ASSESSMENT REPORT

1987 DIAMOND DRILLING UNDERTAKEN ON THE BIG MISSOURI PROPERTY STEWART, BRITISH COLUMBIA

Claims involved:

East Group; West Group

LC A

Mining Division:

NTS Location:

Latitude & Longitude:

Owner of Claims:

Operator:

Author:

Skeena

Map 104B/1E

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56°05'N; 130°00'W

Tournigan Mining Explorations Ltd. Westmin Resources Limited

Westmin Resources Limited

Shaun M. Dykes Project Geologist Westmin Resources Limited

December 3, 1987

GEOLOGICAL BRANCH ASSESSMENT REPORT

Date:

87-1060

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INTRODUCTION

The Big Missouri Property is located 25 kilometers north of the town of Stewart, B.C. and situated between the Silbak Premier and Granduc Mines in northwestern British Columbia (Fig. 1).

The property is accessible by road during snow-free months by way of the Granduc road from Stewart to Premier and then by the Big Missouri road into Joker Flats and the claims areas (Fig. 1 and Fig. 2).

The Big Missouri Mine was discovered in 1904, and was subsequently put in production between 1938 and 1942 by Consolidated Mining and Smelting Co. (Cominco). Subsequent to the mine closure in 1942, there have been several attempts by various mining companies to re-evaluate the mineral potential in the area. This includes:

- work by Hecla Mining
- geological work by Falconbridge in 1966
- geological and geochemical work by El Paso in 1970.
- extensive underground sampling by Aetna Mines in late 1960's and early 1970's, and
- diamond drilling by Giant Mascot Mines in 1974.

Since the fall of 1973, Tournigan Mining Explorations Ltd. has held title to the property. In 1979 Tournigan and Westmin Resources Limited entered into agreement whereby Westmin Resources Limited by fullfilling certain obligations, could earn an interest in the property. It is in conjunction with this agreement that the 1986 geophysical program was undertaken.



GEOLOGY AND MINERALIZATION

The volcanic sequence consists of agglomerates, tuffs and flows of andesitic composition intercalated with cherty tuff bands. The sequence is cross-cut by andesitic and granitic dykes, and truncated by numerous faults of several ages. The mineralization observed consists of fine grained disseminated pyrite with or without sphalerite and galena contained mainly in the cherty tuff horizons or as small sulphide stringers and veinlets within the andesite. Gold and silver values are erratic. Better intersections are commonly in the 0.10 to 0.15 oz/T Au and 0.5 to 1.0 oz/T Ag range. Lead and zine values greater than 1% are present locally. Nature and control of the gold and silver distribution is as yet unknown.

Sericitization and silicification are the predominant alteration types within the mineralized zones. Sericitization is the most pervasive and widespread, while silicification is found locally in relationship to the mineralized horizons.

The preliminary interpretation of the geological environment is that the mineralization occurs in narrow stratabound interflow siliceous exhalative horizons.

PURPOSE

Diamond drilling described in this report was undertaken to examine the continuity of mineralization observed in surface showings on the Laura and Golden Crown claims and to determine structures and rock strengths in the vicinity of the proposed hydroelectric dam on the Pass Fraction. The drilling was undertaken by Boisvenu Diamond Drilling Ltd. under the supervision of Westmin exploration personnel and Sigma Engineering Ltd. Figure 2 shows the location of the drilling.



AREA OF 1987 ASSESSMENT DRILLING

DIAMOND DRILL PROGRAM AND RESULTS

Laura Claim

A total of 143.9 m in 3 NQ diamond drill holes was completed on the Laura claim. The purpose of the drilling was to test the up-dip extension of a zone of semi-massive sulphide (Au-Ag-Cu-Pb-Zn) known as the Creek zone (Figure 3). The sulphide is contained within the lower cherty tuff horizon hosting the Dago deposit located 500 metres to the south.

Holes 87-50, 87-51 located 50 m up-dip from the surface showing (Figures 3 & 4) intersected the cherty tuff horizon hosting the mineralization near surface. Assays returned only low grade results (Appendix C). Hole 87-52 intersected 2.5 m of the cherty tuff which assayed 0.033 oz Au/t, and 0.13 oz Ag/t over 4.21 m. The intersection is a low precious metal-zinc rich typical of those located on the edge of the high precious-base metal rich exhalative centres.

The drilling indicates the surface exposure has limited up-dip potential with mineralization confined to a narrow lens, approximately 50 m long x 25 m wide and 2.3 m thick.

Golden Crown

Two NQ diamond drill holes totalling 92.0 m were drilled to test a mineralized cherty tuff bed exposed in the Golden Crown Adit. The 2.5 m thick bed was not intersected in either of the drill holes 87-54, 87-55. The holes intersected footwall rocks to the zone indicating the presence of a fault between the adit and the two drill holes. The location of the drill holes is shown in Figures 5 and 6.

Pass Fr.

Six holes (3 on each abutment) were drilled at the damsite, to depths of 23.77 m to 28.35 m. Two of the holes on each side were vertical, while one was angled at 60° to the horizontal (Figure 7). Permeability testing using a











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single packer system was carried out in each hole after drilling was completed. Results indicate that, in the majority of holes, significant water loss occurred at specific depths only, with most of the depth of the hole being fairly watertight. Standpipe piezometers were installed in the deepest vetical holes on the left and right abutments, with their tips at 25.30 m and 29.35 m respectively below ground surface. These holes were backfilled with sand to well above the piezometer intakes, and then with cement to the surface. The other four holes were filled with cement for their full length. The piezometers were read on 9 September. Water levels were 9.49 m below ground level on the left abutment and 14.57 m below ground level on the right abutment. The piezometers should be read at least once more before winter.

NQ (4.5 cm diameter) drill core was recovered from the full lnegth of each hole, except for the top 0 - 0.91 m. Geotechnical logs emphasizing recovery, fracture spacing and orientation, RQD, rock type, and flush return were made for each hole. Selected samples will be shipped to Vancouver for strength testing (uniaxial compression tests).

All holes intersected the Lower-Middle Jurassic Bowser sediments which do not contain significant mineralization.

APPENDIX A

ITEMIZED COST STATEMENT

WEST GROUP

Drilling – Direct 235.9 m @ \$57.40/metre	\$13,541
(mobilization, footage, mining)	
Site Preparation	
7 man days @ \$225/day (\$100 for tractor, \$125/operator)	1,525
Senior Supervision	
5 days @ \$200	1,000
Assays & Sample Preparation	
54 samples @ \$45	2,430
(\$35 assay + \$10 splitting + prep.)	
Room and Board	
63 man days @ \$30/day	1,890
Report Preparation	150
TOTAL	\$ <u>20,536</u>
WORK APPLIED	\$20,400

EAST GROUP

Note:	Due to nature of drilling, all costs were done on with equipment used on a cost plus 15% basis.	an hourly rate basis
	Drilling	
	(as invoiced)	\$47,441.47
	Supervision	
	7 days @ \$200	1,400.00
	Helicopter (204 Jet Ranger)	
	4 hours @ \$1250/hour	5,000.00
	Room and Board	
	60 days @ \$30/day	1,800.00
	Report Preparation	150
	TOTAL COST	\$ <u>55,791.47</u>
	WORK APPLIED	\$32,100.00

APPENDIX B

STATEMENT OF QUALIFICATIONS

(14)

- University Education: 1976 Graduated with B.Sc. (Eng.) degree in Geology from Queen's University, Kingston, Ontario.
 - 1979 Graduated with M.Sc. (Eng.) degree in Geology from Queen's University, Kingston, Ontario.
 - Courses taken based on mineral exploration, igneous petrology, and mineral economics.

Practical Experience:

- 4 summers experience in Northern Ontario and ---Northeastern British Columbia
- Since 1979 working as Project Geologist for Westmin Resources Limited with emphasis on the Big Missouri property.

Respectfully submitted,

Shaun M. Dykes

APPENDIX C : 1987 DIAMON DRILL LOGS

LAUKA CLAIM	1	HULES	887CH20	IU	887CH32
GOLDEN CROWN CLAIM	:	HOLES	B87CH54	то	B87CH55
PASS FR. CLAIM	*	HOLES	297	то	302

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DATE : 12-10-87 TIME : 10:33:41

	BIG MISS	SOURI LAUR	A CLAIM	
	HOLE/TRAVERSE	> В87СНО5	o GEOLOG	VERSION : 6B0202
	SURVEYED BY : CD COLLA TOTAL LENGTH : 47,85 NORTH CORE DIAMETER: NQ EASTI DRILLED BY : BOISVEN HOLE	R ELEV. : .00 A ING : .00 V NG : .00 C STARTED : 87 09 03 H	ZIMUTH(DEGREES) : .00 ERTICAL ANGLE : .00 OORD SYSTEM : GRID OLE ENDED : 09 03	GEOLOGGED BY : SMD DATE(Y/M/DY) : 87 09 04 TRAVERSE ATTRIB: CREEK DRILLING HOURS :
	SURVEY PT DEPTH NUMBER METRES	AZIMUTH ANGLE N Degrees degrees	ORTH COORD EAST COORD Metres Metres	ELEVATION METRES
	S 1 0.00	.00 .00	.00 .00	.00
0.00	2.44 CASING			
2.44	8.63 ANDESITE LAPILLI TUFF	light green , 10 % 5 % 0.5 mm amphibole 20 % more siliceous ma 40 % volcanic fragment 40 % Feldspar-Amphibol 8 veins/metre or 10 % 20 % Quartz occurs as 1 % Leucoxene as spots 2.5 % Carbonate occurs 10 % Sericite occurs as 2.5 % Chlorite occurs 1 % Pyrite occurs as p high silicification as Pyrite Bearing Bull Qu	2.0 mm plagioclase phenocr phenocrysts; trix to fragments; breccia s; 2.0 mm for maximum fra e Porphyritic as dominant of which 5 % are miner perv. dissem.,veins,selvage as perv. dissem.,veins,selv as perv. dissem.,veins,selv as perv. dissem.,veins,selvage dominant alteration; tartz for dominant veins;	ysts; agment size 0.12 mm , fragment; valized; ges and envelopes, ins,selvages and envelopes, vages and envelopes, lvages and envelopes, es and envelopes,
	REMARK :=	2.44 8.63 COA	SE PORPHYRITIC	
8.63	13.14 CHERTY TUFF ligh	t grey , 80 % recrystalli 0.12 mm for maximum fo 5 % Non-porphyriticas 80 % Quartz occurs as 10 % Sericite occurs as 1 % Pyrite occurs as Contact at 80 Degree	zed chert; 5 % volcanic (agment size 0.03 mm , dominant fragment; perv. dissem.,veins,selvag s perv. dissem.,veins,selvag serv. dissem.,veins,selvag s to Core Axis;	fragments; ges and envelopes, vages and envelopes, es and envelopes,
	REMARK :=	8.63 13.14 LIG	HT GREY VERY FINE GRAINED -	- NON MINERALIZED.
13.14	23.53 ANDESITE (UNDEFINED)	light green , 5 % O	.5 mm plagioclase phenocry	sts;

DATE : 12-10-87 TIME : 10:35:01

HOLE/TRAVERSE

2.5 % 0.5 mm amphibole phenocrysts; 5 veins/metre or 2.5 % of which 0.01 % are mineralized;

1 % Quartz occurs as perv. dissem. = to veins, selvages and envelopes,

1 % Leucoxene as spots;

1 % Carbonate occurs as perv. dissem. = to veins, selvages and envelopes, 5 % Sericite occurs as perv. dissem., veins, selvages and envelopes, 2.5 % Chlorite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, fairly low bleaching as dominant alteration; low chloritization as secondary alteration Barren Quartz-Carbonate for dominant veins;

Pyrite Bearing Quartz-Carbonate for secondary veins;

23.53 24.11 CHERTY TUFF

- 3.33 24.11 UNERIT IU

REMARK :=

23.53 24.11 INTER UNIT BRECCIA ZONE.

24.11 47.85 ANDESITE (UNDEFINED)

pale green , 5 % 0.12 mm plagioclase phenocrysts; 2.5 % 0.12 mm amphibole phenocrysts; 6 veins/metre or 1 % of which 0.01 % are mineralized; 1 % Quartz occurs as perv. dissem.,veins,selvages and envelopes, 2.5 % Leucoxene as spots; 1 % Carbonate occurs as perv. dissem. = to veins,selvages and envelopes, 2.5 % Sericite occurs as perv. dissem.,veins,selvages and envelopes, 5 % Chlorite occurs as perv. dissem.,veins,selvages and envelopes, 5 % Chlorite occurs as perv. dissem.,veins,selvages and envelopes, 1 % Pyrite occurs as perv. dissem.,veins,selvages and envelopes, 1 % Pyrite occurs as perv. dissem.,veins,selvages and envelopes, fairly low chloritization as dominant alteration; low bleaching as secondary alteration Barren Quartz-Carbonate for dominant veins; Pyrite Bearing Quartz-Carbonate for secondary veins;

DATE : 12-10-87 TIME : 10:36:48

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HOLE/TRAVERSE ----->

--> B87CH050

CONTINUED

PAGE : 3

REMARK := 24.11 47.85 LOCAL BLEACHED ZONES.

REMARK := SUN	HOLE INTERSECTED TWO NON-MINERALIZED CTUF ZONE WITH FINE GREY
REMARK := SUM	SIPICA - UPPER BED COULD BE CREEK ZONE HORIZON WITH COARSE
REMARK := SUM	PORPHYRY IN HWALL - FINER ANDESITE BENEATH.

DATE : 12-10-87 TIME : 10:36:54

BIG MISSOURI -- LAURA CLAIM

GEOLOG VERSION : 6B0202 HOLE/TRAVERSE B87CH05100 AZIMUTH(DEGREES) : .00 GEOLOGGED BY : SMD CD COLLAR ELEV. : SURVEYED BY : DATE(Y/M/DY) : 87 09 05 .00 NORTHING .00 VERTICAL ANGLE TOTAL LENGTH : 48.16 : 1 COORD SYSTEM TRAVERSE ATTRIB: CREEK EASTING : GRID CORE DIAMETER: NQ .00 : DRILLED BY : BOISVEN HOLE STARTED : 87 09 04 HOLE ENDED : 09 04 DRILLING HOURS : EAST COORD ELEVATION SURVEY PT DEPTH AZIMUTH ANGLE NORTH COORD NUMBER METRES DEGREES DEGREES METRES METRES METRES .00 .00 .00 S 0.00 .00 .00 1 0.00 1.83 CASING 1.83 11.67 ANDESITE LAPILLI TUFF dark , 5 % 2.0 mm plagioclase phenocrysts; 2.5 % 0.5 mm amphibole phenocrysts; 20 % more siliceous matrix to fragments; 20 % volcanic fragments; 0.5 mm for maximum fragment size 0.12 mm , 20 % Feldspar-Amphibole Porphyritic as dominant fragment; 6 veins/metre or 2.5 % of which 0.01 % are mineralized; 20 % Quartz occurs as perv. dissem.,veins,selvages and envelopes, 1 % Carbonate occurs as perv. dissem. = to veins, selvages and envelopes, 10 % Sericite occurs as perv. dissem., veins, selvages and envelopes, 5 % Chlorite occurs as perv. dissem., veins, selvages and envelopes,

1 % Pyrite occurs as perv. dissem.,veins,selvages and envelopes, fairly high bleaching as dominant alteration; very low chloritization as secondary alteration Barren Quartz-Carbonate for dominant veins; Pyrite Bearing Quartz-Carbonate for secondary veins;

medium grey , 60 % recrystallized chert; brecciated,, 30 % volcanic fragments; 0.12 mm for maximum fragment size 0.03 mm , 30 % Feldspar-Amphibole Porphyritic as dominant fragment; 2 veins/metre or 0.3 % of which 0.01 % are mineralized; 60 % Quartz occurs as perv. dissem.,veins,selvages and envelopes, 1 % Carbonate occurs as perv. dissem.,veins,selvages and envelopes, 20 % Sericite occurs as perv. dissem.,veins,selvages and envelopes, 2.5 % Chlorite occurs as perv. dissem.,veins,selvages and envelopes, 1 % Pyrite occurs as perv. dissem.,veins,selvages and envelopes, 2.5 % Chlorite occurs as perv. dissem.,veins,selvages and envelopes, 1 % Pyrite occurs as perv. dissem.,veins,selvages and envelopes, 2.5 % Chlorite occurs as perv. dissem.,veins,selvages and envelopes, 3 % Pyrite bearing Quartz-Carbonate for dominant veins; Contact at 30 Degrees to Core Axis;

11.80 14.39 CHERTY TUFF

DATE : 12-10-87 TIME : 10:38:26

HOLE/TRAVERSE	···· ··· ··· ··· ··· ··· ··· ··· ··· ·	B87CH051	CONTINUED	PAGE : 2
	REMARK :=	11.80 14.39	GREY FINE CTUF MORE FRAGMENTS THA	AN 87-50.
14.39 36.21 ANDESITE	(UNDEFINED)	green grey , 5 % 2.5 % 0.5 mm amph 0.01 % are minera 5 % Quartz occurs 0.3 % Leucoxene as 1 % Carbonate occu 5 % Sericite occur 1 % Chlorite occur 1 % Pyrite occurs fairly high bleach very low chloritiz Barren Quartz-Carb Pyrite Bearing Qua	0.5 mm plagioclase phenocrysts; ibole phenocrysts; 5 veins/metre lized; as perv. dissem.,veins,selvages a spots; rs as perv. dissem.,veins,selvages s as perv. dissem.,veins,selvages s as perv. dissem.,veins,selvages as perv. dissem.,veins,selvages s as perv. dissem.,vei	e or 1% of which and envelopes, es and envelopes, s and envelopes, s and envelopes, and envelopes,
26.52 28.6	50% SAMEAS 1.	4.39 36.21 9 2.5 % Pyrite occur 0.01 % Galena as v Py-Sph-Gal Vuggy Q	veins/metre or 20 % of which f s as perv. dissem.,veins,selvages eins, 0.01 % Sphalerite as veins, uartz Breccia for dominant veins;	50 % are mineralized; s and envelopes,
	REMARK :=	26.52 28.65	QTZ-BX VEIN ZONE.	
34.08 34.4	4 100 % ANDESITE DY	KE palest green , 0.3 % Quartz in am 0.3 % Carbonate in 40 % Sericite perv Contact at 20 Deg	1 % 0.12 mm plagioclase phenocrys ygdaloids or cavity fillings, amygdaloids or cavity fillings, asive, high bleaching as dominant rees to Core Axis;	sts; : alteration;
	REMARK :=	34.08 34.44	SMALL BLEACHED DYKE - APLITE?	
36.21 39.26 CHERTY T	UFF mediu	m grey , 40 % recrys 50 % volcanic frag 50 % Feldspar-Amph 40 % Quartz occurs 20 % Sericite occu 0.3 % as dissem 1 % Pyrite occurs Contact at 70 Deg	tallized chert; brecciated,, ments; 0.5 mm for maximum fragme ibole Porphyritic as dominant fra as perv. dissem.,veins,selvages rs as perv. dissem.,veins,selvage inations, as perv. dissem.,veins,selvages a rees to Core Axis;	ent size 0.12 mm , agment; and envelopes, es and envelopes, and envelopes,
	REMARK :=	36.21 39.26	WK-DK GREY VARIETY CTUF	

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HOLE/T	RAVERSE		->	B87CH051	CONTINUED	PAGE : 3
39.26	48.16 ANDESIT	E (UNDEFINED)		pale green , 2.5 2.5 % 0.12 mm amph 2.5 % are minerali 1 % Quartz occurs a 1 % Carbonate occur 5 % Sericite occurs 2.5 % Chlorite occu 1 % Pyrite occurs a 0.01 % Galena as ve moderate bleaching low chloritization Barren Quartz-Carbo Py-Sph-Gal Vuggy Qu	or 1% of which envelopes, ages and envelopes, nd envelopes, and envelopes, envelopes,	
		REMARK	:= SUM	Н	IOLE INTERSECTED TWO FINE GREY CTUF	ZONES NON MINERALIZED
		REMARK	:= SUM		COARSE PORPHYRITIC UPPER UNIT - UP	PER CTUF GOOD POSSIBLY BE
		REMARK	:= SUM		THE CREEK ZONE HORIZON - HOLE SIMI	LAR TO DAGO FOOTWALL HOLES.

DATE : 12-10-87 TIME : 10:40:53

BIG MISSOURI -- LAURA CLAIM

	HOLE/TRAVERSE -		-> B87CH	052	GEOLOG	VERSION	: 6B0202
	SURVEYED BY : CD TOTAL LENGTH : 47.85 CORE DIAMETER: NO DRILLED BY : BOISVEN	COLLAR ELEV. NORTHING EASTING HOLE STARTED	: .00 : .00 : .00 : 87 09 06	AZIMUTH(DEGRE VERTICAL ANGL COORD SYSTEM HOLE ENDED	ES) : .00 E : .00 : GRID : 09 06	GEOLOGGED BY DATE(Y/M/DY) TRAVERSE ATTR) DRILLING HOUR	: SMD : 87 09 07 B: CREEK RS :
	SURVEY PT	DEPTH AZIM Metres Degr	JTH ANGLE Ees degrees	NORTH COORD Metres	EAST COORD Metres	ELEVATION Metres	
	S 1	0.00 .00) .00	.00	.00	.00	
0.00	2.44 CASING						
2.44	8.47 ANDESITE (UNDEFINED)	lig 2.5 10 % 10 % 5 % (20 % 0.01 1 % f fair) Barr(Pyrit	yht to medium y 4 0.12 mm amp of which 5 7 Quartz occurs Carbonate occur Sericite occur X Chlorite as Cyrite occurs a Ly high bleachi en Quartz-Carbo se Bearing Quar	rey , 2.5 % 0.1 sibole phenocrys are mineraliz as perv. dissen s as perv. diss s perv. dissen. spots; spots; ng as dominant onate for domina tz-Carbonate for	2 mm plagiocla ts; 21 veins/ ed; .,veins,selvag em. = to veins em.,veins,selv ,veins,selvage alteration; ent veins; er secondary ve	ise phenocrysts; metre or is and envelope s,selvages and envelope ages and envelopes es and envelopes	es, envelopes, opes,
8.47	10.21 CHERTY TUFF	grey black 40 % 40 % 3 vei 20 % 5 % 30 % 5 % 2.5 % Conta	20 % recrysta volcanic fragn Feldspar-Amphi ns/metre or 1 Quartz occurs Carbonate occur Sericite occur Occurs as pe Pyrite occurs act at 60 Degr	Allized chert; Aents; 0.5 mm f bole Porphyriti 2 of which (as perv. dissen as as perv. diss as perv. dissen.,vei as perv. disse ees to Core Axi	brecciated,, for maximum fra c as dominant 0.01 % are min n.,veins,selvag sem.,veins,selv ns,selvages ar em.,veins,selva	igment size 0.12 fragment; eralized; jes and envelop rages and envelo rages and envelo ad envelopes, ages and envelop	2 mm , 25, opes, opes, des,
10.21	REM 34.84 ANDESITE AGG. LAP. T	IARK := 8. TUFF 1 % 4 5 % 1	.47 10.21 M pale green , S D.12 mm amphil more siliceous	10D CARBON CTUF 5 % 0.5 mm plagi pole phenocrysts matrix to fragi	- NON-MINERALI loclase phenocr ;; ments; 30 % vol	ZED. Yysts; Icanic fragment:	5;

PROJE	<u>(1</u>	Ŀ	ong	La	<u>ke</u>	De	am ar	(Machania) ICONTRACTOR	Boie	VPAU	Dr	BUREHULE NU. 298
MACHI CORE I BIT DI CORF I	INE BARREI ESIGN DIAMET	<u>- ら</u> ア/ L	nn 45	En.	<u>410.6</u>	-LUS	19. 1 W	COORDINATES COLLAR ELEVAT INCLINATION V CASING	ion 1 ertical	001, 75 1	55	FINAL DEPTH 23.77 AZIMUTH - OATE 284-291/08/87
T			Ī		1.5	:	2	DISCONTINUITIES	Ġ			GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH, m	DRILLING PROGRESS	FLUSH RETURNS, "/-	DEPTH TO WATER, m	CORE RUN DEFTN	TOTAL CORE RECOVERY.	SOLID CORE RECOVERY.	ROCK QUALITY DESIGNATO		DOWAHOLE DEPTH I	ELEVATION, m	SYMBOLIC LOG	
1.91		\checkmark			-		-	Not cored				
.44		\$			82		0	First 20 cm: loose stale rocks from surface zone Remainder of run: Fractices 0°-15° to horiz., 1-3 cm typ. spcg. A few stoeply inclined fractices with oxidized surfaces. Highly fractured at 1.46- 1.52 m and at 2.44 m				SHALE, small amount ot siltstone, no quartz or calc. carbonate veins
3.96		. ,			100		30	 1.32m, and ai 2.79m 2.44-2.55: Highly fractured 2.55-2.74: Near-horiz. fractures, 2-6 cm speg. one short, oxidized vertical fracture. 2.74-2.79: highly fractured due to combination of vertical 4 horiz. fractures 2.79-3.96: fractures at 0°-15° to horizontal, 3-19 cm speg. A few oxidized fractures at 60°-90° to horizontal 	-			SHALE with siltstone bands, minor pyrite. No veins.
5.49					160		44	3.96-4.58: Fractures at 0°-15° to horizontal, 3-16cm spacing. 4.58-4.68: Several fractures, horiz. and 45°, quartz veins. 4.68-5.09: Intact core 5.09-5.49: Near-horiz. fractures at 2-10cm spcg., two long, near. Vertical, oxidized fractures: 5.17-5.55 5.44-5.82 m	- 7			SHALE, minor siltstone, minor pyrite. Numerous quartz veins, minor cal some pyrite at 4.58-4.68m
10					95		50	Only eight near-horin and four near-vert fractures in entire core run. Low RQD is due to long, oxi- dized vertical fracture	r			SHALE, minor siltstone, minor pyri

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PROJ		40	ng	Lat	(e	Da	m		Barrow	en T	7.:1	BUREHULE NU. 298
MAC CORE BIT CORE	HINE BARRE DESIGN DIAME	2/9 1	ma JKS	<u>Ergini</u> 300 45	<u>8071</u>	19 FLUS	H V	COORDINATES COLLAR ELEVA INCLINATION V Vater CASING	ION /c ertical	001. 75 <u>:</u>	5	FINAL DEPTH 23-77 AZIMUTH – DATE DATE DATE DATE DATE DATE DRAWN BY
T				Í	-	:	No.	DISCONTINUITIES	Ë			GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH, m	DRILLING PROGRESS	FLUSH RETURNS, "/.	DEFTH TO WATER, m	CORE RUN DEFTH, .	TOTAL CORE RECOVERY	SOLID CORE RECOVERY.	ROCK QUALITY DESIGNAT		DOWNHOLE DEPTH	ELEVATION, m	SYMBOLIC LOG	
8.53					100		46	7.01-7.71: threa near - horizontal fractures 7.71-7.76: highly fractured 7.76-8.53: Fractures at 0°-15° to horiz., 2-9cm Spcg., a few steeply. Inclined oxidized fractures				SHALE, minor siltstone, minor pyrite. Minor calc. matl. on fracture surfaces in lowest 5 cm of core run
10.06					60		58	8.53-8.85: Closely spaced near-horiz. + near- Vertical fractures, only two pieces in 5-8 cm range. Steeply-inclined fractures oxidized. 8.85-9.63: Only five near-horiz. fractures, one of them Oxidized, 11-21 cm spacing. 9.63-10.06: near-horiz. froctures at 2-11 cm spacing, two fractures at 80°, one of which is oxidized				SHALE, minor siltstone, minor pyrite. No veins.
11.58		•			100		22	10.06 -11.45: near - horiz fractures, typ. sprg. 2-16 cm, only slightly oxidized, a four slightly oxidized fractures at 70°-90° 11.45-11.58: highly fractured both horiz ontally and vertically				SHALE, siltslone bands. No pyrite. 2-15mm thick band of harder rock (mainly quartz) at 11.42m. Quar Veins common from 11.45m to 11.58n
08.		,			9	T	0	Only 13 cm of highly			T	SHALE with quartz veins
14.33		✓ ✓			103		24	HACTURED FOCK FOCONOM Most fractures 15° - 25° to horiz., a few near horiz., some 60°-80°. Typ. spcg. 3-9cm, with three 12-15cm long pieces of core. No oxidation. 14.33-14.46: Highly fractor	3			SHALE, some siltstone, quartz veins. Veins mostly thin (< Imm) and paralle (50° to horiz.) but thicker and mon randomly oriented in last 45 cm. H.33-15.60: SHALE with thin parallel
15.85		V						14.46 - 15:40: Near - horiz fractures, 7-15cm typ. 5pcg., one 3 cm long vertical fracture, not oxidized. 15.40 - 15.85: highly fractur vert. 4 horiz.	e,			9tz. Veins, 50° to horizontal 15.60-15.85: SHALE with abundant 9tz. and calc. material. Minor siltstone in entire core run.

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FLUCH RETURNS, "	DEFTH TO WATER, m	CORE RUN GEFTH	A DIAL CORE RECOVERY, V.	SOLID COAE RECOVERY . */.	O BOCT OILUITY DESIGNATION, 1.	DISCONTINUITIES Highly fracturecl, most	DOWNHOLE DEPTH m.	ELEVATION, m	80LIC 106	GEDLOGICAL DESCRIPTION
/	30	89	101 75	201	0	Highly fractured, mostly	8	ದ	X	
		1.		1		Vertical. Five pieres in 6-8 cm range, all others 25 cm. Fractures not oxidized			15	SHAFE some sillstone, Minor quartz Cale. matl. cammon on fracture surfaces.
/			96		52	17.37-18.32: Most Frac- tures 0°-30° to hariz, 4-15cm spcg., a fau short near-vertical ones, 18.32-18.59: Highly frac- tured, horiz. and vert., lgst. piece 6 cm long.				17.37 - 17.77 : SHALE with gtz. Veins, calc. matl. on many fracture sorter 17.77 - 18.59 : SILTSTONE with less gi and calc. than above. Distinct Contact @ 40° to horizontal.
/			88		5!	7 fractures at 0°-45° to horiz, one vertical. Highly fractured 19.10 - 19.20, core loss here.				SILTSTONE minor shale, quartz as sto thin veins and along the one vertical fracture.
/			113		73	Most fractures 0°-15°to horizontal, 3-22 cm speg. Five fractures 70°-90°, not oxidized.				SILTSTONE, minor shale, thin (< 1m gtz. veins at 45°-90° to haviz 5min thick calc. vein, 10 cm long, 80° to haviz, cit 20.73m
			100		65	20.73 - 21.02: Fractures 0°-15° to horiz., 3-em typ. spocing 21.02 - 21.14: Badly fractured zone 21.14 - 22.25: Twelve froctures, 2-29cm spacing, all except orre @ 0°-15° to horiz. The one is 60° to horiz.				20.73-20.00: SUITSTONE with this gtz. Veins and the extension of the lay calc. Vein noted above 20.80-22.25: SHALE, minor siltstore quartz veins. 8 mm thick gtz. la in fractured zone at 21.02 m. Siltstone/shale contact 2400 to horizontal.
			98		43	22.25 - 22.53: Infact core 21.53 - 22.81: Highly fractured, near-horiz, and near - vertical. 22.81 - 23.17: Two near-horiz. froctures. 23.17 - 23.77: Fractures @ 10°-25° to horiz. ord 60°-80° to horiz. 1-9 cm typ. spcg.				SHALE, minor siltston P. No qtz. or calc. material.
				/ ////////////////////////////////////	/ ////////////////////////////////////	✓ 1/3 73 ✓ 1/3 73 ✓ 65 ✓ 98 ¥3 ✓ 98 ¥3	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	118 13 14 14 14 14 14 14 14 14 14 14 14 14 14	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

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DATE : 12-10-87 TIME : 10:42:23

HOLE/TRAVERSE	>	B87CH052	CONTINUED	PAGE : 2
		16-64 mm for maximum frag 30 % Feldspar-Amphibole P 8 veins/metre or 2.5 % 5 % Quartz occurs as perv 2.5 % Carbonate occurs as 10 % Sericite occurs as p 2.5 % Chlorite occurs as 1 % Pyrite occurs as perv moderate bleaching as dom very low chloritization a Barren Quartz-Carbonate f Pyrite Bearing Quartz-Car	ment size 0.12 mm , orphyritic as dominant fragmen of which 0.01 % are minerali . dissem.,veins,selvages and e perv. dissem. = to veins,selv erv. dissem.,veins,selvages an perv. dissem.,veins,selvages and inant alteration; s secondary alteration or dominant veins; bonate for secondary veins;	t; zed; nvelopes, ages and envelopes, d envelopes, nvelopes,
31.58 32.92 100	% MICRODIORITI	E DYKE light to medium gr 5 % 0.12 mm amphibole ph 0.01 % Quartz in amygdalo 0.3 % Carbonate in amygda 5 % Sericite occurs as pe 1 % Chlorite occurs as pe 0.01 % Pyrite occurs as p Contact at 60 Degrees to	ey , 10 % 0.12 mm plagioclase enocrysts; equigranular,, ids or cavity fillings, loids or cavity fillings, rv. dissem.,veins,selvages and erv. dissem.,veins,selvages an Core Axis;	phenocrysts; envelopes, envelopes, d envelopes,
34.84 37.34 CHERTY TUFF	green	grey , 30 % recrystallized 30 % volcanic fragments; 30 % Feldspar-Amphibole P 3 veins/metre or 1 % of 30 % Quartz occurs as per 1 % Carbonate occurs as per 5 % Sericite occurs as per 2.5 % Chlorite occurs as perv 0.01 % Galena as spots; Barren Quartz-Carbonate fo 70 Degrees to Core Axis;	chert; brecciated,, 2.0 mm for maximum fragment s orphyritic as dominant fragmen which 0% are mineralized; v. dissem.,veins,selvages and erv. dissem., veins, selvages and perv. dissem.,veins, selvages and perv. dissem.,veins, selvages and e 0.3 % Sphalerite as spots; or dominant veins; Contact at	ize 0.12 mm , t; envelopes, es and envelopes, envelopes, nd envelopes, nvelopes,
37.34 47.85 ANDESITE LAPILL	REMARK := I TUFF	34.84 37.34 WK-CTUF pale grey , 5 % 0.5 mm 1 % 0.12 mm amphibole ph 0.01 % are mineralized; 0.3 % Quartz occurs as per	WITH PY >> BASE METALS. plagioclase phenocrysts; enocrysts; 3 veins/metre or rv. dissem. = to veins,selvage	1% of which s and envelopes,

DATE : 12-10-87 TIME : 10:44:22

HOLE/TRAVERSE		B87CH052	CONTINUED	PAGE	: 3	
37.34 41.45	REMARK := 5 0 % SAME AS 37	1 % Carbonate occ 20 % Sericite occu 1 % Chlorite occu 1 % Pyrite occurs very high bleachi very low chloriti Barren Quartz-Car Pyrite Bearing Qu 37.34 47.85 .34 47.85 li 5 % Sericite occu 5 % Chlorite occu fairly low bleach	urs as perv. dissem. = to veins,sel urs as perv. dissem.,veins,selvages rs as perv. dissem.,veins,selvages as perv. dissem.,veins,selvages ar ng as dominant alteration; zation as secondary alteration bonate for dominant veins; artz-Carbonate for secondary veins; BLEACHING DUE TO HOLE CLOSE TO SUF ght to medium green , rs as perv. dissem.,veins,selvages rs as perv. dissem.,veins,selvages ing as dominant alteration;	lvages and enve s and envelopes, and envelopes, nd envelopes, RFACE. and envelopes, and envelopes,	lopes,	
		low chloritizatio	n as secondary alteration			
	REMARK := SUM		COARSE PORPHYRITIC FSPAR AXXX - U	NDERLYING CB-CT	UF - SEQUENCE	
	REMARK := SUM		APPEARS TO BE IN GROUND HOG MARKS	ER – SIMILAR TO	A-VEIN AND T	0
	REMARK := SUM		SECTION.			

DATE : 12-10-87 TIME : 10:47:09

BIG MISSOURI -- GOLDEN CROWN CLAIM

	HOLE/TRAVERSE -	>	B87CH0	54 1	GEOLOG	VERSION : 6B0202
	SURVEYED BY : CD TOTAL LENGTH : 44.20 CORE DIAMETER: NQ DRILLED BY : BOISVEN	COLLAR ELEV. : NORTHING : EASTING : HOLE STARTED : 6	.00 .00 .00 37 09 08	AZIMUTH(DEGREES) VERTICAL ANGLE COORD SYSTEM HOLE ENDED) : .00 : .00 : GRID : 09 08	GEOLOGGED BY : SMD DATE(Y/M/DY) : 87 09 09 TRAVERSE ATTRIB: GOLDEN DRILLING HOURS :
	SURVEY PT Number	DEPTH AZIMUTH METRES DEGREES	ANGLE DEGREES	NORTH COORD E	AST COORD Metres	ELEVATION METRES
	S 1	0.00 .00	.00	.00	.00	.00
0.00	5.79 CASING					
		5 % 0.5 m 0.01 % 4 1 % Quart 1 % Carbo 5 % Serio 5 % Chlom 1 % Pyrit fairly 10 fairly 10 Barren Qu Pyrite Bo	an amphibole are mineraliz tz occurs as onate occurs cite occurs as rite occurs as te occurs as ow chloritiza ow chloritiza ow bleaching uartz-Carbona earing Quarta	e phenocrysts; ed; perv. dissem. = as perv. dissem. s perv. dissem. perv. dissem.,v ation as dominan as secondary al ate for dominant e-Carbonate for	8 veins/met to veins,se . = to veins ,veins,selva ,veins,selva t alteration teration veins; secondary v	re or 2.5% of which elvages and envelopes, s,selvages and envelopes, ages and envelopes, ages and envelopes, es and envelopes, n; eins;
	REM/ 24.38 25.91 0 % SAM	ARK := 5.79 E AS 5.79 35.4 2.5% Sei 10% Chl 0.01% Gi fairly h very low Py-Sph-G	35.91 SE 91 dark g ricite occurs orite occurs alena as vein igh chloritiz bleaching as al Quartz-Can	VERAL QTZ VEINS grey , s as perv. disse as perv. dissem ns, 0.3 % Sphale sation as domina s secondary alte rbonate for seco	(BULL) 46, m.,veins,se .,veins,sel rite as vei nt alterati ration ndary veins	48, 64 FT. lvages and envelopes, vages and envelopes, ns, on; ;
	REM	ARK := 24.38	25.91 2"	VGMQ WITH SPH +	•6AL € 88 F	ī.
35.91	36.70 CHERTY TUFF	grey white , 5 40 % vol 40 % Fel	% recrystall canic fragme dspar-Amphib	ized chert; bre nts; 0.5 mm for ole Porphyritic	cciated,, maximum fr as dominant	agment size 0.12 mm , fragment;

HOLE/	TRAVE	ERSE			->	B87CH	054	CONTIN	NUED	PAGE	2	2
						1 veins/m 5 % Quart 40 % Cart 2.5 % Ser 5 % Chlor 1 % Pyrit Barren Qu 70 Degree	netre or z occurs ponate oc ricite occurs rite occurs partz-Car Pas to Cor	0.3 Z of which 0Z as perv. dissem.,ve curs as perv. dissem curs as perv. dissem rs as perv. dissem.,ve bonate for dominant e Axis;	are mineralized; ins,selvages and env .,veins,selvages and .,veins,selvages and veins,selvages and e ins,selvages and env veins; Contact at	relopes, envelopes envelopes envelopes, relopes,	3	
				REMARK :	=	35.91	36.70	CARBONATE RICH WK C	TUF - FWALL BX DEVEL	.OPED NARRO	W.	
36.70	44.20	ANDESITE	LAPILLI	TUFF		medium 5 % 0.5 m 5 % more 2.0 mm fo 30 % Felo 3 veins/m 5 % Quart 1 % Carbo 2.5 % Sen 5 % Chlom 1 % Pyrit fairly 10 very low Barren Qu Pyrite Ba	m green , am amphi siliceou or maximu ispar-Amp metre or tz occurs onate occurs onate occurs ricite occurs ricite occurs te occurs ow chlori bleachir uartz-Car earing Qu	10 % 0.5 mm plagioc bole phenocrysts; is matrix to fragment im fragment size 0.12 hibole Porphyritic a 1 % of which 0.01 as perv. dissem., curs as perv. dissem., curs as perv. dissem., curs as perv. dissem., curs as perv. dissem., as perv. dissem., as perv. dissem., tization as dominant das secondary alter bonate for dominant hartz-Carbonate for s	ase phenocrysts; s; 30 % volcanic fra m , s dominant fragment; % are mineralized; ins,selvages and env = to veins,selvages and env weins,selvages and env t alteration; ration veins; secondary veins;	agments; ; velopes, s and envel d envelopes, velopes, velopes,	ope: ;,	ā,
				REMARK	:=	36.70	44.20	COARSE PORPHYRITIC.				
				REMARK	:= SUM			HOLE INTERSECTED W	K CARBONATE CTUF WITH	H LOW PYRI	TE CI	ONTENT
				REMARK	= SUM			TEST ZONE SOUTH O	F INTERSECTION.			

DATE : 12-10-87 TIME : 10:49:37

BIG MISSOURI -- GOLDEN CROWN CLAIM

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	HOLE/TRAVERS	E	>	B87CH0	055	GEOLOG	VERSION	: 6B0202
	SURVEYED BY : TOTAL LENGTH : CORE DIAMETER: DRILLED BY : 1	CD COLLAR 47.85 NORTHI NQ EASTIN BOISVEN HOLE S	ELEV. : NG : G : TARTED : 8	-1.00 .00 .00 7 09 09	AZIMUTH(DEGREE VERTICAL ANGLE COORD SYSTEM HOLE ENDED	(S) : .00 : .00 : GRID : 09 09	GEOLOGGED BY DATE(Y/M/DY) TRAVERSE ATTR DRILLING HOU	: SMD : 87 09 10 18: Golden IRS :
	SURVI NU	EY PT DEPTH Mber M etres	AZ IMUTH DEGREES	ANGLE DEGREES	NORTH COORD Metres	EAST COORD METRES	ELEVATION METRES	
	S	1 0.00	.00	.00	.00	.00	-1.00	
0.00	7.62 CASING							
7.62	36.00 ANDESITE LAPI	LLI TUFF	light 2.5 % 0.5 5 % more 2.0 mm fo 40 % Feld 2 veins/m 5 % Quart 1 % Carbo 5 % Seric 2.5 % Chl 1 % Pyrit fairly lo low chlor Barren Qu	green , 5 mm amphi siliceous r maximum spar-Amphi etre or 1 z occurs a nate occur ite occurs orite occu e occurs a w bleachin itization artz-Carbo	% 0.5 mm plagioc bole phenocrysts matrix to fragme fragment size 0. bole Porphyritic % of which 0. s perv. dissem. as perv. dissem. s perv. dissem. g as dominant al as secondary alf nate for dominant	lase phenocry it as dominant 5 mm , as dominant 01 % are min veins, selvage m. = to veins a., veins, selvage veins, selvage teration it veins;	ysts; lcanic fragment; heralized; es and envelope s,selvages and ages and envelope lvages and envelope	s; envelopes, opes, elopes, *5,
36.00	37.61 CHERTY TUFF	REMARK := blue	7.62 grey , 10 % 60 % volc 50 % Feld 1 veins/m 10 % Quar 1 % Carbo 30 % Seri 20 % Chlo 2.5 % Pyr high blea	36.00 W recrystal anic fragm spar-Amphi etre or 1 tz occurs nate occur cite occur rite occur ite occurs	ELL DEVELOPED F lized chert; bu ents; 2.0 mm f bole Porphyritic % of which 0% as perv. dissen s as perv. dissen s as perv. disse as perv. dissen ominant alterat	RAGMENTAL TEX recciated,, or maximum fr as dominant are minera ,veins,selva em., veins,selva em.,veins,sel m.,veins,selva a,veins,selva	TURE. agment size 0.1 fragment; lized; ges and envelop s,selvages and vages and envel vages and envelop ages and envelop	2 mm , ees, envelopes, lopes, lopes, opes,

DATE : 12-10-87 TIME : 10:51:04

HOLE/TRAVERSE

B87CH055

37.61 47.85

CONTINUED

fairly high chloritization as secondary alteration Barren Quartz-Carbonate for dominant veins; Contact at 30 Degrees to Core Axis;

REMARK :=

36.00 37.61 BRECCIATED-GREY BLACK-CHLORITIC-NON-MINERALIZED.

37.61 47.85 ANDESITE LAPILLI TUFF

dark to medium green , 1 % 0.12 mm plagioclase phenocrysts; 5 % 0.5 mm amphibole phenocrysts; brecciated,, 3 veins/metre or 1 % of which 0.01 % are mineralized; 1 % Quartz occurs as perv. dissem. = to veins, selvages and envelopes, 1 % Carbonate occurs as perv. dissem. = to veins, selvages and envelopes, 2.5 % Sericite occurs as perv. dissem., veins, selvages and envelopes, 10 % Chlorite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv. dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv., dissem., veins, selvages and envelopes, 1 % Pyrite occurs as perv., dissem., veins, selvages, and envelopes, 1 % Pyrite occurs as perv., dissem., veins, selvages, and envelopes, 1 % Pyrite occurs as perv., dissem., veins, selvages, and envelopes, 1 % Pyrite occurs, as perv., dissem., veins, s

GOOD HEAVY CHLORITE - INSITU BRECCIA WITH CHLORITE.

REMARK :=

REMARK := SUM

INTERSECTED.

ConstructionCase of the second s	CLIEN MACH CORE	T INE BARREI	<u></u> L	<u>iqma</u> JK5	<u>Eng</u> 300	i <u>ne</u> e	riA	1	(UKSYMIN) (URINALIUN) COORDINATES COLLAR ELEVA	IDN 100	06.82)°)	FINAL DEPTH 25.30 DRILLED BY LOGGED BY BRA AZIMUTH - DATE DRAWN BY
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	CORE (esidin Diamet	ER,	mm	45	۶	LUS	11	Vater CASING		ar ch	· · ·	27/08/67
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	DOWNHOLE DEPTH, m	ORILLING PROGRESS	FLUSH RETURNS, "/.	DEFTH TO WATER, m	CORE RUN DEPTN, m	TOTAL CORE RECOVERY, ".	SOLID CORE RECOVERY, "1.	ROCK DUALITY DESIGNATION, "1.	DISCONTINUITIES	DOWNHOLE DEPTH m	ELEVATION, m	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
$\frac{1}{10}$	1.48		/			65		0	First 0.10 m highly fractured, then most fractures 10°-15° from horiz., 1-3 cm spacing typical. Largest disc is 4.5 cm long. 17 cm long highly fractured 20 ne beginning at 0.44 m				All Bowser SHALE, no gtz. or cale. Veins
$\frac{1}{100}$ $\frac{1}{1000}$ $\frac{1}{100}$ 1	2.74		1			100		0	Similar to above, but spcg. slightly larger. 3 pcs. in 4.5-5.0 cm range. Highly fractured 2.53 2.60m				SHALE, Same as above
84 20 3-8 cn typ. fracture sprg. Highly fracture 20 ms at 335-339 SHALE there. No dominant veins, but cale. 9 3.46-3.50, 3.70-3.80 Only two fractures in bast 50 cm, one of which is 650 k horiz. and ordized on surface. Shale the shale. Shale the shale. 8 6 5.18-5.69; Inhate rock fracture sprg. 4-15cn, host almost hariz. two oxidized fractures 70° to horiz. Shale, occusional very this (0.3 mm) guartz veins, 45° to horiz parallel, immediated fractures 70° to horiz. 98 67 6.71; Fracture 45° tu horiz, not ordized 6.83; Hariz, 10° tu horiz 7.91; Fracture 50° to horiz. State the shale spread the source in the source for the state spratte State the source in the source spratte 98 67 6.71; Fracture 45° tu horiz, not ordized fractures on 70° to horiz. State the source in the source for the source for the source for the source in the source for the source for the horiz. State the source in the source for the horiz for the source for the source fo	3.35		1			100		v	Similar to above. Some fractures 40°-45° to hariz, and oxidized on surface. Highly fractured 2.46 - 3.06 m				Bowser shale SHALE 2.75 m: Imm quartz vein, 45° to hori 2.42 m: two 0.5 mm qtz. veins, paral 1.5 cm apart, 45° to horiz
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	5. <i>18</i>		S			67		28	3-8 cm typ. frecture spcy. Highly frectured 20,105 at: 3.35-3.39 3.46-3.50, 3.70-3.80 Only two fractures in last 50 cm, one of which is 650 to hariz. and oxidized on surface				SHALF. No dominant veins, but culc. deposits on a few fracture surface: Some bythen colonnel bands in the shale. both for this of the rock described as fighter cultures of cultures is probably siltstone
18 67 6.71: Fracture 45° to heriz, not oxidized 5.71: Fracture (sectore) heriz, not oxidized 5.71: Fracture (sectore) bands. Several His gitz. veis, almost all parallel, 50° to horiz. 6.83: Horiz. Fract. 10° to horiz. 6.95: Fract. 10° to horiz. A few veiss up to 3 nm thick. 7.41: Two fractures one horiz, on 70° to horiz. Veins generally thicker, more numerous, and more randomly oriented in last 0.4 m No 7.71-8.23: several neur-horiz. fractures 3-6cm typ. spog. oriented in last 0.4 m	6.71		J			k0		58	5.18-5.69. Intert rock 5.69-6.11. Typical firecture spcy. 4-15cm, Most almost hariz, two exidized fractures 70° to horiz.				Shalë, cacasional very thin (0.3 mm) quartz veins, 45° to horiz, parallel I mm thick horiz. ytz. vein at 6.63.
	8.23		ſ	-		78		67	6.71: Fracture 45° to heriz, not exidized 6.83: Hoiz. fracture 6.95: Fract. 10° to horiz 7.41: Two fractures - one horiz, on 70° to horiz. 7.71-8.23: several near-horiz. fracture 3-6cm typ. spcg.				SHALE with some lighter (sandler) bands. Several thin gtz. vens, almost all parallel, so ^c to horiz A few wins up to 3 mm thick. Veins generally thicker, more numerous, and more randomly oriented in last 0.4 m
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PROJ	IECT NT	<u> </u>	ong	Lak	el	lam		CONTRACTOR	Bois	venu	Dri	Hing Sheet 201 3
MAC CORE BIT CORF	HINE BARRE DESIGN	EL IFR	nm	300	<u> 1/A</u>	FLUS	на н (COORDINATES COLLAR ELEVAT INCLINATION Mater- Casing	110N 1C Vortica	006.82 1 [40	6)	FINAL DEPTH 25.30 AZIMUTH - CRILLED BY LOGGED BY BRL DATE OT/09/69 DATE ORAWN BY 27/08/97
				<u> </u>	1	-		DISCONTINUITIES	, e			GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH. IB	DRILLING PROGRESS	FLUSH RETURNS, "/.	DEPTH TO WATER, m	CORE RUN DEPTH. m	TOTAL CORE RECOVERY,	SOLID CORE RECOVERY.	ROCK DUALITY DESIGNATIO		DOWNHOLE DEPTH	ELEVATION, m	SYMBOLIC LOG	
9.75		5			66			First 15 cm highly fraction 8138 - 8.53: 3mm thick fracture infilled with calc. matt., 80° to horiz. 8.53 - 9.31: Hariz. fract- ures 3-15 cm spag. typ., a few 70°- 80° to horiz, oxidized Highly fractured at 8.53 - 8.58 and 8.73 - 8.78. Highly fractured after 9.31 m, no piece larger than 4 cm. 9.75 - 10.35: None-huriz				SHALE Strate, as above. Major calc. vein noted at left. Minor calc. on some fracture surfaces. Some gtz. veins, but less freque than above. Strate V. faw this quarter veins.
11 11.28					92		83	fractures, S-15 cm typ. speg., one 24 cm long wit. fracture, slightly oxidized 10.35-11.28; a forw horiz. fractures, 7-31 cm speg., one 80° to horiz.not oxidized very fow fractures,				shale, so the print parts out
13				ļ				all 0°-15° from horiz				SHALE siltstone
14,63]			100		92	Only 5 tractures, all 0°-15° to horiz. except for a highly fractured ZONE at 13.64-13.69 m				SHALE, as above. Some higher bunds. 2 mm wide near - vertical quartz veil at \$ 13.36 m, several randomly orient veins near 13.60 m SHALE
16.15		r-h holow here -			100		87	17.63-17.42: 7 Fractures 0°-15° to horiz., 3-17co SPCJ. One Fracture 80° to horiz., v. little surface oxidation 15.42-16.15: Unly one fracture, 5° to horiz., at 16.05 m 18 Fractures. 10°-15° to				Smather, some seating layers. Smather, some seating layers. Smather rock at 15.42 m, 15° to horiz. State, no veins, some kighter sittstor
7.68		No reh						hariz., one vertical fracture at 16.63 - 16.72 m, with an oxi- dized in reactur surface				zones (sandies), minor pyrite.

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PROJECT CLIENT	Sig	<u>Long</u> ma	Lok Engin	e eer	<u>Dai</u> ina	n (Westmin) CONTRACTOR	Boi	svenv	Dr	-illing Sheet 3 of 3
MACHINE Core Barf Bit Design Core Diam	IEL I ETER	5 <i>KS</i>	300 45		FLUS	H	COORDINATES COLLAR ELEVAL INCLINATION Water CASING	ion / lertic	006.8 ul	2	FINAL DEPTH 25.30 AZIMUTH _ DATE 27/06/167
DOWNHOLE DEPTH, m Orilling Progress	FLUSH RETURNS, "/.	DEFIN TO WATER, m	CORE RUN DEPTIN, m	IDTAL CORE RECOVERY, "/.	SOLIO CORE RECOVERY, ".	ROCK OLIVLITY RESIGNATION, '1.	DISCONTINUITIES	DOWNHOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
19.20				100		28	Numerous fractures 8-15 to horiz., typ. spcg. 1.5 - 5.0 cm in first 0.3 m, then 3 - 13 cm except a backly broken 20.18 at 18.32 - 18.38 m Fractures 70°-90° at 17.78 - 17.94, 18.16 - 18.22, 18.40 - 18.44 18.57 - 18.70				and <u>content</u> zones, minor pyrite
20.73				17		0	Poor recovery of body broken core due to a broken core spring. First 12 cm has 3 near-horiz. fractures and two at 60°-70°				SHALE with quartz veins and lonsus, no, calc. or pyrite
22,25	No return			100		4	Neur-horiz. Fractures at typ. spcg. of 3-10 cm, and fractures at 60°-90° throughout. Budly broken zones at 21.05m, 21.22m, 21.57m				SHALE with numerous quartz veins and lenses, sentimer zones, minor- culc., minor pyrite
23.77				100		38	22.25-22.74: two fractures 10° to hariz. 22.74-23.77: Fractures at 0°-15° to horiz. at 5-10cm spacing. Mighly Broken rock at 23.50-23.55 m due to neur-horiz. und neur-vertical fractures.				SHAFE with large zones of <u>contractor</u> Frank, abundant quarte veins and lenses, minor calc.
25.30				100		90	7 Fractures at 0°-10° to horiz, no near- vertical fractures. End of log.				stude with sailtstone zones, some thin quartz veins, minor pyrite

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PRO	IJECT	te	ng	Lak	e	D	am		TONTOACTOO	R		<u>n .</u> ,	BUREHOLE NO. 299
MA		L	<u>19 E</u> TKS	<u>ng ine</u> 3 <i>00</i>	<u>eria</u>	<u>g</u>	(1)	iestmin)	COORDINATES COLLAR ELEVAI	IDN 10	01.75	5	FINAL DEPTH 26.52 A7IMITH 7/2 DATE TO AND BY
COR	e diame	TER,	mm 4	45	F	LUS	H (Nator	CASING	·····	o nori	2 . T T	29430/08/87
					v	*	Ē	DISCONT	TIXUITIES	É.			GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH, m	ORILLING PROGRESS	FLUSH RETURNS, '.	OEPTH TO WATER, a	CORE RUN DEFTN.	TOTAL CORE RECOVER	SOLID CORE RECOVERY	ROCK DUALITY DESIGNAT	(All depth along con	is measured re axis)	DOWNHOLE DEPTH	ELEVATION, m	SYMBOLIC LOG	and a state of the
<i>.</i>					63		0	13 cm gra by fractu most fract to core ax typ. spxg in first 5 2-5 cm	vel, followal red core, fures 0°-10° eis normal, . 0.5-2.cem Socn, then Most				SHALE, minor siltstone. Colc. matl. on a few fracture surfaces.
10								frachres	oxidized.				
3.96		1			100		43	Most fractur to core axis o few near Typical spa but two pie long. Most	res 15°-25° s normols - 0° or 90° rcing 4-15cm aces 24-30cm 4 oxidized.				SHALE, minor silts tone, minor pyrite, minor calc. matl.
5.49		/			96		88	Fractures core axis typ. space but as mon Only slight	0° - 20° to normal, ing 2 - 17cm, ch as 27cm. oxidation.				SHALE with bands of siltstone, minor gtz., minor calc., minor pyrite
7.01		.,			100		95	6 Fracture core axis no one 45° tu Highly fractu -6.43 m.	es 0°-10° tu rmal, und o axis normal ured 6.38m				SHALE with sittstone bands, role. on surfaces of steeper fractures. No quartz or pyrite.
8.53		1			100		60	All fractur to core a typ. sprg. but os lowa as high as Minor Oxidati fracture su	es $0^{\circ}-15^{\circ}$ is normal, Y = 15cm, as 0.5cm and 30 cm. ian on some rfaces.				SHALE with siltstone bonds, minor quartz, minor pyrite, v. little calc. material.
10.06		1			100		57	8.53-8.73; 0°-10° to 2-5 cm sp 8.73-8.82: F 8.82-10.06: typ. Fract but one p 10 ng. Mo 10°-20° on core axis many high	Fractures oxis normal, pacing. Highly fracked 2-15cm ture spacing, piece 24cm ist fractures r 60°-80° to normal, by oxidized.				SHALE with significant siltstone, esp. one 13 cm wide bond starting of 8-84 m. Minor quartz, minor pyrite.

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PROJECT	L	ong	Lak	<u>ee</u>	I	am	Alerta in 1 M	INTRACTOR	Roie	Paris	Dui	BUREHOLE NO. 299 Mina Sheet 2 of 3
MACHINE CORE BARRI BIT DESIGN CORE DIAME	EL.	9.~~ KS	300 45	<u>. e</u>	FLUS	19 H <i>V</i>	Vater C	DORDINATES Dillar elevat Iclination <i>G</i> Asing	ion 10 0° te	001.75 horit	5 z	FINAL DEPTH 26.52 AZIMUTH 071° DATE 29+30/00/07 CALLED BY DATE 29+30/00/07
DOWNHOLE DEPTH, m Drilling Progress	FLUSH RETURNS, "/.	DEPTH TO WATER, m	CORE RUN DEPTIN	TOTAL CORE RECOVERY, ".	SOLID CORE RECOVERY, "1.	ROCK OLIVILITY DESIGNATION, "1.	Discontinu (All depths m along core d	ITTIES ne <i>asured</i> 2×is)	DOWNHOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
<i>ll. 58</i>	/			83		35	Most fracture: core axis n I-12cm type but as mue A faw oxidi tures 70°-90 normal Lie a parallel to c	s 0°-10° to ormal, p. speg., th as 24 cm. ized frac- to axis almost ore axis).				Bands of SHALE and SILTSTONE (est. 60% - 70% shale). Quartz veins up to 3 mm thick, minor pyrite.
13.11	1			82		23	11.58 - 12.76: highly broke fractures almost p core axis. piece 7 cm 2-5 cm. No 12.76-13.11: tures, 10° to co	Core n along nost normal ara/lel to Largest long, most oxidation. Two free- axis normal.				11.58-12.76: Broken SHALE and SILTSTONE gtz. veins, calc. math. on many fracture surfaces. 12.76-13.11: Shale with thin quartz veins.
4.63 %		(1 1.2	ting to a sect to a	100		83	Most fracture or 60° - 80° ⁽¹⁾ xis norma Mp. spacing Oxidized.	s 10°-20° to core 1 ₃ 3-25	äi			SHALE with animor siltstone, quart and calc. veins, minor pyrite
16.15 1	1	<u> </u>		100		70	Most froctures or 60°-80° qxis normal spacing. Not	10°-20° to core , 2-20cm oxidizel.				SHALE with siltstone bonds, quartz veins, minor calc. material.
17.68	1			86		10	16.15 - 16.30 : 16.30 - 17.68 : 5 pacing 2 - fractures a to core axis	Intact core Fracture 10cm, re 0°-70° normal.				SHALE with siltstone bonds, quarter and calc. Veins.
19.20	~			100		58	Most fracture to core axis 5cm-22cm except two at 70° to as at 218.65m highly fractur of 10 at	es 10°-20° s normal, spacing, , fractures kis normal , and o red Zane 98				SHALE with sillstone bands, gtz. vein minor calc., esp. in highly fracture zone noted at laft.
20.73	ſ			60		86	Eight Fracture to Core axis n 70° to axis n Spacing 2 - 10-15cm typin	to m to Co-10° formal, one ormal. 59 cm, cal.				SHALE with minor sillstone, thin, sleeply inclined quartz veins, minor pyrite.
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PROJ	ECT	La	na	Lake	De	2/19								ROKEHOLE N	IU. 299
CLIE MAC CORE BIT	NT HINE BARRE Design	<u>Sig</u>	na l sks	300	eria	g	(w	estmin)	CONTRACTOR CDORDINATES COLLAR ELEVAT INCLINATION	Boisu ION loc 20° to	<u>рели</u> 01. 75. hori	<u>Dri</u> 5 z.	FINAL DEPTH 26,52 AZIMUTH 071°	DATE	LOGGED BY BRD DATE <u>10/09/87</u> DRAWN BY
CORE	DIAME	TER,	mm	45	12	EUS		DISCONT					GEDLOG	ICAL DESCRIPTION	
DOWNHOLE DEPTH, m	DRILLING PROGRESS	FLUSH RETURNS, "/.	DEPTH TO WATER, m	CORE RUN DEFTK.	IDTAL CORE RECOVERY. "	SOLID CORE RECOVERY. "	ROCK BULLITY DESIGNATION,	(All depths along corr	e axis)	DOWNKOLE DEPTN m.	ELEVATION, m	SYMBOLIC LOG			
-				1	100	1	83	Most frac	tures 0°-10°				SHALE, minor si	Itstone, mis	nor pyrite.
22,25		1						to core ax Two fracts 80° to ax	is normal. Ures about is normal.				5 mm thick high slickensided 91 normal to corr	hly fracture iz. vein at e aris.	d and 20.78m,
-				+	100	,	86	Eleven fracti	res 5°-20°				SHALE with silt	stone bank	s, a few
23,77		1						to core axis one 70° to Spacing 2- 20 cm typ	s normal; axis normal- 35cm, 5- pical;				quortz veins,	Minor pyri	1e.
25.30		. /			100		64	23.77-23.9 core due te 80° to com intersected at about 12 normal. 23.99-25. fractures 9×is norm 60°-80° normal. 1-37cm More typi fractured 24.13 m.	7: Broken a fracture e axis normal by several 0° to axis 30: Most 0°-10° to mal, a few to oxis Spacing 1, 8-15cm cal. Highly at 24.11-				SHALE with si pyrite (but a usual: Icm minor quartz	Itstone band larger lense thick at max veins	(s, minor of then cimum),
6.52					100		96	Eight fra. 0°-10° to normal, : 6.5-41 ca two 0.5 c.	ctures, all core axis spacing except m aport				SHALE with 2 a few quort	0-30% s; 2. veins	ltsløne _j
								End of 1	og .					:	

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PRO.	JECT	Loi	ng L	ake	Da	m	1.40	4	CONTRACTOR	Bai		D	BUREHULE NU. 300
MAC CORE BIT CORE	HINE E BARRI Design Diame	EL TER,	JKS MM	300 45			H V	Vater	COORDINATES Collar Elevat Inclination V Casing	ION //	006.34 1	45 15	FINAL DEPTH 26.82 AZIMUTH - ORILLED BY LOGGED BY BRD DATE 31/06 - ORAWN BY 01/09/07
		Γ			*	\$	1	DISCONT	INUITIES	Ė			GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH, m	ORILLING PROGRESS	FLUSH RETURNS, "/.	DEFTH TO WATER. m	CORE RUN DETTN .	TOTAL CORE RECOVERY	SOLID CORE RECOVERY,	ROCT OLULITY DESIGNATI			DOWNHOLE DEPTH	ELEVATION, m	SYMBOLIC LOG	
.6		-			Ē		-	Not cor	red				
2./3		/			95		0	Fractures 0° horiz, 1-60 most not 0	-15° to m spacing, widized.				SHALE with very little quartz or calc. material
44		1			100		0	Fracture spe ation same	cg. 4 orient. as above, fr. oxidetion				SHALE, as above.
3.96					77		0	Most fracture horiz. or no with most a inclined one Typ. sprg.	res near - hear -vert., of the stopy es oxidized. 2 - 9 cm.				SHALE, as above, except a broken and highly oxidized gtz. + carbonate layer at 3.61 - 3.72 m.
9''		1			75		0	Most Fracture horiz or r 1.5 - 6 cm Oxiderlian or inclined free	es neur - Dear - vert.; spcg. n steepty ture surtaces				SHALE with occasional thin quartz veins.
5.79		·.,			100		0	Most fractu horiz. or to horiz., sp Mony Fracture oxidized.	eres inear- 60°-90° erg. 2-9cm. e Surfaces				SHALE with occasional thin quartz veins.
6.7/		~			85		13	All fractures to horiz., s 2-12 cm. O oxidation.	0°-15° Pacing nly minor				SHALE with some sillstone bands, on thin quots vein.
67.0		1	~		90		50	First 7 cm a Horiz. frz 1.5 cm sp Probable z core los Romainder of a Fracturos horiz., 2 spacing, 0 60° to hor little stc. a	of core: inclures, pacing. one of s core run: 0°-15° to -14 cm one at iz. Very Xidotion.				SHALE with siltstone bands, occasional thin guartz veins at 50° to horizontal.
7.17	,	5			88		74	Most fractu horizontal spacing, no 32 cm long fracture, his ized and wi growth on s 8.90 - 9.20	res near - , 2-19 cm + oxidized. vertical ghly oxid- th gtz. itc. at Jm.				SHALE with siltstone bonds, considerable quortz in last 25 cm

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	NT HINE BARRE DESIGN	Sig L	ma JKS	Engin 300	nee.		д (н И	westmin) Vater	CONTRACTOR COORDINATES COLLAR ELEVAT INCLINATION CASING	Boisu ION 10 Vertic	<u>106</u> .34 al	Dri 'S	FINAL DEPTH26.82 AZIMUTH	Sheet 2 of 4 DRILLED BY DATE 31/08 - 01/09187	LDGGED BY <i>BRD</i> DATE <u>/0 /09/87</u> DRAWN BY
	UAMC		1111 . 7		1.5	1.5	1	DISCONT	TINUITIES				GEDLOG	ICAL DESCRIPTION	
WWWALE DEPTH, M	ORILLING PROGRESS	FLUSH RETURNS, "/.	DEPTH TO WATER, m	CORE RUN DEFTN.	TOTAL CORE RECOVERY.	SOLID CORE RECOVERY,	ROCT DIVLITY DESIGNATION			DOWNHOLE DEPTH IN	ELEVATION, m	SYMBOLIC LOG			
10.67					100		36	Most fract or 70°-90 Oxidation o inclined fi surfaces. 5-15 cm, to 28 cm fractured 9 ancl. 9.78-	vres 0°-20° ° to hariz. n steeply tackure Typ. sprg. Lut up Highly 14-9.16m -9.81m				SHALE with s Veins, minor Some fracture	iltstone ba calc. mot surfaces.	inds, gtc. 1. on
12.19					100		46	Most fract horiz. or 1-20 cm s but up to Near - verti often show or mineral (slickensides	tures near- near-vert., pcg.typ., 34 cm. cal fractures i oxidation growth 5).				SHALE with si veins up to or no calc. i	ltstone ba. 1.5 cm thi material.	rds, qtz. ck, little
15.12					100		68	12.19 - 12. 0°-20° and horizontal Badly frac 212.27 N of conside growth. 12.35 - 13 0°-10° to 12-25cm	35: Fractures d 60°-80° to common. tured at tured at in an area irable gtz. .72: Fredues horizo spacing.				SHALE with si gtz. crystals thick in fi thin gtz. No calc. ma	Itstane ba and veing rst 15cm, ue in af H.	inds, up to 1.50 Calg^oone ter 12.35cm
54		No return below here -> 14.35			98		65	13.72 - 14.35 horiz. and Vertical fr Oxidation G slickenside steppis - inc 14.35 - 14.45 three fract horiz., shu side growt 1055. Prob 2000 14.45 - 14.66 14.63 - 14.66 to horiz -hik sl. Vern. 14.65 - 15.26	Three near- one near- actures - Minai rel minai s on the clined surface : At least wres, 10° to owing slickan- th. Some core able fault : Intact core Fracture 30° ; along a 3mn ickensided gtz. I Fractures				SHALE with su veins and slid fracture surt	Itstone ba ckensicles a faces.	nds, gtz Ilong many

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MAC CORE BIT	NI HINE BARRE Design	<u>- Si</u> - 丁 - 1	ema Es :	<u>Engir</u> 300.	1 <i>0.81</i>	ring	<u>í (</u>	COORDINATES COULLAR ELEVA INCLINATION V	101 bo ion bo iertic	<u>venu</u> 06.34 al	5	FINAL DEPTH 26.02 AZIMUTH -	DATE 31/08- DRAWN BY
CORE	DIAME	TER,	mm 4	<i>15</i>		FLUS		Nater CASING			Π	GEDLOG	101/09/87
DOWNHOLE DEPTH	ORILLING PROGRESS	FLUSH RETURNS, "/.	DEFTH TO WATER, m	CORE RUN DETTN.	IOTAL CORE RECOVERY.	SOLID CORE RECOVERY	ROCT GUALITY DESIGNATION,		DOWNHOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG		
6./5					92		26	15.24-15.72: Highly fractured along neur- vertical and neur-horiz Fractures, no piece larger than 6 cm, most 2-3 cm. Many tracked slickensided. 6mn thick layer of fault gouge at 15.34m, 20° to horiz. 15.72-16.15: Most frac- tures neur-horiz. 2-15 cm sparing				SHAFE with si quartz veins, 15.88 - 15.99: shale, qt	Itstone bands, thin except: Siltstone, minor z. veins
17.68					100		33	16.15 - 17.00: Most fractures 10°-20° to horiz, minor slicken siding on surfaces. 3-17 cm spacing. Some near-vert fractures 17.00 - 17.68: Highly fractured, most pieces 2-4 cm long, but up to B cm.				SHALE with si veins. Quartz some Fractur	ltstone bands, quarte crystal growth on e suitaces.
1.20		No Return			100		58	Most fractures 10°-20° to horizontal, 2.5-20cm spacing. Some fractures about 60° to horiz. Only minor slickensiding. Highly fractured 18.63-18.59				SHALE with si siltstone. 20 at 18.06m, a all 200-600	Histone bands. 20-3. cm thick quartz vein few thinner ones, to horizontal.
20,42					100		73	19.20-19.70: Most frac- tures 0°-15° to horiz, 1.5 - 16 cm spacing, two fractures 60°-80° to horiz. No slickensides 19.70-20.42: Just two pieces of core, with a fracture 10° to horiz. at 20.12 m				SHALE with s accasional	iltstone bonds, thin quartz veins.
21.95					100		77	20.42-21.36: Only six fractures, 100-200 to horiz, 10-26cm spacing except two I cm apart. 21.36-21.95: Fractures 100-200 and 600-800 to horiz., typ. spcg. 2-6cm, but up to 19cm.		-		SHALE with sin quartz veins. about 10 cm	Itstone bands, thin One qtz. vein thick.

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LIE	NI S	igm	a E	noine	eri	na	(h	lestmin) CONTRACTOR	Boisu	enu I	7,-,4	ling Sheet 4 of 4
AAC ORE	HINE BARRI DESIGN DIAME	EL. TER.	TKS	300		FLUS	• •	COORDINATES COLLAR ELEVAN INCLINATION V Mater CASING	10N /00 Vertica	06.34 1	5	FINÁL DEPTH26.02 AZIMUTH – ORAWN BY
COWKHOLE DEPTH, M	ORILLING PROGRESS	FLUSH RETURNS, "/.	DEPTH TO WATER, m	CORE RUN DEFIN. M	TOTAL CORE RECOVERY, "A	SOLID CORE RECOVERY, ".	"." HELMOSSE ALITHE SOC	DISCONTINUITIES	DOWNHOLE DEPTH m.	ELEVATION, œ	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
23.77					74		6	Broken core for entire run. Last. piece 10 cm long, most 65 cm. Fractures at a variety of: angles, some are slickensided.				SHALE, minor siltstone, thin quartz veins
25.30		- Nu Retur			92		43	23.77-24.14: Highly fractured 24.14-24.44: Most frocture 10°-20° or 60°-00° to horiz., 1.5-7cm. Minor slickensiding. 24.44-25.30: Most Fracture near-horiz. or near- vertical, 10-28 cm spacing, except for a highly fractured Zone of 24.93-25.05m				SHALLE, minor sillistone, quartz veins.
26.82		•			81		78	Recovered core has only five near-horiz. and two near-vert. fractures, widely spaced. Lost core likely all from bottom 30 cm of run. Last fracture is slickensided, all others not.				SHALE with siltstone bands, minor pyrite, minor quartz.
								. End of Log				

06/09/8/ 1	AZIMUTH - OATE	,	07.90 al	ion 10. Vertica	COLLAR ELEVAT Inclination V				300	ks :	ถ. ว	HINE Barri Design	MAC Core Bit
LAL DESCRIPTION	GEDLOGICAL DESCRIPTI	Π			DISCONTINUITIES	2			45		ETER,	DIAME	CORE
		SYMBOLIC LOG	ELEVATION, m	DOWNHOLE DEPTH m.		ROCK QUALITY DESIGNATION,	SOLID CORE RECOVERY.	TOTAL CORE RECOVERY	CORE RUN DEFTH.	DEFTH TO WATER, m	FLUSH RETURNS, "/.	DRILLING PROGRESS	DOWNHOLE DEPTH, m
-	-				Not cored	0		93			7).G
in sillstone bands	SHALE with minor sittste				DiGI-0.77: Loose rocks from surface 0.77-1.52: Most fractures 0°-15° or 60°-80° to horiz., 1-5 cm \$PC9; minor oxidation on some surfaces.	0					1		1.52
'stone bands	SHALE with sillstone bo				.52-1.85 Highly fracture probable core loss zone Oxidation on fract. stc. .85-2.44: Most fractures near-horiz., one 70° to horiz., slightly ox-	01		74					*
	·				3-5 cm typically.						1		2.4
Itstone bands. Hered carbonate in at 2.84m, noted wartz vein at 3.61 to horizontal.	SHALE with siltstone Rtz. and weathered co Fractured zone at 2.8 at left. 2 cm thick quartz v oriented 40° to hori				2.44 - 3.68 m: Most fractures 10°-30° to hariz., 2-14 cm spcg. except a highly free- tured and weathered zone at 2.84-2.92 m 3.68 m: Fracture 40° to hariz along bottom of quartz vein 3.68 - 3.96: Intact core	33		100					3.96
Itstone bands.	SHALLE with siltstone				Daly 6 near-horizontal and one near-vertical fracture in entire run. No surface Oxidation.	96		100					5.49
stone bands.	SHALE with siltstone ba	1	<u> </u>		Six near-horizontal fractures, not oxidized	100		100					6
tone bonds, slickensio fracture surfaces. Itstone bonds.	SHALE with siltstone ban on two steep tracture SHALE with siltstone ,				7.01-7.88: Just two mear = horiz. fractures 7.80 - 8.53: Fractures 0°-20° and 60°-70° to horizontal. Slickencide growth on steeply - inclined fracture surfaces. Nine well-spaced near- horiz. fractures, two Gt 60°-90°. One of the steep fractures is oxidized, the other has miror gtz. and calc- carbonate on	80 98		100					0.06 8.53 7
-	SHALE with sit				Nine well-spaced near- horiz. Fractures, two at 60°-90°. One of the steep fractures is oxidized, the other has miror gtz. and calc. corbonate on the stc.	98		100			,		10.06

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MAC CORI BIT	HINE E BARRI DESIGN	150 150	J K-S	500 UE		3 110		COLLAR ELEV INCLINATION	Vertic	07.90 al		FINAL DEPTH 28-35 AZIMUTH - DATE 02/09/87 DATE
	. UAMC		1140	72			3	DISCONTINUITIES			Π	GEDLOGICAL DESCRIPTION
DOWNHOLE DEPTH, IN	DRILLING PROGRESS	FLUSH RETURNS, "/-	DEFTH TO WATER, m	CORE RUN DEFTN, m	TOTAL CORE RECOVERY.	SOLID COLE RECOVERY.	ROCK BULLY DESIGNATION		DOWNHOLE DEPTH #	ELEVATION, m	SYMBOLIC LOG	
11.58	v				97		84	16.06 - 11.34: Four fractures 0°-10° to horiz., one slights Oxidized 11.34 - 11.58: Six frac- tures 0°-25° to hori and two about 60° to horiz., 2-7cm spra Slickensides on one moor -horiz. fracture, mire atz. on asterno	•			SHALE with siltstorie bands, minor quartz
(3./)							70	11.58 - 12.16: Six frecture 0°-15° to horiz., 2-22 cm spacing. Minor slickensides. 12.16 - 12.29: Fracture 0°-15° and 60°-90° to horiz., 1-3 cm Spcg., 1 cm long highly fractured 2000 Oxidation, slickensid 9tz veins all common 12.29-12.72. Five near horiz. fractures, two at 60°-80° to horiz. one of which is v. smoothe and slicken- sided. 12.72-13.11. Tabut - are	s s -			SHALE with siltstone bands, thin quartz veins. Considerable quart in fractured zone at 12.16-12.29 including one vein #1 cm thick, horizontal.
4.021					100		100	Three well-spaced near-horiz. fracture	s			SHALE, minor siltstone
1 65.5					100		90	Seven well-spaced neur-horiz, fracture	s		-	SHALE, minor siltstone
11.07 1		ſ		ыл. 	100		100	Six well-spaced Near-horiz. Fracture one with minor weathared carbonate on surface.	5			SHALE, minor siltstone, minor calc. corbonate on one fracture surface
17.68		No Return Below + 2 17.44	Here		100		95	Intact core except two fracture zones: 17.29-17.31m: core broken horizontally and vertically 17.44 m: 7-13 mm thick fractured qtz. Vein, 45° to horiz. Probable water loss zone.				SHALE, minor siltatore. Single quartz vein noted at ler

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CLI	ENT	Sign	a T	naine	erin	4	(We	stmin) CONTRACTOR	Boisu	enu	Dri	lling	Sheet 3 of	Uncern m. ?
MAI COR BIT COR	CHINE E BARR Design E Diami		TKS	300		LUS	<u> </u>	COORDINATES COLLAR ELEVAT INCLINATION V Water- CASING	10N / Intica	007.90 I	8	FINAL OEPTH 28.35 Azimuth —	ORILLED BY Oate 02/04/87	DATE 11/09/E DATE 11/09/E DRAWN BY
		T		Í	:	:	3	DISCONTINUITIES	e.			GEDLOG	ICAL DESCRIPTION	
DOWRHOLE DEPTH, m	ORILLING PROGRESS	*/• *SRANLEE MSN15	DEFTIN TO WATER, m	CORE RUN DEPTH.	TOTAL CORE RECOVERY.	SOLID CORE RECOVERY.	ROCK GUALITY DESIGNATION		DOWNHOLE DEPTH n	ELEVATION, m	SYMBOLIC LOG			
19.20	-		,		98		87	6 neur-horizontal and one mear-vertical fracture, no oxidation, only V. minor slickersiding.				SHALE with sil. thin quartz ve	t store - bard. lin	s, one very
20.73					95		85	All well-spaced near- horizontal fractures except three zones: - 19.20-19.23: three horiz. and one 60° to horiz. fractures. - highly fractured at 20.34-26.38 m * highly fractured at 26.68 - 20.73 m				SHALE with s. Two 3cm this veins contain at 20.34 m veins are ho	iltstone t ok fracture ning shale and 20-68 n rizantal.	ands. d quarte fragments n. These
22.25		No Return			100		54	Most Fractures 0°-15° and 60°-80° to horiz., spcy. 1.5 - 22 cm, two highly fractured zones near 20.83 m and 21.68 m. Slickonsides on most steep fractures and some near-horiz. ones.		-		SHALE with g slickensides of occasional thin	iltstone fracture quartz	bands, surfaces, veins.
23.47		•			94		/3	22.25-21.39: 3 fractures 0°-20° to horiz. 22.39-22.63: Highly fractures Three pieces 3-5.5 cm long, otherwise rubble. Slickmsicles and qtz. Veins common 22.63-22.96: Two near- . Horiz. Fractures, one 21.70° along a slicken- sided qtz. vein. 22.96 - 23.47: Highly fractured. Longest pieces 6 cm long, but split vertically. Considerable quortz and slickensides.				SHALLE with sill fractored zone mainly SILISTAN 972. vein and o Considerable qu in the two hig including a nea at least 2 cm	tstone ba at 22.63 E with one ne 5 mm t ortz and s hly fractu vertical a thick.	nds. Vn - - 22.96 m V. thin hick. lickensides red Zonez, guartz lens
24,69					8/		33	Most fractures at 0°-15.° or 60°-80° to horiz., typ. sprg. 3-11 cm, except highly fractured at 23.77- 23.85m and 24.47- 24.54. Qtz. and slickensides in highly fractured 2009s.				SHARE and GLTSI amounts, quartz highly fractured Rtz. veins are	and slick and slick zones note 2-4mm th	phy equal ensides in nd at left. ick.

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CLIE MAC CORE BIT	HINE BARRE DESIGN	igm J	<u>a E</u> ks	nginee 300	<u>ria</u>	FT 115	1457 H 1	^t min)	CONTRACTOR COORDINATES COLLAR ELEVAT INCLINATION CASING	Bois ION / Vortic	venu 00 7. 9 9	0- 0	FINAL DEPTH 20:35 AZIMUTH - DATE DATE DATE DATE DATE DATE DATE DATE
DOWNHOLE DEPTH, m	DRILLING PROCRESS	FLUSH RETURNS, "/.	DETTU TO WATCH	CORE RUN DEFINE, M	IOTAL CORE RECOVERY. "	SOLID CORE RECOVERY, "V.	ROCK BULLI'Y DESIGN TON "'.	DISCON	TINUITIES	DOWNKOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
26.21					Ka		24	Most fractu or 60°- 80 speg. 2 - locm typ. fractures	res 0°-15° p° to horiz., 15 cm, 5- Many slickonsided.				Roughly equal amounts of SILTSTONE and SHALE. Two borizontal bands of quartz and charker shale at 25.46- 25.49 m and 25.88 - 25.97 m. Slickensides on many fracture surfaces.
27.74		No Return			ю	a	80	Most fract or 60°-7 generally except his zones at 26.75m of 27.47m. in second Zones	vres 0°-15° 70° to hariz, well-spaced ghly froctural 26.69- and 27.42- Qtz. Veins 1 of these				26.21-27.42: SHALE with siltstone ben and accasional very thin quartz ver 27.42-27.47: Highly fractured SHALE with 942. Veins up to 5mm thick. 27.47-27.74: Dorker SHALE with abundant thin, randomly-oriented quartz veins.
28.35					89	1	0	Most Fran 15° or 60° horizonital, 3-8 cm, highly fran 27.91-27.	ctures O- -90° to typ.spcg. except ctured at 95 m.	4			27.74 - 28.07 m : Dark SHALE with abor randomly oriented quartz veins up to 7 mm thick. 28.07 - 28.35 : SHALE with siltstone bands, occasional very thin quartz veins
								End of l	lag				

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llf	NT	51	gma	Emi	100	rin	9	(Westmin) CONTRACTOR	Boisu	ienu l	Drill	
AAC ORE IIT	HINE E BARRI Design F Olame	EL. TFR	JKS	300 US	, Alau F	1115	• · ·	COORDINATES COLLAR ELEVAT INCLINATION G Voter CASING	ion 4 0°	to hor	1 72.	FINAL DEPTH 27.13 AZIMUTH 160° DATE 0'3 169/67 DRAWN BY
Ĩ					S		3	DISCONTINUITIES	ė	Ι		GEDLOGICAL DESCRIPTION
DOWNOLL DEFIN, M	DRILLING PROCRESS	FLUSH RETURNS, '	CETT TO WATCH	CORE RUN DEFEN.	IOTAL CORE RECORDED	SOLID CORE RECOVERY.	DECT DULITY DESIGNATION		DOWNHOLE DEPTH #	ELEVATION, m	SYMBOLIC LOG	
0.04					100		/2	Most fractures 0° -30° to core axis normal, or 60° -90° to axis normal. Mony axidized. Typ. Sprg. 3-8cm. Highly fractured at 8.25-8.30 m and 8.74-8.79.0.				SHALE with sillstone bands and occasional thin guartz veins.
					100		13	Most fractures 0°-20° to core axis normals some 60°-90°. Typ. Spcg. 4-Bcm. Minor oxidation and slicken- sides on a fav Surfaces.	с			SHALE with siltstone bands. A few gtz. veins, up to 3mm thick. Minor slickensiding on some fracture
1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	· · · ·	- No return *			94		10	9.75-10.42; Most fractures 0°-20° or 70°-90° to core axis normal, typ. sp cg. 5-10 cm; some with minor oxidation Or slickensiding. 10.42 - 10.97: highly fractured, one piece 7cm kny, all others < 5cm. Slickensides present, also fault gouge.	•			SHALE with sittstore bands. Qtz. veins up to 2 cm thick, containing shale fragments (only two such veins). Slickensides near bottom of core run, also apparent fault gouge.
00.71	-				98		16	10-97-11.31: Most frac- tures 0°-20° or 60°-90° to core axis normal, 5-Bcm spcg., minor- Slickensides. 11.31-11.39: Randalgravel 11.39-12.56: Fracture orientation similar to above, but wider spcg., up to 17 cm. Slicken- sides more common.				SHALE with siltstone bands. GRAVEL (not all shale) at 11.31-11.39 m Thin, steeply inclined q.tz. veins in the shale below the gravel zone, becoming thicker Cup to Tmu and more numerous in last 30cm. Minor pyrite in last 10 cm.
*					98		28	12.50-13.28: Almost all fractures 10°-20° to care axis normal, 3-12 cm spacing, V. minor slickonsiding. 13.28-13.40: Highly fractured 13.40-13.72: Most fractures 0°-15° or 60°-90° to axis normal, 3-8cm spcg.				SHALE with siltstone bands, steeply- inclined (normal to Fractures) quarts veins up to 12 mm thick. Highly fractured zone at 13-28-13.40. is mostly quartz.

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PRO	IECT	Le	ing l	Lake	Ţ	am T		The second	900709	Rain		Dr.	Ilina	BUREHULE N	11.302 4
CLIE MAC CORI BIT	HINE BARRE Design		n <u>a Er</u> JKS	<u>nginea</u> 300	ring	<u> </u>	wes	COOR COOR INCLI	DINATES Ar Elevati Nation <i>G</i> C	0N /0 5° to	004.50 horizon	q Hal	FINAL DEPTH 27.19 AZIMUTH 160°	DRILLED BV DATE, 03/09/87	LOGGED BY BRD DATE <u>P2/09/87</u> DRAWN BY
	UAME	ien,		<u>45</u>		[_•		DISCONTINUTIE	is I			Π	GEDLOC	GICAL DESCRIPTION	
DOWNHOLE DEPTH. M	DRILLING PROGRESS	FLUSH RETURNS, "/.	057TH TO WATER,	CORE RUN DEFTN .	IDIAL CORE RECOVERY.	SOLID CORE RECOVERY.	ROCK GILLI'N DESIGUATION.	(All depths m along core a	eesured nxis)	DOWNHOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG			
0.91					27		ڪ	Not cored					· · · · · · · · · · · · · · · · · · ·	·	
2.13		?			77		0	0.91 - 1.11: Loose from surface 1 1.11 - 2.13: Core mainly along p. 40-50 to core normal, glso al cure axis. La Pieces 7-9cm Most steeply-in fracture curface	rocks zone broken langs z axis ong irges long clined os acimal				SHALE with this	n siltstone	bands
Ĥ					93		0	Most fractures	either			 	SHALE with th	hin siltstand	e bands
3.66	-	<u>ې</u>						2 45° to core or parallel to More closely=sy than above: 2- typically; 7.50 Many surfaces 0	axis axis. paced -6cm m max. ridized.	-				• .	
8B.;		?.			88		0	Most fractures ? or 70°-90° to axis normal, f spcg. 3-6cm to 8.5 cm. 0. and minor gtz. many surfaces	30°-50° corre lyp. lyp. lyp. xidation con				SHALE with t Thin, stepply - veins present. few Aachne s	thin sittsta inclined qu Minor qu urfaces.	ne bands, vartz nartz on o
6.40	-	?					9	Most Fractures a 70° - 90° to axis normal. spcg. 4-Bcm, "several pieces but most split core axis. Ox Minor qtz. on surfaces.	20°-40° core Typ. with 10-15m abng widetion, many				SHALE with occasional th	thin siltst	ane bands, veins.
7.92	-	No return below 7.42			100		15	6.40 - 7.42: M fractures 0° - 3 76° - 90° to ax typ. spcg. 3 - many oxidized 7.42 - 7.59: Hi fractured, hig oxidized zone ing opporent t 7.59 - 7.92: Mos 0° 30° or 70° axis normal, C 2 - 6 cm spe	lost. 0° or- is normal, -10 cm, ighly phly e contain- fault gage. + Fractures -90° to oxidized, sg-				: SHALE with Except: 6.82 - 7.06 7.42 - 7.59:	siltstone : Mostly s Fault zone	bands, ULTSTONE

Note: exact depth of water loss not known, but was 7.92 m or above.

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LIE	NT S	igma	a En	qì <i>neel</i>	ing	(we	tmin) CONTRACTOR	Boisu	onu Di	<u>. 11. 1</u>	Ingliten RV Lincen RV Rom
AAC ORE	HINE E BARRE Design	ד <i>ו</i> ב	k5	300				COORDINATES Collar Elev Inclination	ation .	1004.59 to hoi	τz.	FINAL DEPTH 27.13 AZIMUTH 160 ° DATE 03/19/87 DRAWN BY
ORE	DIAME	TER,	mm 4	<i>15</i>	ः •	LUS		Nater CASING				GEDLOGICAL DESCRIPTION
XIWENGLE DEFIX, m	JRILLING PROGRESS	-/- "FILIPHIA"	DEFTH TO WATER, m	ORE BUIL DEFIL	IOTAL CORE RECOVERS, "	SOLID CORE RECOVERY. "	ROCK QUALITY DESIGNATION,	UISCOMINAULIES	DOWNHOLE DEPTH m.	ELEVATION, m	SYMBOLIC LOG	
5.44					83		0	Core highly broken along planes in all direc- tians, but mostly nou- normal and nea parallel to core axis. Fractore spacing 1-15c but larger pieces split along core axis. Slicke. sides, minor oxidation, minor calc. carbonate	3			SHALE with siltstone bands, gtz. veins up to 5mm thick.
10		No return			98		52	1524 - 16.24 : Almosta fractures 0°-20° to core axis normal, 3-15 cm spcg. Highl fractured 13mm thick gtz. vein at 15.64 m Minor slickensides and culc. matl. on same fracture surfaces. 16.24 - 16.76 : Most fracture 40°-80° to core axis norm 3-8 cm spcg. Highly functured 16 61-16.65 m	11 f res tul			SHALE with sillstone bands, ytz. Veins (one 13mm thick, the rest < 1mm). Minor calc. carbonate on some tracturp surfaces.
18.27					3/		0	Poor recovery of highly fractured core. Most fractures near-normal or near-porallel to core axis. Minor slickensides				SHALE with siltstone bands, minor quartz, minor slickenside growth.
14.51					56		0	Highly fractured con A few pieces up to B cm long, but split along core axis. Man Atactures & 15° to core axis normal. Minor slickensides, sma amount of possible foult gouge.	e. 9			SHALE with sillstone bands, minor quartz, minor slickonside growth.
21.03					93		38	19.51-20.50 Most find 0°-20° or 70°-90° to core axis normal, 2-5 cm typ. spcg . minor slickensides. Highly fractured at 19.94 - 20.10 m. 20.50 - 21.03: Three fractures, 10° to axis normal. well-sourced	lra			SHALE with siltstone bands, minor quartz, minor slickenside growth.

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LIENT S AACHINE CORE BARRE SIT DESIGN CORE DIAMF	Dig ma JKS	Lake Engin 300	<u>eer</u> i	SH	(Westmin) CONTRACTOR COORDINATES COLLAR ELEVA INCLINATION CASING	Bois Int 60°	1004.50 to fre	Drij 9 poriz	FINAL DEPTH 27.13 AZIMUTH 160° DATE 03/09/87 DONETTOLE TO, 50.2 Sheel 4 of 4 001LLED BY LDCGED BY BRD DATE 03/09/87 DRAWN BY
COWLAGLE CEPTH, an	FLUSH RETURNS, ". Defin to water, m	CORE NUN DEPTIM, m	IDIAL CORE RECOVERS, "A.		DISCONTINUITIES	GOWARDLE DEPTH M.	litte de se	SYMBOLIC LOG	GEDLOGICAL DESCRIPTION
ar 17 4			100	9#	Only 9 Fractures, 0°-15° to core axis normal, well-spaced, minor slickansides on two of them.				SHALE with with siltstone bands, two quarter veins 5-8 mm thick.
a	Ke return			83	Nine fractures 0°-15° to core axis normal, one 60° to axis normal, typ. spog. 4-40 cm. V. minor slickonsiding on o four fracture surfaces.				SHALE with siltstone bands, minor quartz.
09.67			160	64	Most fractures 0°-20° or 70°-90° to core axis normal, generally well-spaced. Minor Slickensides.				SHALE with sillstone bands, a few quarter veins, minor pyrite.
			100	54	25.60-27.02: Most fractures 0°-20° or 70°-90° to core axis normal, typ. spcg. 3-17cm, but two pieces 27 + 37 cm long. Minor slicken- sides. 27.02 - 27.13: Highly fractured.				SHALE with siltstone bands, Minor quartz, minor pyrite. Darker and with re quartz in lost 15 cm.
					.End of hog				
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BRUCE RONALD DAGG

Resume: April 1938

ADDRESS: 2945 West 10th Ave, Vancouver, B. C., V6K 2H5 (604)-733-6848 BIRTH: 7 January 1958, Vancouver, British Columbia AGE: 30 years

HEIGHT: 5° 7.5" (172 cm)

WEIGHT: 160 lbs. (72.6 kg)

HEALTH: Excellent

MAIN AREAS OF EXPERTISE/INTEREST

Slope hazards, geotechnical engineering, groundwater and surface water hydrology.

EDUCATION

Graduation (with honours), Kitsilano Secondary School, Vancouver, B.C., 1976. Main areas of study: Science, Nathematics, Music.

B.A.Sc. (Geological Engineering), University of British Columbia, Vancouver, B.C., 1981. Main areas of study: Groundwater Hydrology; Geotechnical Engineering, including Soil and Rock Mechanics; Geomorphology; Computer Modelling; Geology; Technical Writing. <u>Bachelor's</u> <u>Thesis</u>: An Analysis of the Piezometer Cone as an Instrument for Soil Investigations. Supervisor: Dr. R. G. Campanella, Civil Engineering.

Unclassified Studies in Geomorphology, Hydrology, and Rock ... Mechanics, University of British Columbia; Sept. 1982 - April 1983.

M.Sc. (Physical Geography), University of British Columbia, 1987. Area of study: Process Geomorphology. <u>Thesis</u>: Debris Supply Mechanisms to Torrent-Prone Channels on the East Side of Howe Sound, British Columbia. Supervisory Committee: M. J. Bovis, Geography (supervisor); M. Church, Geography; S. O. Russell, Civil Engineering.

EMPLOYMENT EXPERIENCE

<u>Geotechnical and physical decoraphy contract work</u>, since May 1987. Main projects have been a geotechnical investigation for a proposed hydroelectric project near Stewart (with Sigma Engineering Ltd., under the supervision of N. A. Skermer, PEng.), and an air quality study (fog water chemistry) (with the Waste Management Branch, B.C. Min. of Environment). Other contracts with D. L. Hogan, consulting geomorphologist; Dr. J. M. Ryder, consulting geomorphologist, and Dr. D. G. Steyn, Associate Frofessor of Geography, University of B. C.

University of British Columbia, Department of Geography, Sept. 1983 - July 1987. Teaching Assistant in physical geography, Graduate Research Assistant both during thesis work and following completion. Research work included field reconnaissance, surveying, geological mapping, materials sampling, and testing to determine morpholigical, geotechnical, and hydrological properties of hillslope materials and creek channel debris, as these relate to debris torrent activity in the Howe Sound area, southwest British Columbia.

<u>Geological Survey of Canada, Terrain Sciences Division</u>, summer 1983. Field assistant for detailed investigations of several landslides and slope hazards in southern B.C.

Robinson Dames and Moore, Vancouver, B.C. and Calgary, Alberta, June 1981 to July 1982. Junior Engineer, involved primarily in hydrogeology and rock mechanics studies (field work included drill core logging, pump testing, etc.) for proposed coal mines for Fording Coal (Lethbridge, Alberta) and Crows Neut Epsources (Robb, Alberta). Also involved in a study of using mine tailings to reclaim river flood plains in northern Idaho (for the U. S. Bureau of Mines), and several foundation investigations in the Vancouver and Calgary areas.

<u>Crippen Consultants</u>, North Vancouver, B.C., summers of 1979 and 1980. Employed as a summer student at the site of the Aluminum Company of Canada's proposed Kemano Completion power project, Kemano, B.C. Work included diamond drill supervision and core logging, pump testing, surveying, and surface and subsurface geological mapping.

PUBLICATIONS

Bovis, M. J., Dagg, B. and Kaye, D., 1785. Debris flows and debris torrents in the Southern Canadian Cordillera: Discussion. Canadian Geotechnical Journal, 22, p. 608.

Bovis, M. J. and Dagg, B. R., 1987. Mechanisms of debris supply to steep channels along Howe Sound, southwest British Columbia. <u>In</u>: Erosion and Sedimentation in the Pacific Rim: Proceedings of the Corvallis Symposium (I.A.H.S. Publ. No. 165), pp. 191-200.

Bovis, M. J. and Dagg, B. R., 1987. A model for debris accumulation and debris torrent initiation in steep channels. <u>Presented at</u>: I.A.H.S. Debris Torrent Workshop, XIX General Assembly of the I.U.G.G., Vancouver, B. C., August 1987. In press.

PARTICIPATION IN ORGANIZATIONS

<u>Geography Graduate Students, UBC</u>: Involved with 1987 Open House, Vancouver area field trip for new students, organizer of coffee service for Faculty, Staff, and Graduate Students.

<u>Geological Engineering Club, UBC</u>: Member of club executive in third and fourth years, organizer of coffee service.

<u>Kitsilano Secondary School</u>: Student council president in Grade 12, council member in Grade 11.

Scouts Canada: Member since 1967. Most recent major project was chairing the Administration Committee of the 10th Canadian Rover Moot, an international event held in Langley in August 1986. Was West Coast Correspondent for Rovering, a national magazine, for 8 years.

Organized Sports: Played rugby and football in high school, hockey and soccer at U.B.C.

INTERESTS

Hiking, camping, downhill and cross-country skiiing, cycling, tennis, most other sports, reading.

REGISTRATION

Engineer-in-training in British Columbia. Member of the Canadian Geotechnical Society. Member of the Canadian Association of Geographers.

REFERENCES

N. A. Skermer, P.Eng., Steffen Robertson and Kirsten, 801-1000 West Georgia Street, Vancouver, B.C., V6E 2Y3. 681-4196.

Dr. M. J. Bovis, Department of Geography, University of British Columbia, #217 1984 West Mall, Vancouver, B.C., V6T 1W5. 228-3511. Dr. S. G. Evans, Geological Survey of Canada, Terrain Sciences

Division, 601 Booth St., Ottawa, Ontario, KIA OE8.

APPENDIX D : 1987 ASSAY RESULTS

LAURA CLAIM : HOLES B87CH50 TO B87CH52 GOLDEN CROWN CLAIM : HOLES B87CH54 TO B87CH55 PASS FR. CLAIM : NO ASSAY DONE ON HOLES

DATE : 12-10-87 TIME : 10:27:50

BIG MISSOURI -- LAURA CLAIM

TRAVERSE/HOLE NUMBER -----> B87CH50

N.B. Negative number indicates an assay less than the detection limit n.a. indicates no assay entered for data

ASSAY FIELDS

P ---> Primary value
S ---> Sub-prime value
1 ---> Rerun of original pulp
2 ---> Resplit of sample
A ---> Field average value

FROM	TO	SAMPLE	AU	AG	CU	89	ZN	AUE	AUR	5.6	SAMPLE	ROCK
(M)	(M)	NO.	OZ/T	OZ/T	PPM	PPM	PPM	0 7/ 1		MEASUR	TYPE	TYPE
2.44	5.18	8929 P	0.001	0.10	100.0	100.0	200.0	0.002	0.010	0.000	HF-CORE	AXLT
5.18	7.01	8930 P	0.001	0,10	-1.0	100.0	300.0	0.002	0.010	0.000	HF-CDRE	AXLI
7.01	8.53	8931 P	0.001	0.10	100.0	100.0	300.0	0.002	0.010	0.000	HF-CORE	AXLT
8.53	10.06	8932 P	0.001	0.11	-1.0	100.0	100.0	0.002	0.009	0.000	HF-CORE	CTUF
10.06	11,58	8933 P	0.001	0.17	100.0	100.0	100.0	0.003	0.006	0.000	HF-CORE	CTUF
23.16	24.69	8934 P	0.001	0.17	-1.0	100.0	100.0	0.003	0.006	0.000	HF-CORE	CTUF
24.69	26.21	8935 P	0.004	0.08	-1.0	200.0	400.0	0.005	0.050	0.000	HF-CORE	AXXX
26.21	27.74	8936 P	0.016	0.07	-1.0	300.0	400.0	0.017	0.229	0.000	HF-CORE	AXXX
36.88	38.40	8937 P	0.004	0.07	-1.0	200.0	500.0	0.005	0.057	0.000	HF-CORE	AXXX

DATE : 12-10-87 TIME : 10:27:59

BIG MISSOURI -- LAURA CLAIM

TRAVERSE/HOLE NUMBER ----> B87CH51

N.B. Negative number indicates an assay less than the detection limit n.a. indicates no assay entered for data

ASSAY FIELDS

P ---> Primary value
S ---> Sub-prime value
1 ---> Rerun of original pulp
2 ---> Resplit of sample
A ---> Field average value

FROM	TO	SAMPLE	AU	AG	CU	PB	ZN	AUE	AUR	S.G	SAMPLE	ROCK
(M)	(M)	NO.	OZ/T	02/T	PPM	PPM	PPM	OZ/T		MEASUR	TYPE	TYPE
2.74	5,49	8938 P	0.001	0.09	-1.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT
10.06	11.58	8939 P	0.002	0.07	-1.0	100.0	200.0	0.003	0.029	0.000	HF-CORE	AXLT
11.58	13.11	8940 P	0.002	0.12	-1.0	100.0	100.0	0.003	0.017	0.000	HF-CORE	CTUF
13.11	14.39	8941 P	0.003	0.11	-1.0	100.0	100.0	0.004	0.027	0.000	HF-CORE	CTUF
14.39	15.85	8942 P	0.002	0.08	-1.0	100.0	100.0	0.003	0.025	0.000	HF-CORE	AXXX
15.85	17.07	8943 P	0.001	0.03	-1.0	100.0	100.0	0.001	0.033	0.000	HF-CORE	AXXX
26.52	28.04	8944 P	0.001	0.07	-1.0	100.0	100.0	0.002	0.014	0.000	HF-CORE	AXXX
28.04	29.57	8945 P	0.004	0.11	-1.0	100.0	100.0	0.005	0.036	0.000	HF-CORE	AXXX
34.81	36.21	8946 P	0.001	0.10	-1.0	100.0	400.0	0.002	0.010	0.000	HF-CORE	AXXX
36.21	37.43	8947 P	0.004	0.09	-1.0	100.0	400.0	0.005	0.044	0.000	HF-CORE	CTUF
37.43	39.01	8948 P	0.001	0.07	-1.0	100.0	200.0	0.002	0.014	0.000	HF-CORE	CTUF
45.11	46.51	8949 P	0.008	0.07	-1.0	100.0	100.0	0.009	0.114	0.000	HF-CORE	AXXX

DATE : 12-10-87 TIME : 10:28:07

	TRAV	ERSE/I	HOLE	NUMBER		. 1141.1441.1441.1441.44		> B8	37CH5	1		PAGE	2	2
FROM	TO	SAMPLE	AU	AG	CU	PB	ZN	AUE	AUR	5.6	SAMPLE	ROCK		
(11)	(M)	NO.	0Z/T	0Z/T	PPM	PPN	PPM	02/T		MEASUR	τγρε	TYPE		
46.51	47.85	8950 P	0.004	0.06	-1.0	100.0	300.0	0.005	0.067	0.000	HF-CORE	AXXX		

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DATE : 12-10-87 TIME : 10:28:17

BIG MISSOURI -- LAURA CLAIM

TRAVERSE/HOLE NUMBER -----> B87CH52

N.B. Negative number indicates an assay less than the detection limit n.a. indicates no assay entered for data

ASSAY FIELDS

- P ---> Primary value
- S ----> Sub-prime value
- 1 ---> Rerun of original pulp
- 2 ----> Resplit of sample
- A ---> Field average value

FROM	TO	SAMPLE	AU	AG	CU	P8	ZN	AUE	AUR	S.G	SAMPLE	ROCK
(M)	(M)	NO.	OZ/T	OZ/T	PPM	PPM	PPM	OZ/T		MEASUR	TYPE	TYPE
5.49	7.01	8951 P	0.003	0.10	-1.0	200.0	400.0	0.004	0.030	0.000	HF-CORE	AXXX
7.01	8.53	8952 P	0.001	0.11	-1.0	200.0	400.0	0.002	0.009	0.000	HF-CORE	AXXX
8.53	10.06	8953 P	0.004	0.09	-1.0	100.0	200.0	0.005	0.044	0.000	HF-CORE	CTUF
10.06	11.58	8954 P	0.003	0.12	-1.0	100.0	100.0	0.004	0.025	0.000	HF-CORE	AALT
11.58	13.11	8955 P	0.001	0.18	-1.0	200.0	400.0	0.003	0.006	0.000	HF-CORE	AALT
13.11	14.63	8956 P	0.001	0.11	-1.0	200.0	400.0	0.002	0.009	0.000	HF-CORE	AALT
14.63	16.15	8957 P	0.001	0.09	-1.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AALT
16.15	17.68	8958 P	0.001	0.09	-1.0	200.0	100.0	0.002	0.011	0.000	HF-CORE	AALT
25.30	26.82	8959 P	0.003	0.24	-1.0	200.0	300.0	0.005	0.013	0.000	HF-CORE	AALT
26.82	28.35	8960 P	0.001	0.42	-1.0	500.0	800.0	0.005	0.002	0.000	HF-CORE	AALT
28.35	29.87	8961 P	0.001	0.10	-1.0	200.0	600.0	0.002	0.010	0.000	HF-CORE	AALT
29.87	31.39	8962 P	0.003	0.12	-1.0	200.0	400.0	0.004	0.025	0.000	HF-CORE	AALT

DATE : 12-10-87 TIME : 10:28:45

	TRAV	ERSE/	HOLE 1	NUMBER				> B	87CH5:	2		PAGE	а 4	2
FROM	TO	SAMPLE	AU	AG	CU	PB	ZN	AUE	AUR	S.6	SAMPLE	ROCK		
(M)	(M)	NO.	OZ/T	OZ/T	PPN	PPM	PPM	02/T		MEASUR	TYPE	TYPE		
33.22	34.84	8963 P	0.038	0.15	-1.0	800.0	1200.0	0.040	0.253	0.000	HF-CORE	AALT		
34.84	35.97	8964 P	0.028	0.12	-1.0	1000.0	2000.0	0.029	0.233	0.000	HF-CORE	CTUF		
35.97	37.43	8965 P	0.034	0.11	-1.0	1000.0	1700.0	0.035	0.309	0.000	HF-CORE	CTUF		
37.43	38.95	8966 P	0.011	0.08	-1.0	400.0	600.0	0.012	0.138	0.000	HF-CORE	AXLT		
38.95	40.23	8967 P	0.002	0.11	-1.0	300.0	500.0	0.003	0.018	0.000	HF-CORE	AXLT		
40.23	41.76	8968 P	0.003	0,10	-1.0	300.0	500.0	0.004	0.030	0.000	HF-CORE	AXLT		

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DATE : 12-10-87 TIME : 10:52:38

BIG MISSOURI -- GOLDEN CROWN CLAIM

TRAVERSE/HOLE NUMBER -----> B87CH54

N.B. Negative number indicates an assay less than the detection limit n.a. indicates no assay entered for data

ASSAY FIELDS

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P	>	Primary value
S	>	Sub-prime value
1	>	Rerun of original pulp
2	>	Resplit of sample
A	>	Field average value

FROM	TO	SAMPLE	AU	AG	CU	P8	ZN	AUE	AUR	5.6	SAMPLE	ROCK
(M)	(M)	NO.	OZ/T	02/T	PPM	PPM	PPM	QZ/T		MEASUR	TYPE	TYPE
23.77	25.30	7078 P	0.003	0.09	100.0	200.0	700.0	0.004	0.033	0.000	HF-CORE	AXLT
25.30	26.82	70 7 9 P	0.004	0.09	100.0	200.0	500.0	0.005	0.044	0.000	HF-CORE	AXLT
26.82	28.35	7080 P	0.004	0.08	100.0	100.0	200.0	0.005	0.050	0.000	HF-CORE	AXLT
28.35	29.87	7081 P	0.002	0.10	100.0	100.0	100.0	0.003	0.020	0.000	HF-CORE	AXLT
29.87	31.39	7082 P	0.001	0.09	100.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT
31.39	32.92	7083 P	0.001	0.10	100.0	100.0	200.0	0.002	0.010	0.000	HF-CORE	AXLT
32.92	34.44	7084 P	0.001	0.14	100.0	100.0	100.0	0.002	0.007	0.000	HF-CORE	AXLT
34.44	35.84	70 85 P	0.001	0.09	100.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT
35.84	37.49	7086 P	0.008	0.10	100.0	100.0	800.0	0.009	0.080	0.000	HF-CORE	CTUF
37.49	39.01	7087 P	0.001	0.09	100.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT

DATE : 12-10-87 TIME : 10:52:47

BIG MISSOURI -- GOLDEN CROWN CLAIM

TRAVERSE/HOLE NUMBER -----> B87CH55

N.B. Negative number indicates an assay less than the detection limit n.a. indicates no assay entered for data

ASSAY FIELDS

- P ---> Primary value
 S ---> Sub-prime value
 1 ---> Rerun of original pulp
- 2 ---> Resplit of sample
- A ---> Field average value

FROM	TO	SAMPLE	AU	AG	CU	P8	ZN	AUE	AUR	S.G	SAMPLE	ROCK
(M)	(M)	NO.	0Z/T	OZ/T	PPM	PPM	PPM	OZ/T		MEASUR	TYPE	TYPE
28.65	30.02	7088 P	0.003	0.07	100.0	100.0	200.0	0.004	0.043	0.000	HF-CORE	AXLT
30.02	31.39	7089 P	0.001	0.09	100.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT
31.39	32.92	7090 P	0.001	0.09	100.0	100.0	200.0	0.002	0.011	0.000	HF-CORE	AXLT
32.92	36.00	7091 P	0.002	0.06	100.0	100.0	300.0	0.003	0.033	0.000	HF-CORE	AXLT
36.00	37.52	7092 P	0.001	0.06	100.0	400.0	800.0	0.002	0.017	0.000	HF-CORE	CTUF
37.52	39.08	7093 P	0.003	0.09	100.0	200.0	400.0	0.004	0.033	0.000	HF-CORE	AXLT