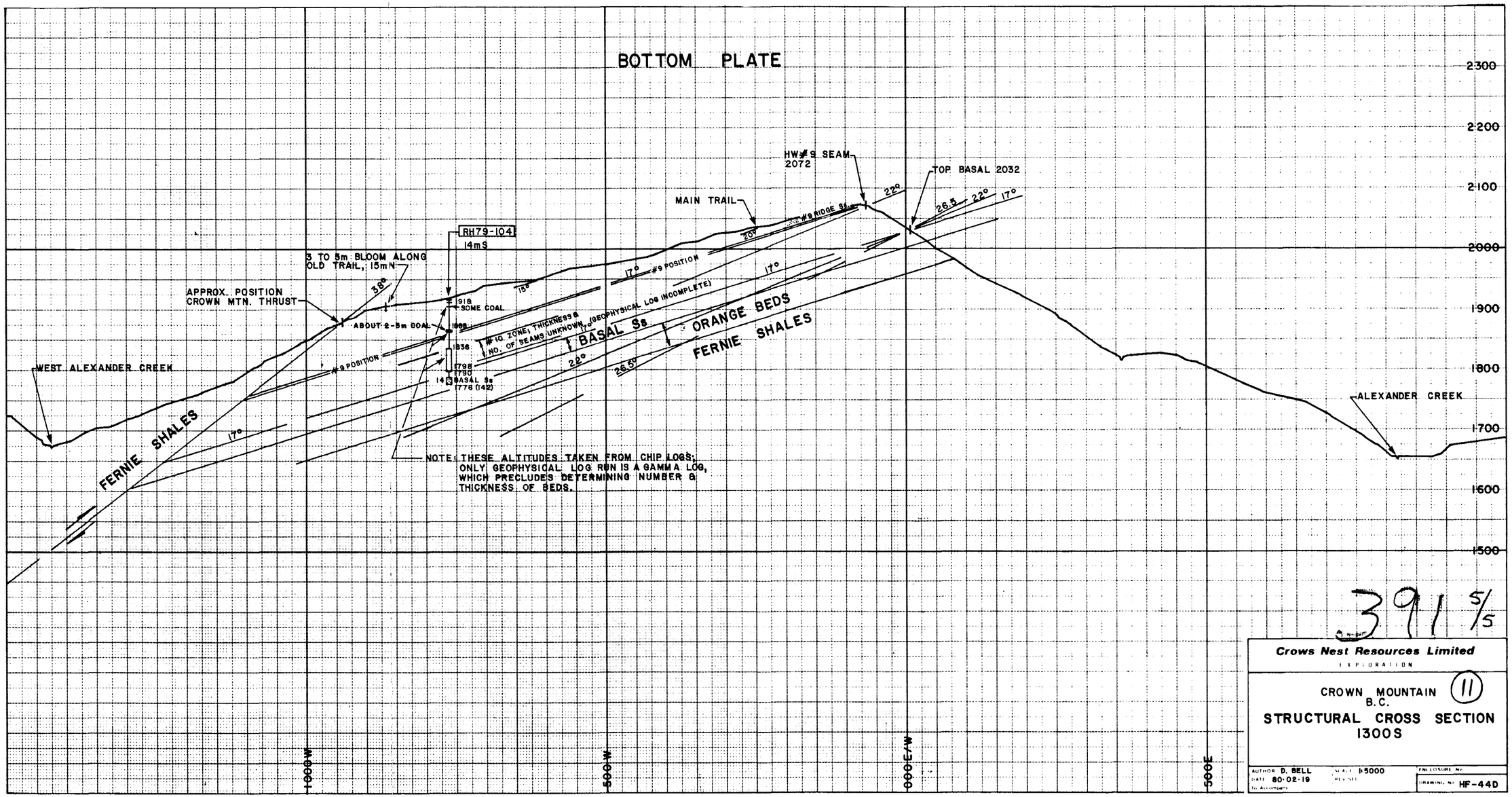
CROWN MOUNTAIN (10)
B.C.

STRUCTURAL CROSS SECTION
1500N

AUTHOR D. BELL
DATE 80-02-19
To Accompany

SCALE 1:5000

DRAWING NO. HE-44E



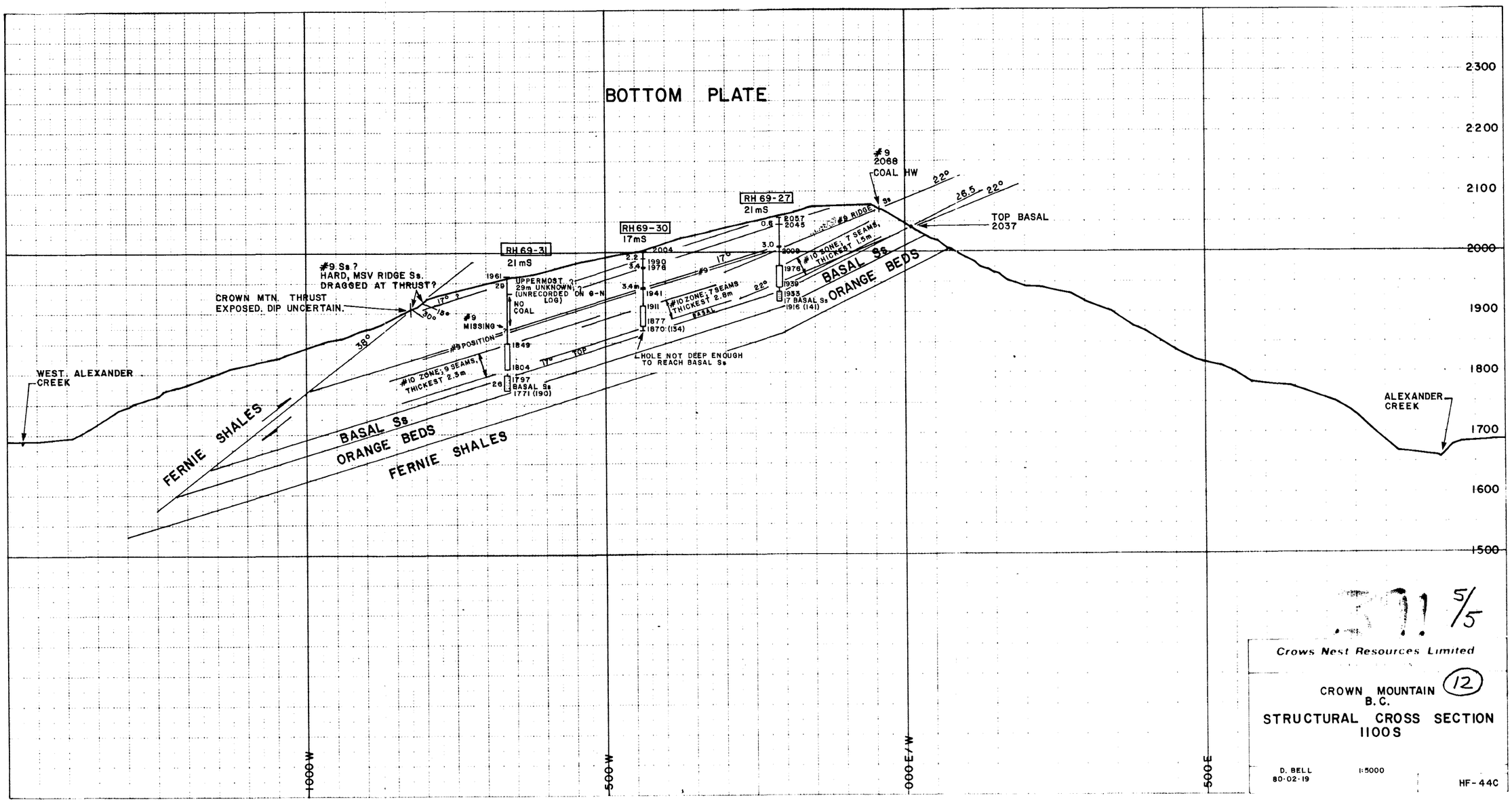
391 5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (11)
B.C.

STRUCTURAL CROSS SECTION 1300S

AUTHOR D. BELL
DATE 80-02-19
SCALE 1:5000
ENCLOSURE No.
DRAWING No. HF-44D



5/5

Crows Nest Resources Limited

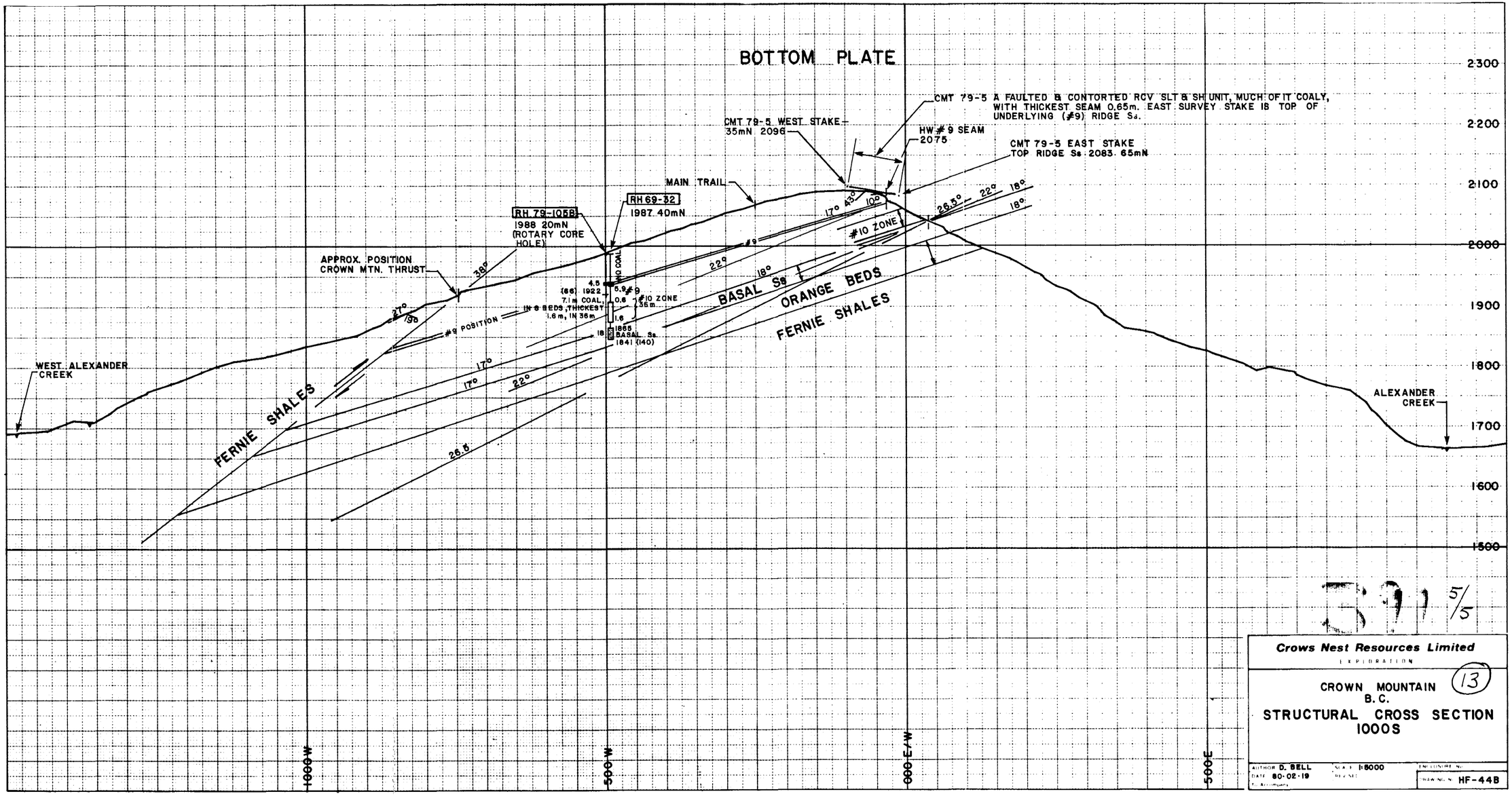
CROWN MOUNTAIN (12)
B.C.

STRUCTURAL CROSS SECTION
1100S

D. BELL
80-02-19

1:5000

HF-44C

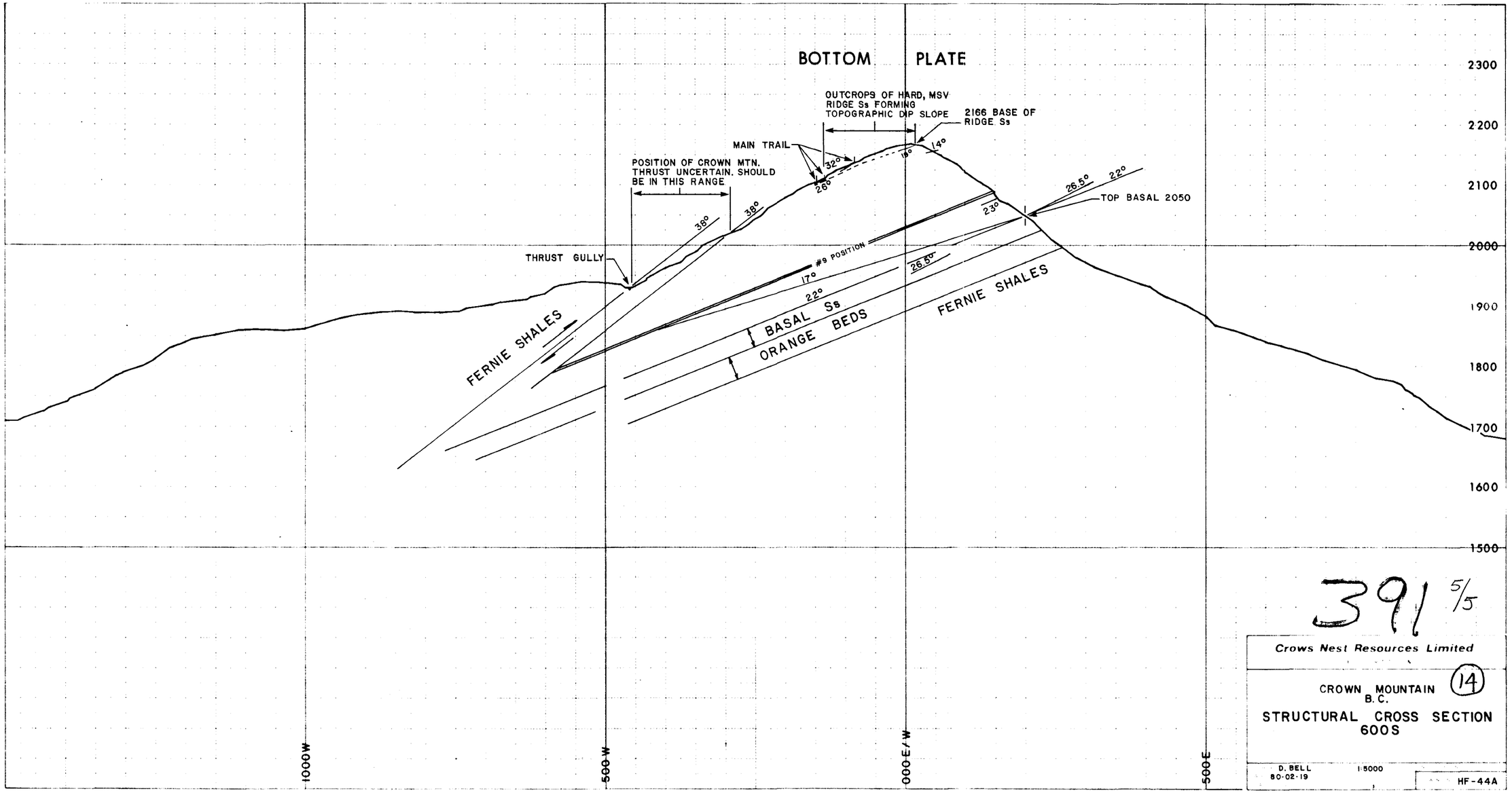


5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (13)
B.C.
STRUCTURAL CROSS SECTION
1000S

AUTHOR D. BELL
DATE 80-02-19
SCALE 1:5000
DRAWING NO. HF-448



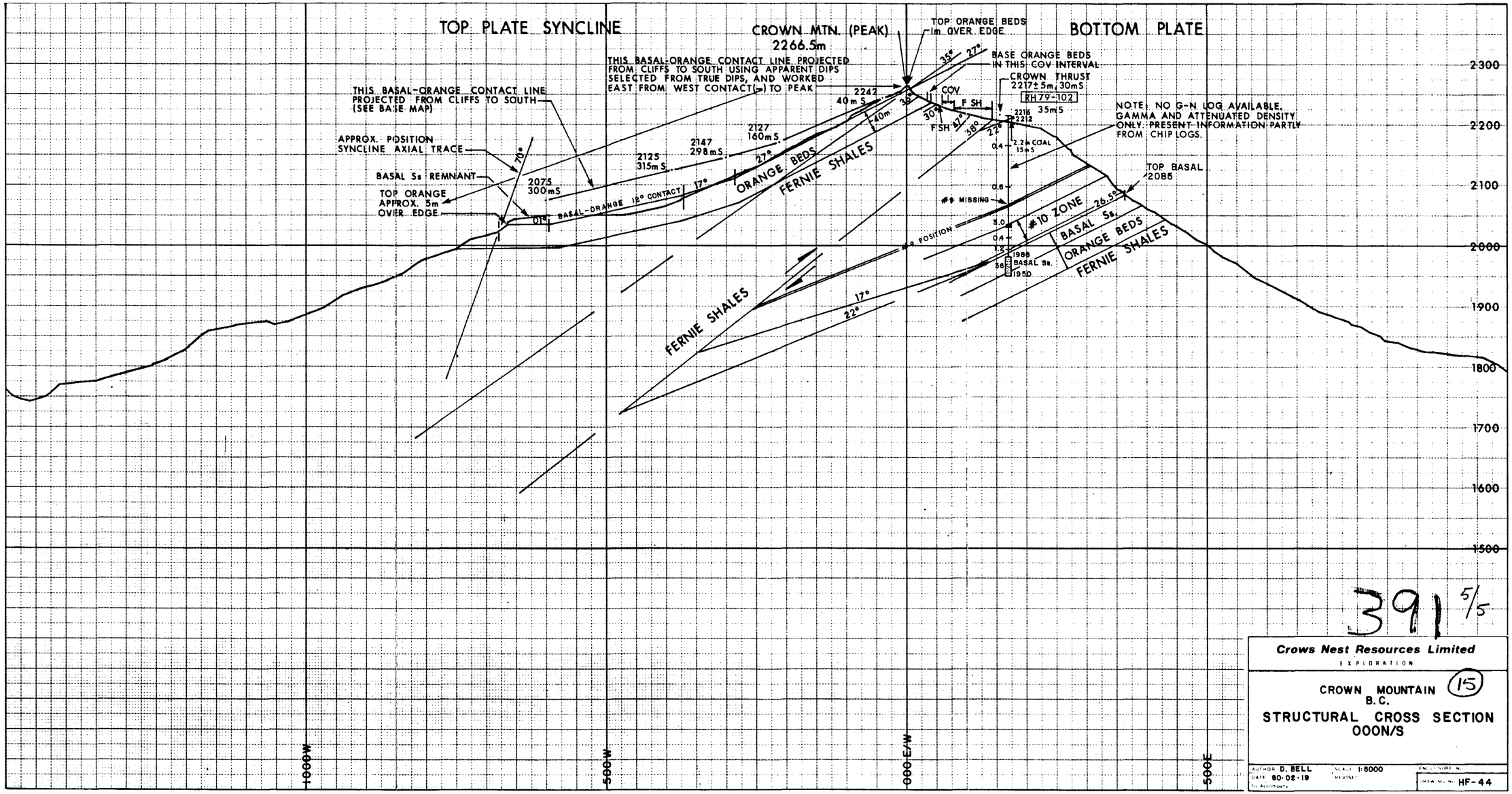
391 5/5

Crows Nest Resources Limited

CROWN MOUNTAIN B.C. (14)

STRUCTURAL CROSS SECTION 600S

D. BELL 80-02-19 | 1:5000 | HF-44A



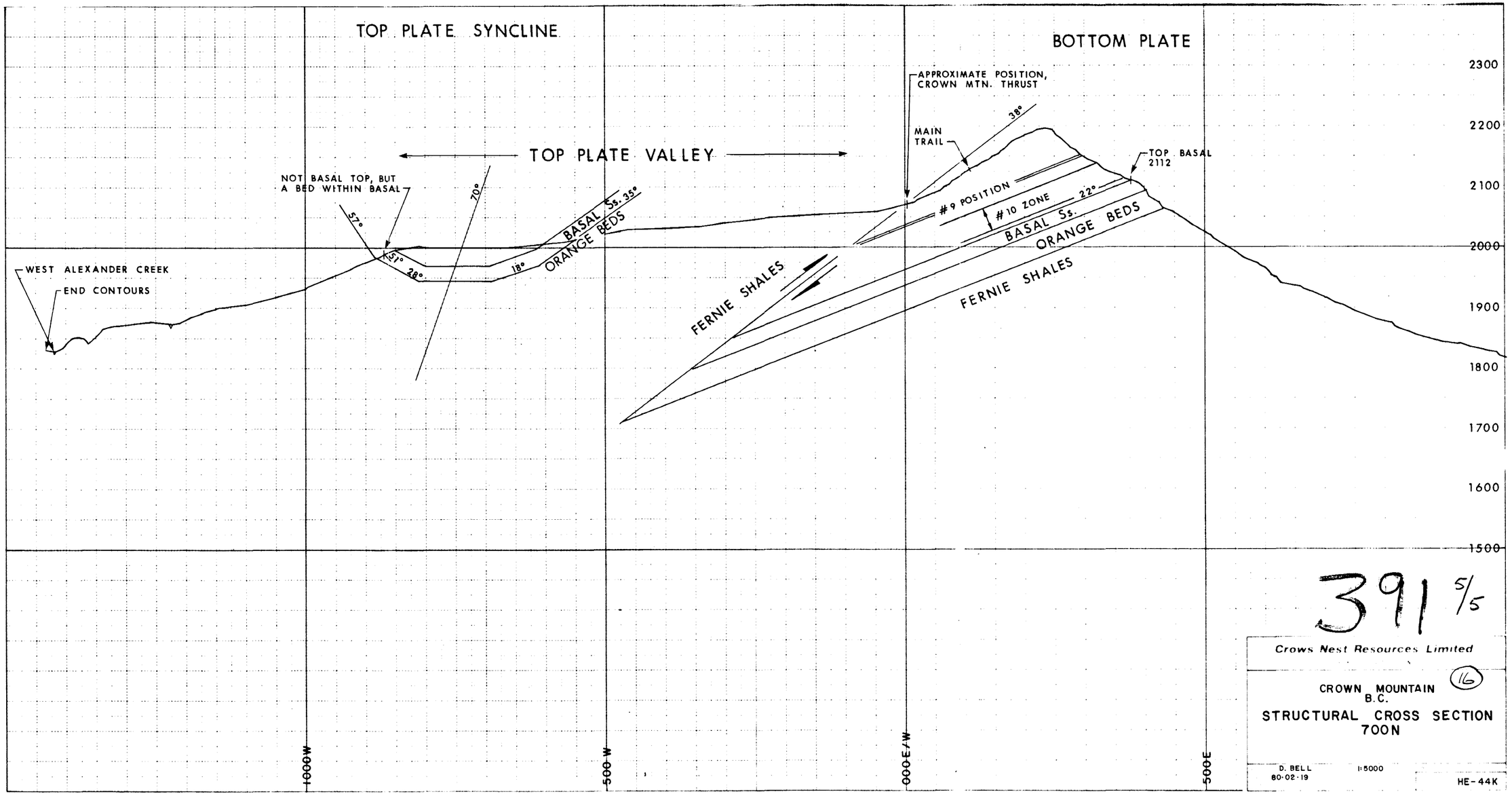
391 5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (15)
B. C.

STRUCTURAL CROSS SECTION 000N/S

AUTHOR D. BELL
DATE 80-02-19
SCALE 1:5000
ENGINEER N.
DRAWING NO. HF-44



391 5/5

Crows Nest Resources Limited

(16)

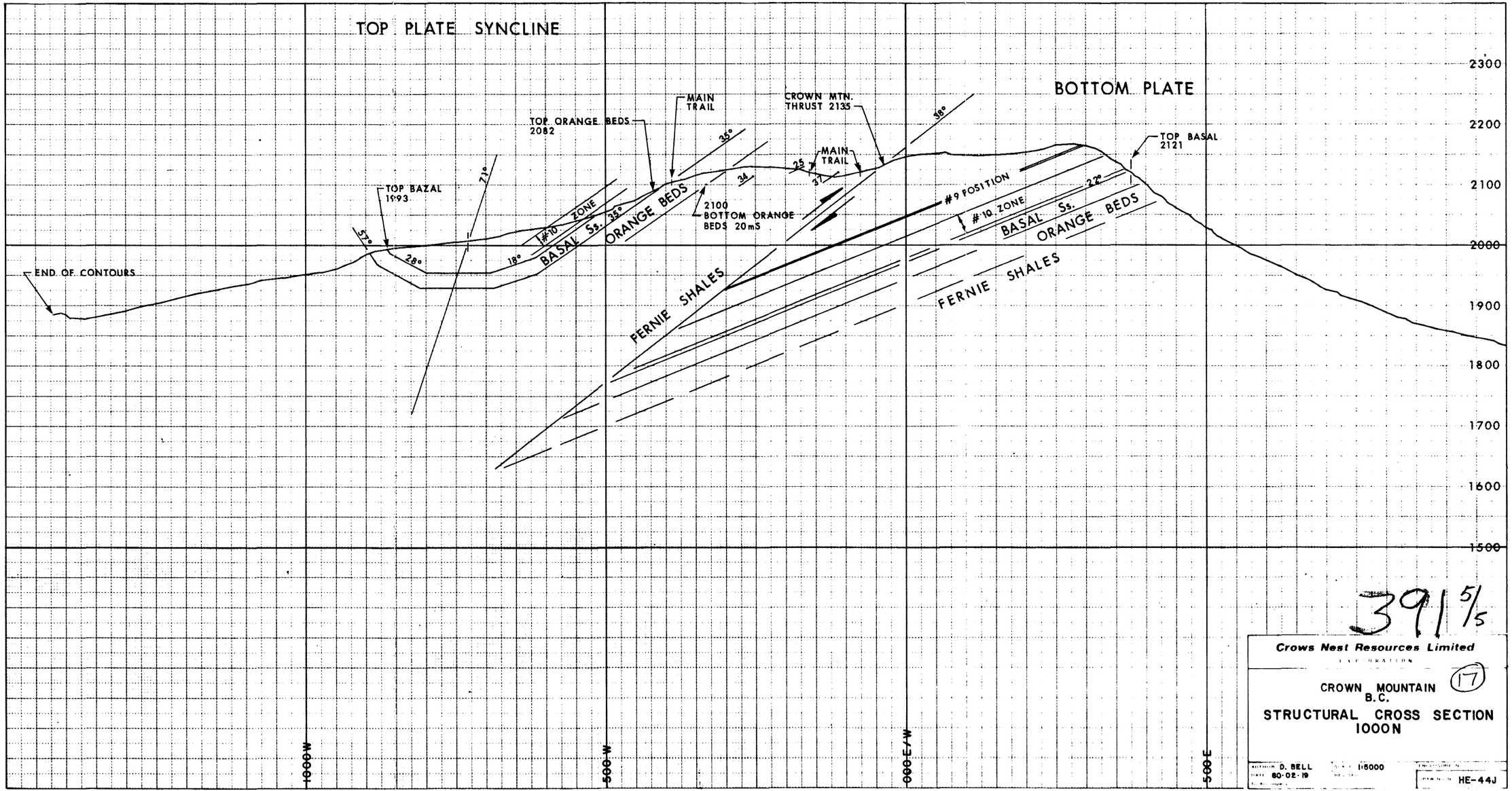
CROWN MOUNTAIN
B.C.

STRUCTURAL CROSS SECTION
700N

D. BELL
80-02-19

1:5000

HE-44K



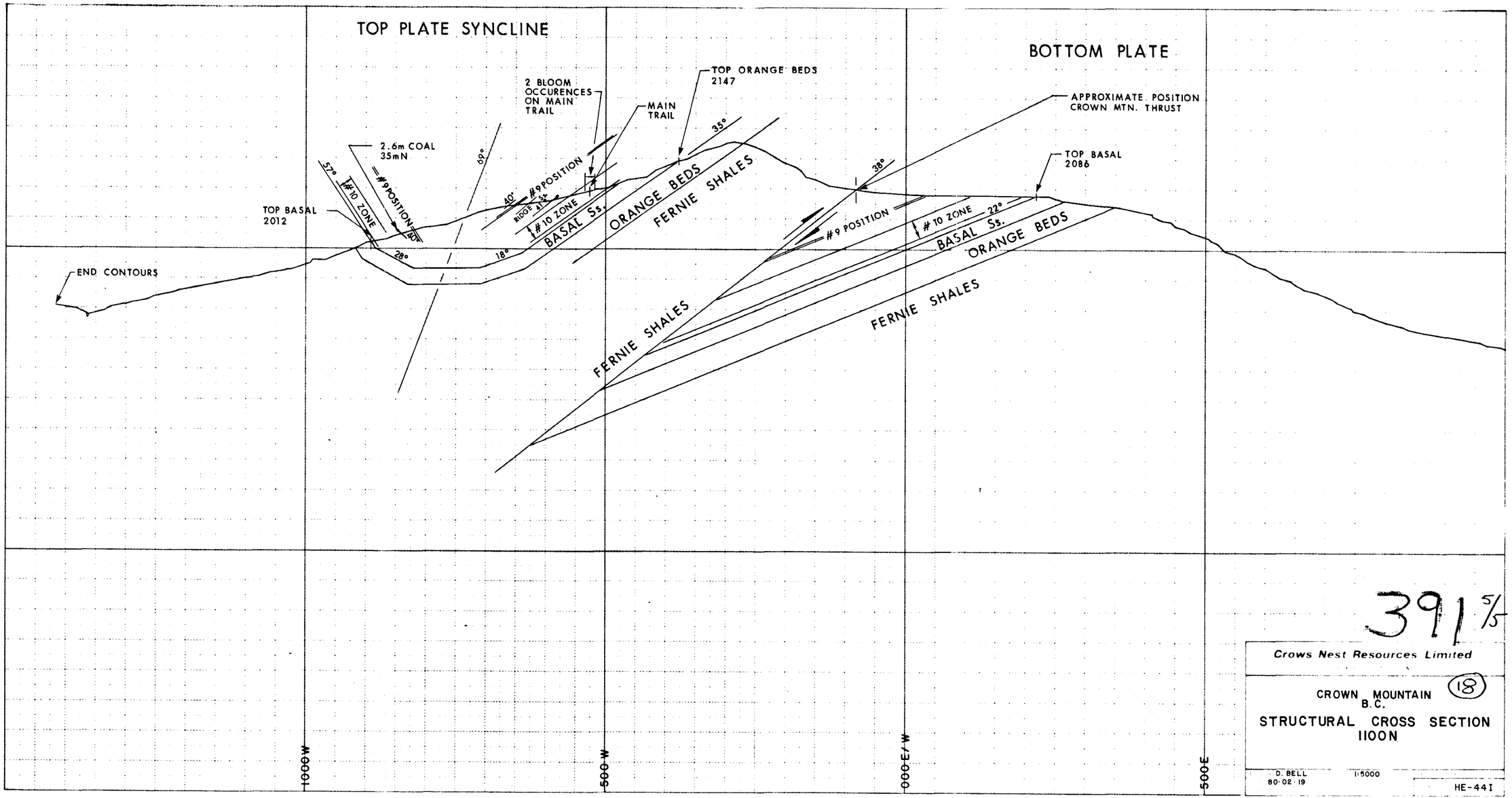
391 5/5

Crows Nest Resources Limited

CROWN MOUNTAIN (17)
B.C.

STRUCTURAL CROSS SECTION
1000N

D. BELL | 1:5000 | 80-02-19 | HE-44J



391 5/5

Crows Nest Resources Limited

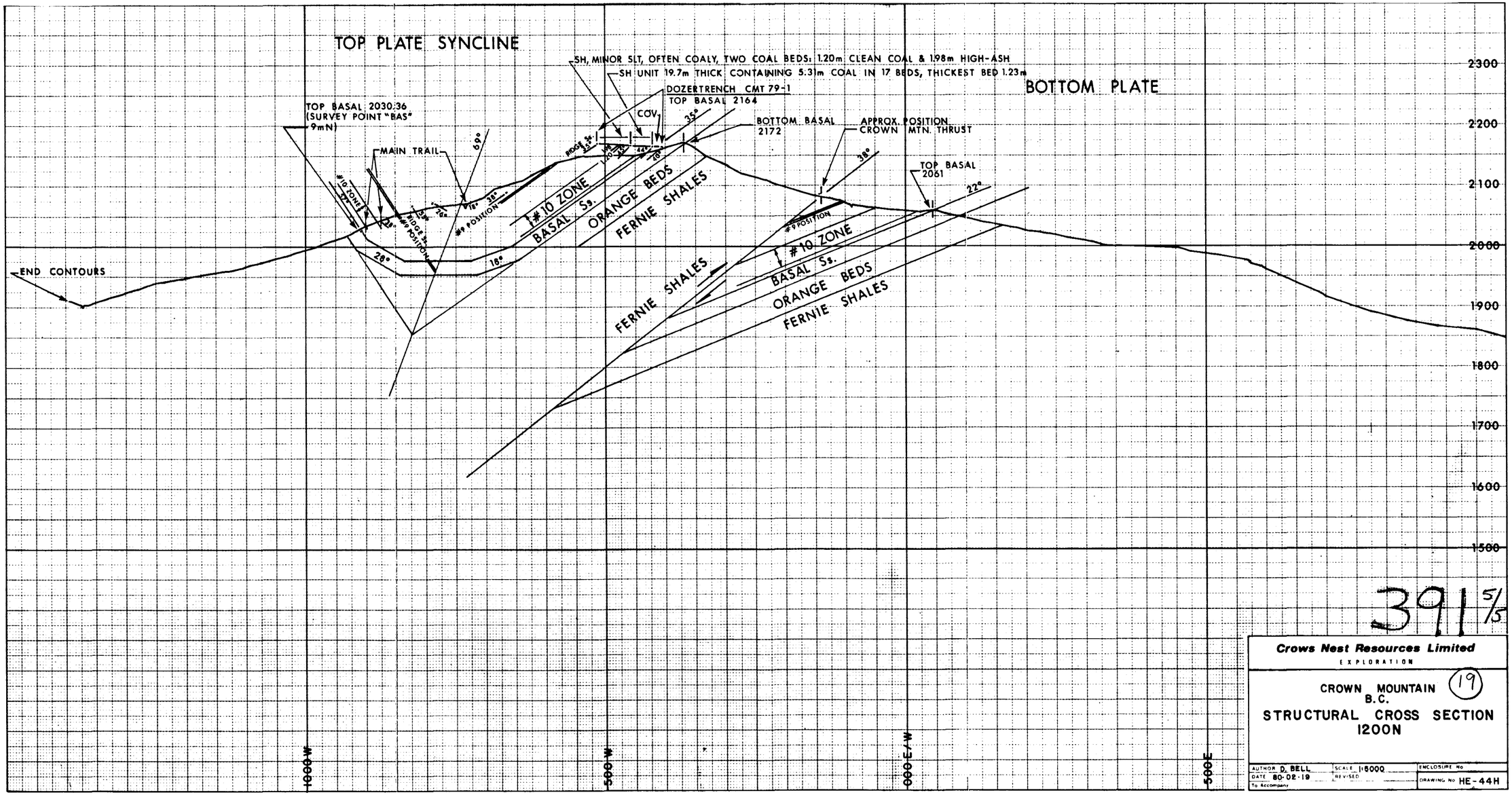
CROWN MOUNTAIN (18)
B.C.

STRUCTURAL CROSS SECTION
1100N

D. BELL
80-02-19

1:5000

HE-441

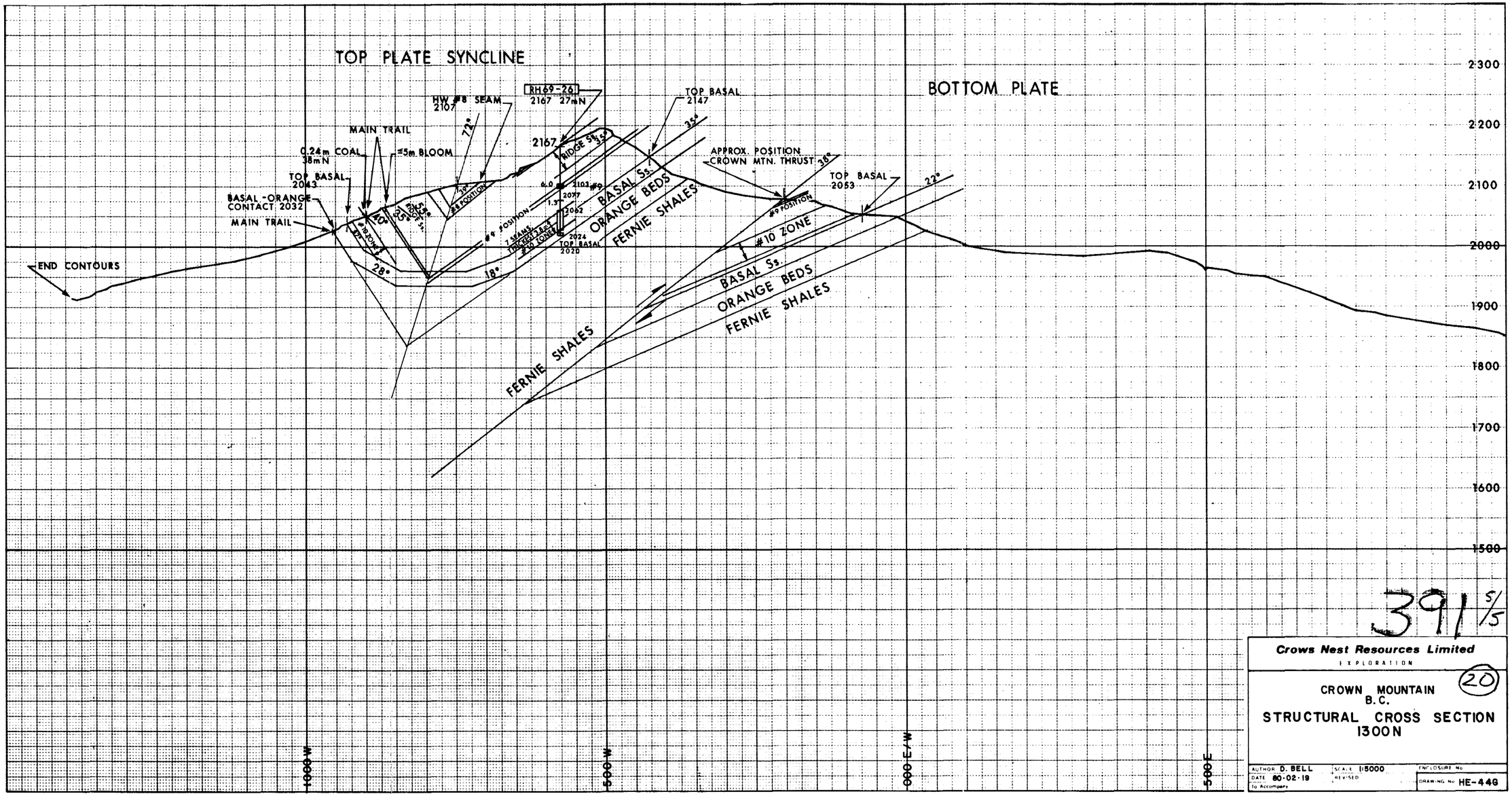


391 5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (19)
B.C.
STRUCTURAL CROSS SECTION
1200N

AUTHOR D. BELL	SCALE 1:5000	ENCLOSURE No
DATE 80-02-19	REVISED	
To Accompany		DRAWING No HE-44H



391 5/5

Crows Nest Resources Limited
EXPLORATION

(20)

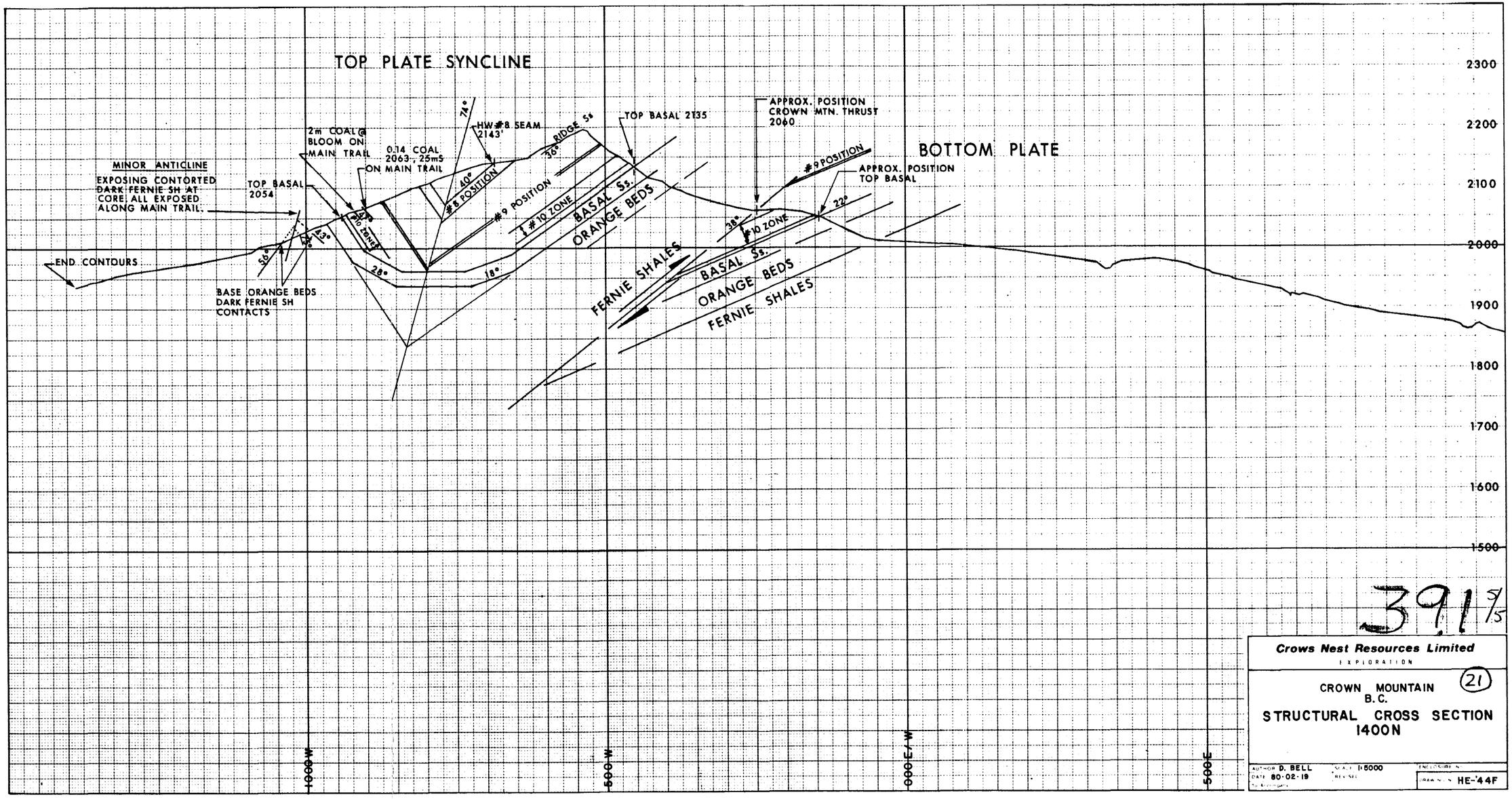
CROWN MOUNTAIN
B.C.

STRUCTURAL CROSS SECTION
1300N

AUTHOR D. BELL
DATE 80-02-19
To Accompany

SCALE 1:5000
REVISED

ENCLOSURE No.
DRAWING No. HE-446



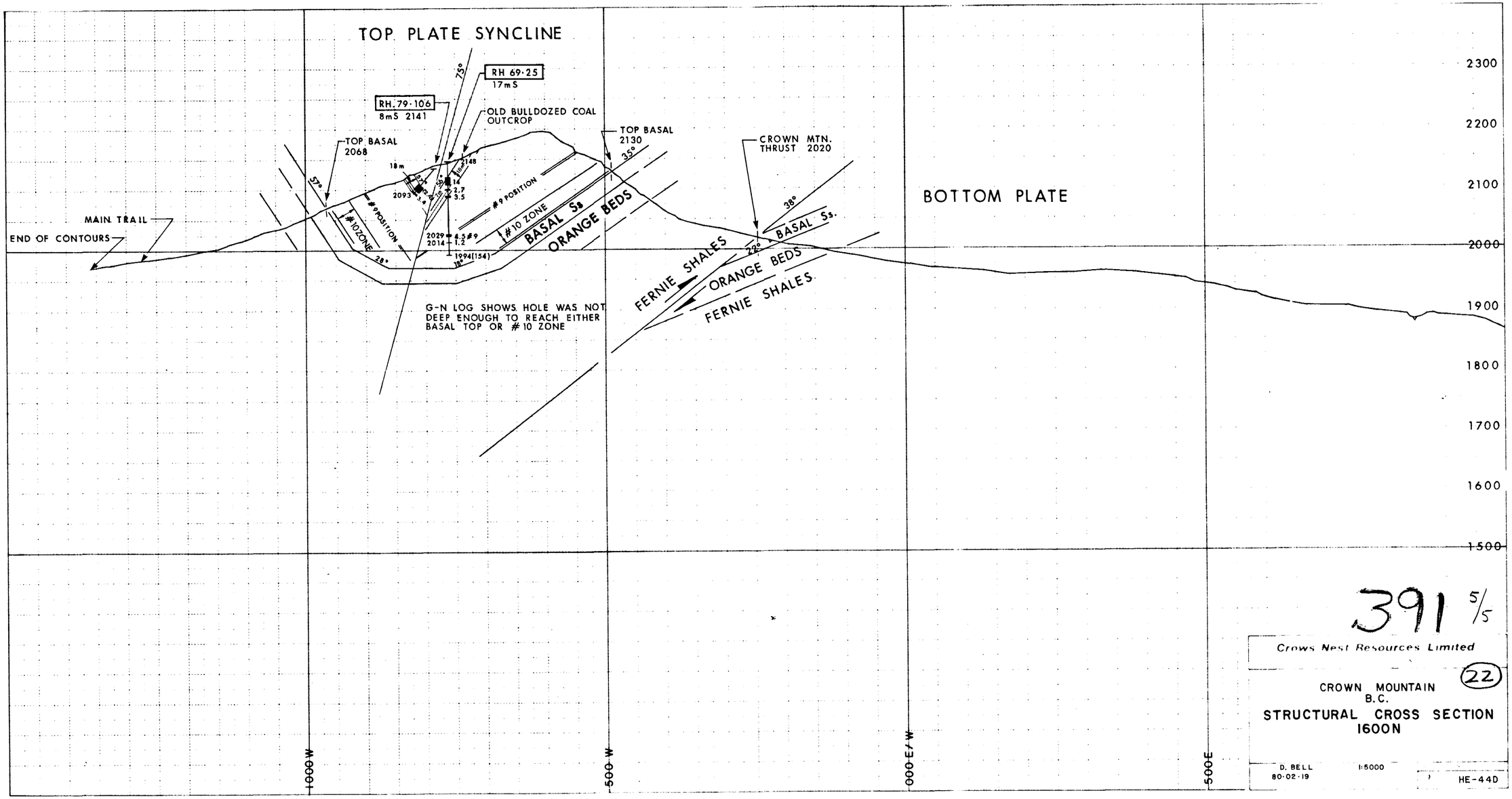
391 5/5

Crows Nest Resources Limited
EXPLORATION

CROWN MOUNTAIN (21)
B. C.

STRUCTURAL CROSS SECTION
1400N

AUTHOR D. BELL SCALE 1:5000
DATE 80-02-19 REVISED
DRAWING NO. HE-44F



391 5/5

Crows Nest Resources Limited

(22)

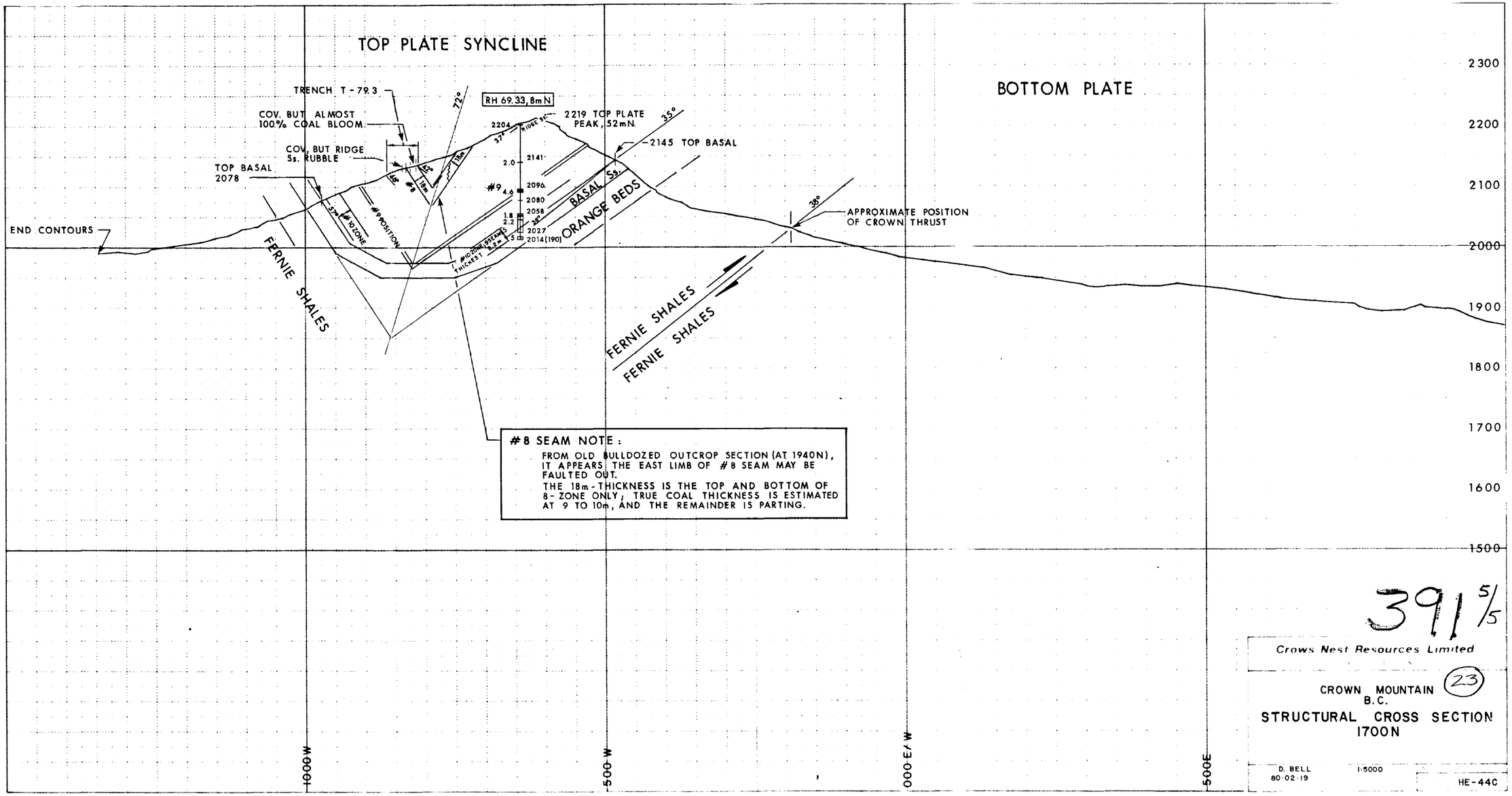
CROWN MOUNTAIN
B.C.

STRUCTURAL CROSS SECTION
1600N

D. BELL
80·02·19

1:5000

HE-44D



#8 SEAM NOTE :

FROM OLD BULLDOZED OUTCROP SECTION (AT 1940N), IT APPEARS THE EAST LIMB OF #8 SEAM MAY BE FAULTED OUT.
THE 18m-THICKNESS IS THE TOP AND BOTTOM OF 8-ZONE ONLY; TRUE COAL THICKNESS IS ESTIMATED AT 9 TO 10m, AND THE REMAINDER IS PARTING.

391 5/5

Crows Nest Resources Limited

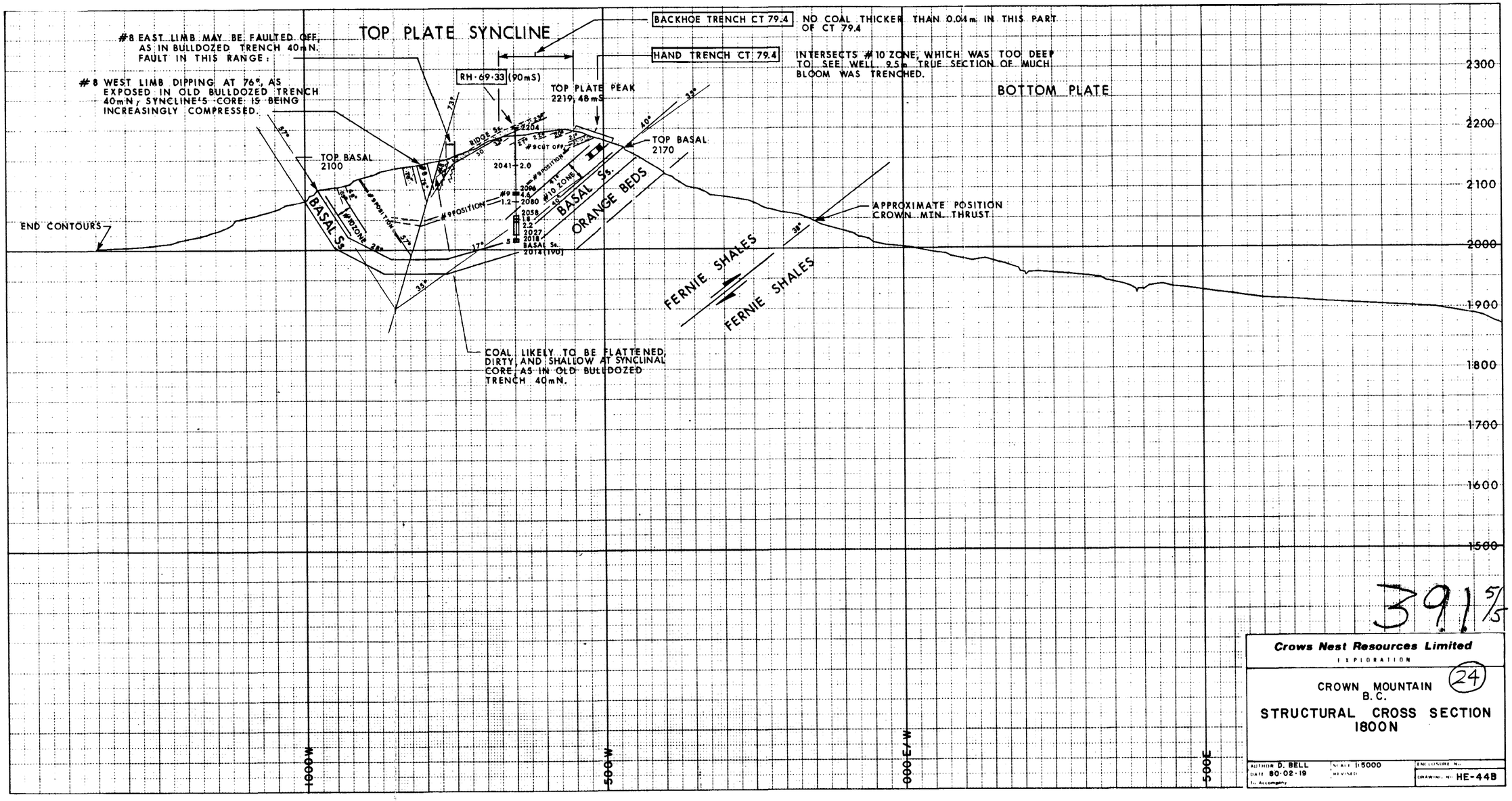
CROWN MOUNTAIN (23)
B.C.

STRUCTURAL CROSS SECTION
1700N

D. BELL
80-02-19

1:5000

HE-440



391 5/5

Crows Nest Resources Limited
EXPLORATION

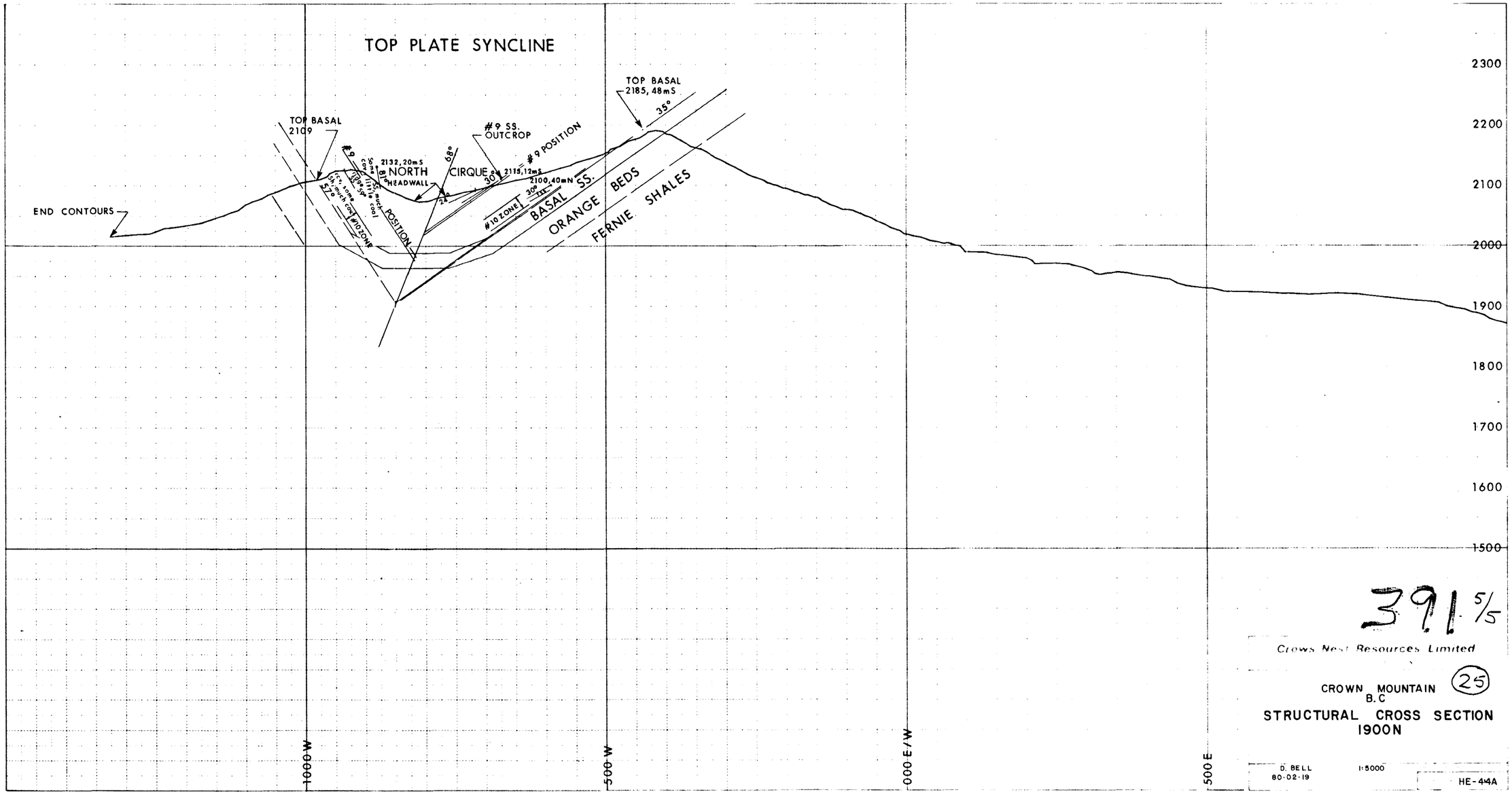
CROWN MOUNTAIN (24)
B. C.

STRUCTURAL CROSS SECTION 1800N

AUTHOR D. BELL
DATE 80-02-19
To Accompany

SCALE 1:5000
REVISED

ENCLOSURE No.
DRAWING No. HE-448



391 5/5

Crows Nest Resources Limited

CROWN MOUNTAIN
B.C

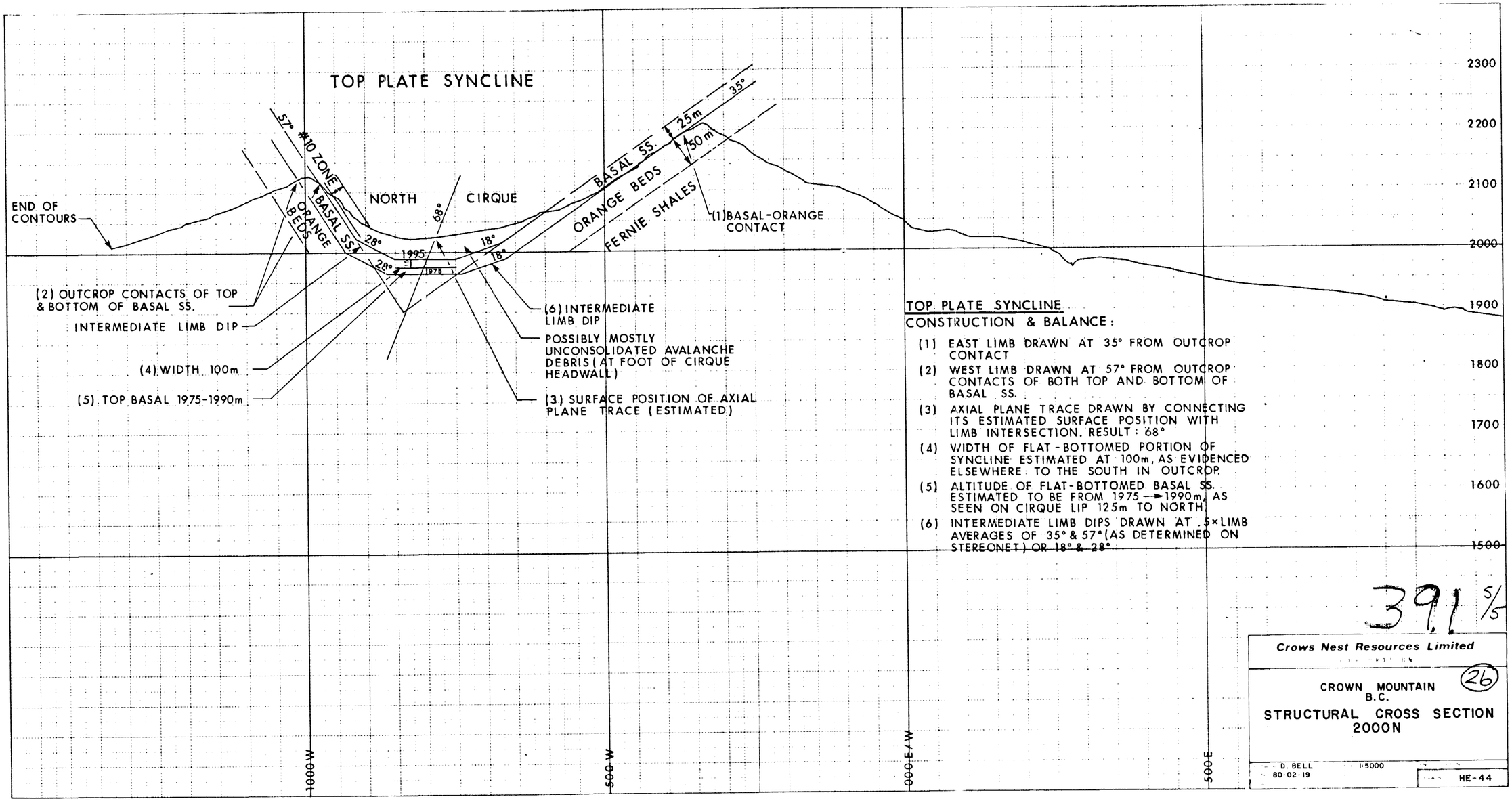
(25)

STRUCTURAL CROSS SECTION
1900N

D. BELL
80-02-19

1:5000

HE-414A



TOP PLATE SYNCLINE

CONSTRUCTION & BALANCE:

(1) EAST LIMB DRAWN AT 35° FROM OUTCROP CONTACT

(2) WEST LIMB DRAWN AT 57° FROM OUTCROP CONTACTS OF BOTH TOP AND BOTTOM OF BASAL SS.

(3) AXIAL PLANE TRACE DRAWN BY CONNECTING ITS ESTIMATED SURFACE POSITION WITH LIMB INTERSECTION. RESULT: 68°

(4) WIDTH OF FLAT-BOTTOMED PORTION OF SYNCLINE ESTIMATED AT 100m, AS EVIDENCED ELSEWHERE TO THE SOUTH IN OUTCROP.

(5) ALTITUDE OF FLAT-BOTTOMED BASAL SS. ESTIMATED TO BE FROM 1975 → 1990m, AS SEEN ON CIRQUE LIP 125m TO NORTH.

(6) INTERMEDIATE LIMB DIPS DRAWN AT .5×LIMB AVERAGES OF 35° & 57° (AS DETERMINED ON STEREONET) OR 18° & 28°

391 S/5

Crows Nest Resources Limited

CROWN MOUNTAIN
B.C.

(26)

STRUCTURAL CROSS SECTION
2000N

D. BELL
80-02-19

1:5000

HE-44