60001859

Mining District File Summary Sheet

DISTRICT	Rosebud
DIST_NO	4010
COUNTY If different from written on document	Pershing
TITLE If not obvious	Rosebud Resource Estimate 1995 - Reserve Compilation - Scope of Work
AUTHOR	Muerhoff C; Helmes, B; Ristorcelli, S; Allen L; Bethard C; Clayton R; Stahlbush F; Gray D; Parent R
DATE OF DOC(S)	1994 - 1995
MULTI_DIST Y / (N?) Additional Dist_Nos:	
QUAD_NAME	Sulphur 7½'
P_M_C_NAME (mine, claim & company names)	Rosebud Mine; Hecla Mining Co; Rosebud Project Mintec, Inc; Mine Development Associates; Hecla Mine
COMMODITY If not obvious	gold; silver
NOTES	Statistics; correspondence; handwritten notes; geochemistry 97p

Keep docs at about 250 pages if no oversized maps attached (for every 1 oversized page (>11x17) with text reduce the amount of pages by ~25)

	Initials	Date
SS:	DP	8/1/08
DB:		
SCANNED:		

Revised: 1/22/08

RESERVE COMPILATION - SCOPE OF WORK
(MEDS)

60001859 4010

6000 1859 4010

Hecla MINING COMPANY Centennial 1891 - 1991

Technical Services

Fax: (208) 769-4122

Date: 11/18/94

To: Charlie Muerhoff

From: Brett

Hecla Mining Company

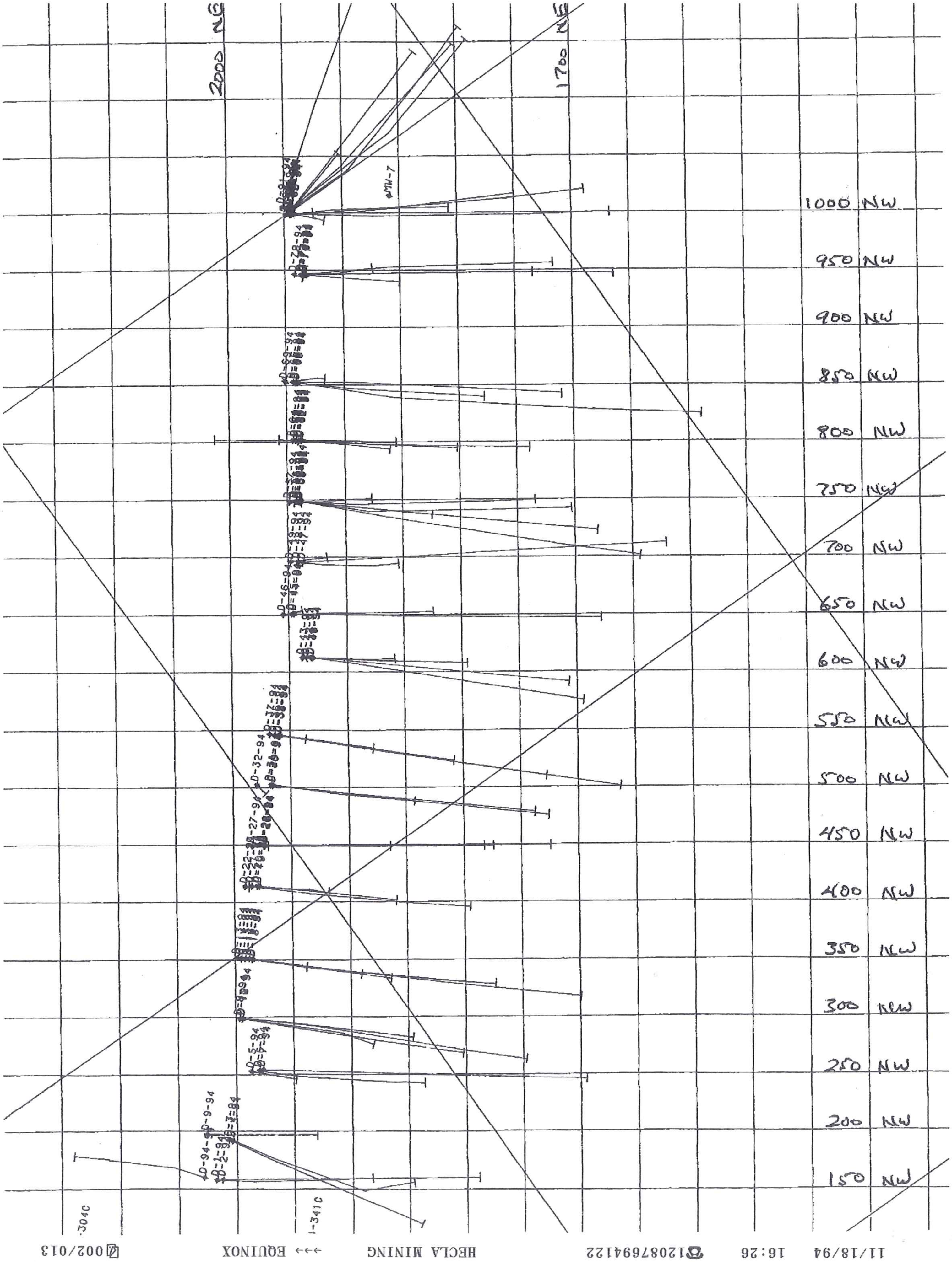
Transmitting: 13 Pages
(Including Cover)

Operator:

Charlie - I'm suggesting cutoffs for plotting of .001, .01, .03, .1, .50 & 2.0 opt. The same set of info. has gone to S. Ristorcelli.

From Brett:
Samples above are footage

6500 Mineral Drive • Box C-8000 • Coeur d'Alene, Idaho 83814-1931 • 208/769-4100 • FAX 208/769-4107


2000 NE
1700 NE
1000 NW
950 NW
900 NW
850 NW
800 NW
750 NW
700 NW
650 NW
600 NW
550 NW
500 NW
450 NW
400 NW
350 NW
300 NW
250 NW
200 NW
150 NW
304C
1-341C

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT ** 11-18-94 13:11:47

CUTOFF GOLD	SAMPLES ABOVE	PERCENT ABOVE	MEAN ABOVE	C.V.
.000	121333.0	100.0	.035	7.979
.005	54894.5	45.2	.074	5.516
.010	32631.0	26.9	.120	4.369
.015	24058.8	19.8	.158	3.821
.020	19601.8	16.2	.190	3.497
.025	16462.7	13.6	.222	3.245
.030	14404.2	11.9	.250	3.065
.035	12787.6	10.5	.278	2.915
.040	11575.5	9.5	.303	2.796
.045	10564.0	8.7	.328	2.691
.050	9653.9	8.0	.355	2.593
.055	9058.6	7.5	.374	2.525
.060	8451.6	7.0	.397	2.454
.065	8006.6	6.6	.416	2.401
.070	7540.9	6.2	.437	2.343
.075	7169.0	5.9	.456	2.296
.080	6855.6	5.7	.474	2.255
.085	6616.9	5.5	.488	2.223
.090	6355.5	5.2	.504	2.188
.095	6107.1	5.0	.521	2.154
.100	5873.2	4.8	.538	2.122
.105	5613.6	4.6	.558	2.085
.110	5367.1	4.4	.579	2.049
.115	5175.5	4.3	.596	2.020
.120	5027.1	4.1	.610	1.997
.125	4806.7	4.0	.633	1.963
.130	4662.9	3.8	.648	1.940
.135	4524.9	3.7	.664	1.918
.140	4365.1	3.6	.683	1.892
.145	4234.7	3.5	.700	1.870
.150	4104.7	3.4	.717	1.848
.155	4013.6	3.3	.730	1.832
.160	3900.6	3.2	.747	1.812
.165	3787.1	3.1	.764	1.792
.170	3729.0	3.1	.774	1.781
.175	3653.4	3.0	.786	1.768
.180	3547.8	2.9	.804	1.748
.185	3490.8	2.9	.814	1.738
.190	3421.3	2.8	.827	1.725
.195	3371.6	2.8	.837	1.716
.200	3295.2	2.7	.851	1.701
.205	3211.7	2.6	.868	1.685
.210	3170.3	2.6	.877	1.677
.215	3116.3	2.6	.888	1.667
.220	3045.7	2.5	.904	1.653
.225	2988.2	2.5	.917	1.642
.230	2932.7	2.4	.930	1.631
.235	2899.2	2.4	.938	1.624
.240	2840.6	2.3	.953	1.612
.245	2785.1	2.3	.967	1.601
.250	2727.3	2.2	.982	1.589

MIN. DATA VALUE = .0010
MAX. DATA VALUE = 15.0710

C.V. = Coef. of variation = Standard deviation / mean
24319 Intervals used out of 47076

```
**  GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT  **  11-18-94  13:11:47
    HISTOGRAM AND FREQUENCY DISTRIBUTION OF ROSEBUD AU ASSAY STATS - ALL DATA
           AVE. DATA VALUE =           .035
           C.V. (STD/MEAN) =          7.979
           MIN. DATA VALUE =           .001
           MAX. DATA VALUE =         15.071

   #      CUM.          UPPER
 FREQ.    FREQ          LIMIT  0        20        40        60        80       100
 -----   -----          -----  +.........+.........+.........+.........+.........+
 66439    .548           .005  +***************************.                       +
 22263    .731           .010  +**********                         .               +
  8572    .802           .015  +****                                   .           +
  4457    .838           .020  +**                                       .         +
  3139    .864           .025  +*                                         .        +
  2059    .881           .030  +*                                          .       +
  1616    .895           .035  +*                                           .      +
  1213    .905           .040  +                                            .      +
  1011    .913           .045  +                                            .      +
   910    .920           .050  +                                            .      +
   595    .925           .055  +                                            .      +
   607    .930           .060  +                                            .      +
   445    .934           .065  +                                            .      +
   466    .938           .070  +                                            .      +
   372    .941           .075  +                                            .      +
   313    .943           .080  +                                            .      +
   239    .945           .085  +                                            .      +
   262    .948           .090  +                                            .      +
   248    .950           .095  +                                            .      +
   234    .952           .100  +                                            .      +
   259    .954           .105  +                                            .      +
   247    .956           .110  +                                            .      +
   192    .957           .115  +                                            .      +
   148    .959           .120  +                                            .      +
   220    .960           .125  +                                            .      +
   144    .962           .130  +                                            .      +
   138    .963           .135  +                                            .      +
   160    .964           .140  +                                            .      +
   130    .965           .145  +                                            .      +
   130    .966           .150  +                                            .      +
    91    .967           .155  +                                            .      +
   113    .968           .160  +                                            .      +
   114    .969           .165  +                                            .      +
    58    .969           .170  +                                            .      +
    76    .970           .175  +                                            .      +
   105    .971           .180  +                                            .      +
    57    .971           .185  +                                            .      +
    70    .972           .190  +                                            .      +
    49    .972           .195  +                                            .      +
    77    .973           .200  +                                            .      +
    83    .974           .205  +                                            .      +
    42    .974           .210  +                                            .      +
    54    .974           .215  +                                            .      +
    70    .975           .220  +                                            .      +
    58    .975           .225  +                                            .      +
    55    .976           .230  +                                            .      +
    34    .976           .235  +                                            .      +
    58    .977           .240  +                                            .      +
    56    .977           .245  +                                            .      +
    58    .978           .250  +                                            .      +
  2727   1.000           .255  +*                                            .     +
 ------  -----          -----  +.........+.........+.........+.........+.........+
121333   1.000                 0        20        40        60        80       100
```

```
*** ---------------------------------------------*-------------------------------------*
***                                              *  Project RUN#    576.              *
*** MEDS-401V1 - Revised on 22-MAR-93            *  Date started   11-18-94           *
***                Version # 10.4 -    3         *  Time started   13:11:47           *
***                                              *  Project Acct   N/A                *
*** ---------------------------------------------*-------------------------------------*


*** Current LOGIN Session:   SRU =       0   TTY =  0HR  0MIN

------------------------------------------------------------------------------------------

         MEDSYSTEM Proprietary Software from MINTEC Inc.
            MEDSYSTEM is a Trademark of MINTEC Inc.
               Copyright 1974-1991 MINTEC Inc
                 Release #10.4,   20-JAN-83

------------------------------------------------------------------------------------------

         DATA FILE ROSE10.DAT *    NO.   SIZE  UNTS  /UNT
         -------------------- *    ---   ----  ----  ----
         Project Control File *     10    510    51    10

------------------------------------------------------------------------------------------

*** Run File = RUN401.A     Print File = RPT401.NAU

Run line# 1--MEDS-401V1  10=ROSE10.DAT 11=ROSE11.DAT  3=RPT401.NAU;
Run line# 2--MEDS-401V1  12=ROSE12.DAT 30=DAT401.NAU

Run line# 3--**  GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT  **

Run line# 4--DOC    ROSEBUD AU ASSAY STATS - ALL DATA
Run line# 5--
Run line# 6--USR = BJH  /  11-18-94  13:10:42
Run line# 7--
Run line# 8--COM --------------------------------------------------
Run line# 9--COM    CLASSICAL STATISTICS ON ASSAY DATA
Run line#10--COM --------------------------------------------------
Run line#11--
Run line#12--IOP1 = 1 0 / FIRST AND LAST RECORD #'S FROM ASSAYS TO USE
Run line#13--IOP3 = 0 / -1=ALL DHS;0=PROJ COORD LIMITS; 1=BOUNDARY
Run line#14--IOP5 = 0 / 0=OMIT DELETED ASSAYS;  1=USE DELETED ASSAYS
Run line#15--IOP6 = 0 / 0=NO TRANSFORM;  1=LOG TRANSFORMATION
Run line#16--IOP7 = 0 / 0=NO PLOT; 1=PLOT FREQ DISTRIBUTION-M122 PLOT FILE
Run line#17--IOP8 = 51 / NUMBER OF CLASS INTERVALS (DEFAULT=20; MAX=100)
Run line#18--IOP9 = 0 / 1=PRINT STATS BY DRILLHOLE; 0=OMIT STATS BY DRILLHOLE
Run line#19--IOP12= 0 / 1=DON'T ACCUMULATE FREQ INTS
Run line#20--IOP13= 0 / 1=DON'T REPORT 1ST ITEM
Run line#21--
Run line#22--
Run line#23--PAR7 = 0. / VALUE OF THE FIRST FREQUENCY INTERVAL
Run line#24--PAR8 = .005 / CLASS INTERVAL FOR GOLD (BASE ITEM)
```

ROSEBUD PROJECT -- PERSHING CO., NV

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

```
  ROSEBUD AU ASSAY STATS - ALL DATA
Run line#25--PAR9 = .001 / MINIMUM VALUE OF GOLD ALLOWED
Run line#26--PAR10= 1. / MULTIPLIER FOR FIRST WEIGHT
Run line#27--
Run line#28--ITM01= GRADE  GOLD  / CONTROLLING ASSAY (BASE ASSAY)
Run line#29--ITM02= FACTR  -AI-  / 1ST WEIGHT ITEM
Run line#30--
Run line#31--END
```

DATA FILE ROSE11.DAT *	NO.	SIZE	UNTS	/UNT	
DRILL HOLE DATA FILE *	11	638	106	6	DIRECT: .

DATA FILE ROSE12.DAT *	NO.	SIZE	UNTS	/UNT	
COLLAR & SURVEY FILE *	12	638	49	13	DIRECT: .

Data file DAT401.NAU *	unit	size	from	program
SUMMARY TABLE file *	30			

PCF X,Y coordinate limits were used.

Elevation range of data accepted= 6500.0 3500.0

OMIT GOLD below minimum value = .001
ASSAYS = 1 GOLD

Column headed WEIGHT # is the sum of dh weights.
Column headed WTD. AVG is the weighted average.
Column headed STD. DEV is the standard deviation.

Base assay is GOLD

Weighting item -AI- X constant 1.000

ROSEBUD PROJECT – PERSHING CO., NV

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AU ASSAY STATS – ALL DATA

Statistical analysis of ROSE11.DAT assays based on GOLD
Minimum value= .0010 Elevations= 6500.0 3500.0

GOLD CUTOFF *	WEIGHT #	% INTERVALS ABOVE CUTOFF *	WTD. AVG *	STD. DEV *	
.000	121333.0	100.0000	.035	.276	GOLD
.005	54894.5	45.2428	.074	.407	GOLD
.010	32631.0	26.8938	.120	.523	GOLD
.015	24058.8	19.8287	.158	.604	GOLD
.020	19601.8	16.1554	.190	.665	GOLD
.025	16462.7	13.5682	.222	.721	GOLD
.030	14404.2	11.8716	.250	.767	GOLD
.035	12787.6	10.5393	.278	.810	GOLD
.040	11575.5	9.5403	.303	.847	GOLD
.045	10564.0	8.7066	.328	.883	GOLD
.050	9653.9	7.9565	.355	.919	GOLD
.055	9058.6	7.4659	.374	.946	GOLD
.060	8451.6	6.9656	.397	.975	GOLD
.065	8006.6	6.5989	.416	.998	GOLD
.070	7540.9	6.2150	.437	1.025	GOLD
.075	7169.0	5.9085	.456	1.048	GOLD
.080	6855.6	5.6502	.474	1.068	GOLD
.085	6616.9	5.4535	.488	1.085	GOLD
.090	6355.5	5.2381	.504	1.104	GOLD
.095	6107.1	5.0333	.521	1.123	GOLD
.100	5873.2	4.8406	.538	1.141	GOLD

ROSEBUD PROJECT – PERSHING CO., NV

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AU ASSAY STATS – ALL DATA

Statistical analysis of ROSE11.DAT assays based on GOLD
Minimum value= .0010 Elevations= 6500.0 3500.0

GOLD CUTOFF *	WEIGHT #	% INTERVALS *	WTD. AVG *	STD. DEV *	
.105	5613.6	4.6266	.558	1.164	GOLD
.110	5367.1	4.4234	.579	1.186	GOLD
.115	5175.5	4.2655	.596	1.204	GOLD
.120	5027.1	4.1432	.610	1.219	GOLD
.125	4806.7	3.9616	.633	1.242	GOLD
.130	4662.9	3.8431	.648	1.258	GOLD
.135	4524.9	3.7293	.664	1.274	GOLD
.140	4365.1	3.5976	.683	1.293	GOLD
.145	4234.7	3.4901	.700	1.309	GOLD
.150	4104.7	3.3830	.717	1.326	GOLD
.155	4013.6	3.3079	.730	1.338	GOLD
.160	3900.6	3.2148	.747	1.353	GOLD
.165	3787.1	3.1212	.764	1.370	GOLD
.170	3729.0	3.0734	.774	1.378	GOLD
.175	3653.4	3.0111	.786	1.390	GOLD
.180	3547.8	2.9240	.804	1.406	GOLD
.185	3490.8	2.8770	.814	1.415	GOLD
.190	3421.3	2.8198	.827	1.427	GOLD
.195	3371.6	2.7788	.837	1.435	GOLD
.200	3295.2	2.7158	.851	1.448	GOLD
.205	3211.7	2.6470	.868	1.463	GOLD

RUN# 576. PAGE 5 METL 401V1 DATE 11-18-94 TIME 13:11:47

ROSEBUD PROJECT - PERSHING CO., NV

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

```
RUN#  576.    PAGE    6    METL 401V1    DATE 11-18-94    TIME  13:11:47
---------------------------------------------------------------------------
ROSEBUD PROJECT - PERSHING CO., NV
**  GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT  **
   ROSEBUD AU ASSAY STATS - ALL DATA
      Statistical analysis of drillhole assays based on GOLD
      Minimum value=      .0010   Elevations=  6500.0  3500.0

   RANGE             *         20        40        60        80       100
---------  --------- *---------+---------+---------+---------+---------+
  .0000     .0049 *XXXXXXXXXXXXXXXXXXXXXXXXXX.                       *
  .0050     .0099 *XXXXXXXXX                           .             *
  .0100     .0149 *XXXX                                   .          *
  .0150     .0199 *XX                                       .        *
  .0200     .0249 *X                                         .       *
  .0250     .0299 *X                                          .      *
  .0300     .0349 *X                                           .     *
  .0350     .0399 *                                            .     *
  .0400     .0449 *                                             .    *
  .0450     .0499 *                                             .    *
  .0500     .0549 *                                             .    *
  .0550     .0599 *                                              .   *
  .0600     .0649 *                                              .   *
  .0650     .0699 *                                              .   *
  .0700     .0749 *                                              .   *
  .0750     .0799 *                                              .   *
  .0800     .0849 *                                              .   *
  .0850     .0899 *                                              .   *
  .0900     .0949 *                                              .   *
  .0950     .0999 *                                               .  *
  .1000     .1049 *                                               .  *
  .1050     .1099 *                                               .  *
  .1100     .1149 *                                               .  *
  .1150     .1199 *                                               .  *
  .1200     .1249 *                                               .  *
  .1250     .1299 *                                               .  *
  .1300     .1349 *                                               .  *
  .1350     .1399 *                                               .  *
  .1400     .1449 *                                               .  *
  .1450     .1499 *                                               .  *
  .1500     .1549 *                                               .  *
  .1550     .1599 *                                               .  *
  .1600     .1649 *                                               .  *
  .1650     .1699 *                                               .  *
  .1700     .1749 *                                               .  *
  .1750     .1799 *                                                . *
  .1800     .1849 *                                                . *
  .1850     .1899 *                                                . *
  .1900     .1949 *                                                . *
  .1950     .1999 *                                                . *
  .2000     .2049 *                                                . *
  .2050     .2099 *                                                . *
  .2100     .2149 *                                                . *
  .2150     .2199 *                                                . *
  .2200     .2249 *                                                . *
  .2250     .2299 *                                                . *
  .2300     .2349 *                                                . *
  .2350     .2399 *                                                . *
  .2400     .2449 *                                                . *
  .2450     .2499 *                                                . *
  .2500     .2549 *X                                                .*
                   ----------+---------+---------+---------+---------+
                            20        40        60        80       100
```

ROSEBUD PROJECT - PERSHING CO., NV

** GOLD ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AU ASSAY STATS - ALL DATA
Summary of assay intervals excluded

Number of assays BELOW MIN = 13809

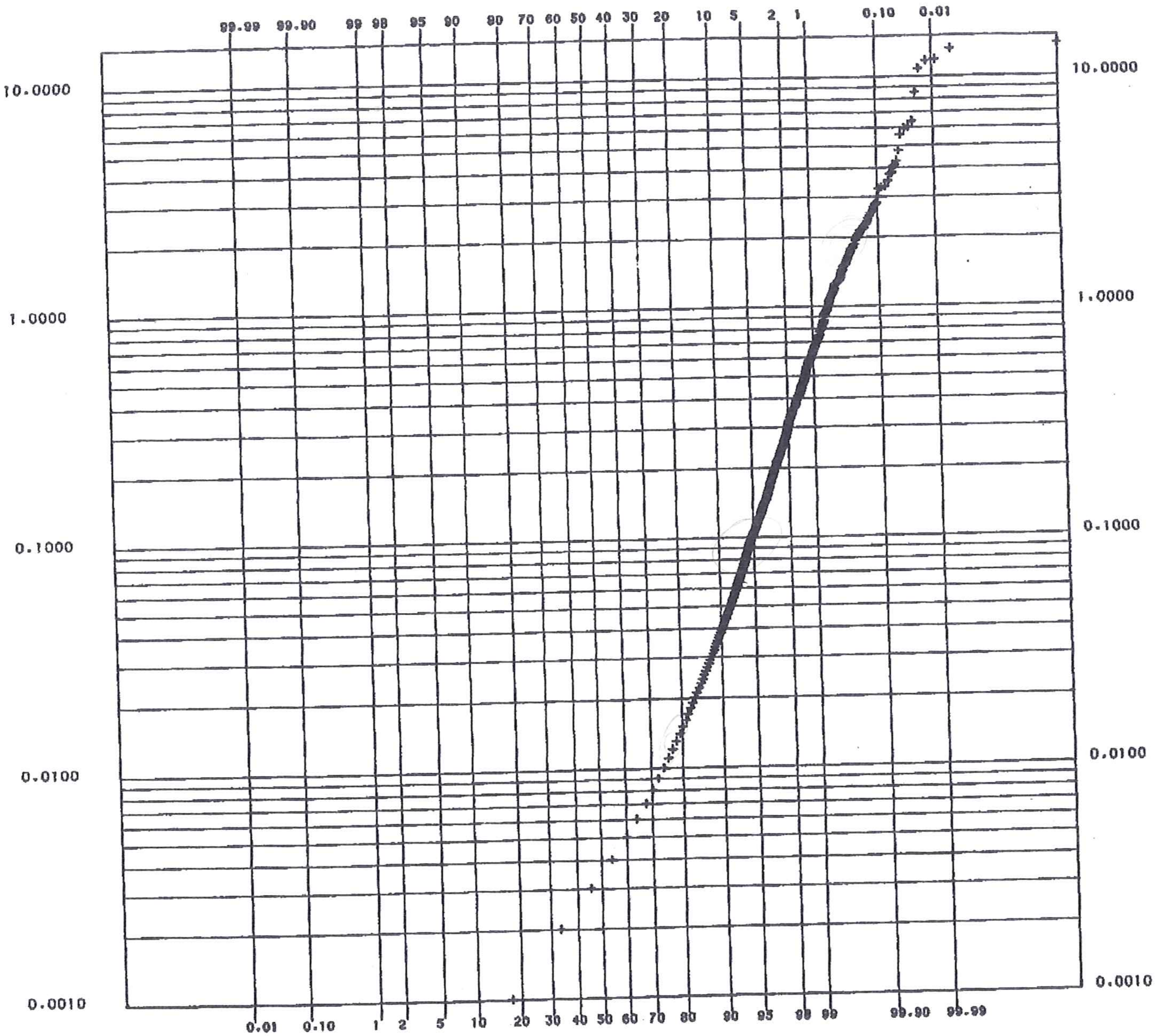
Number of ints OUTSIDE ELEVS= 681

Number of ints OUTSIDE AREA= 8267

24319 Intervals used out of 47076

		NO.	#IN	#OUT	FUNC
DATA FILE ROSE10.DAT--	--	10	5	1	0
DATA FILE ROSE11.DAT--	--	11	445	0	0
DATA FILE ROSE12.DAT--	--	12	38	0	0

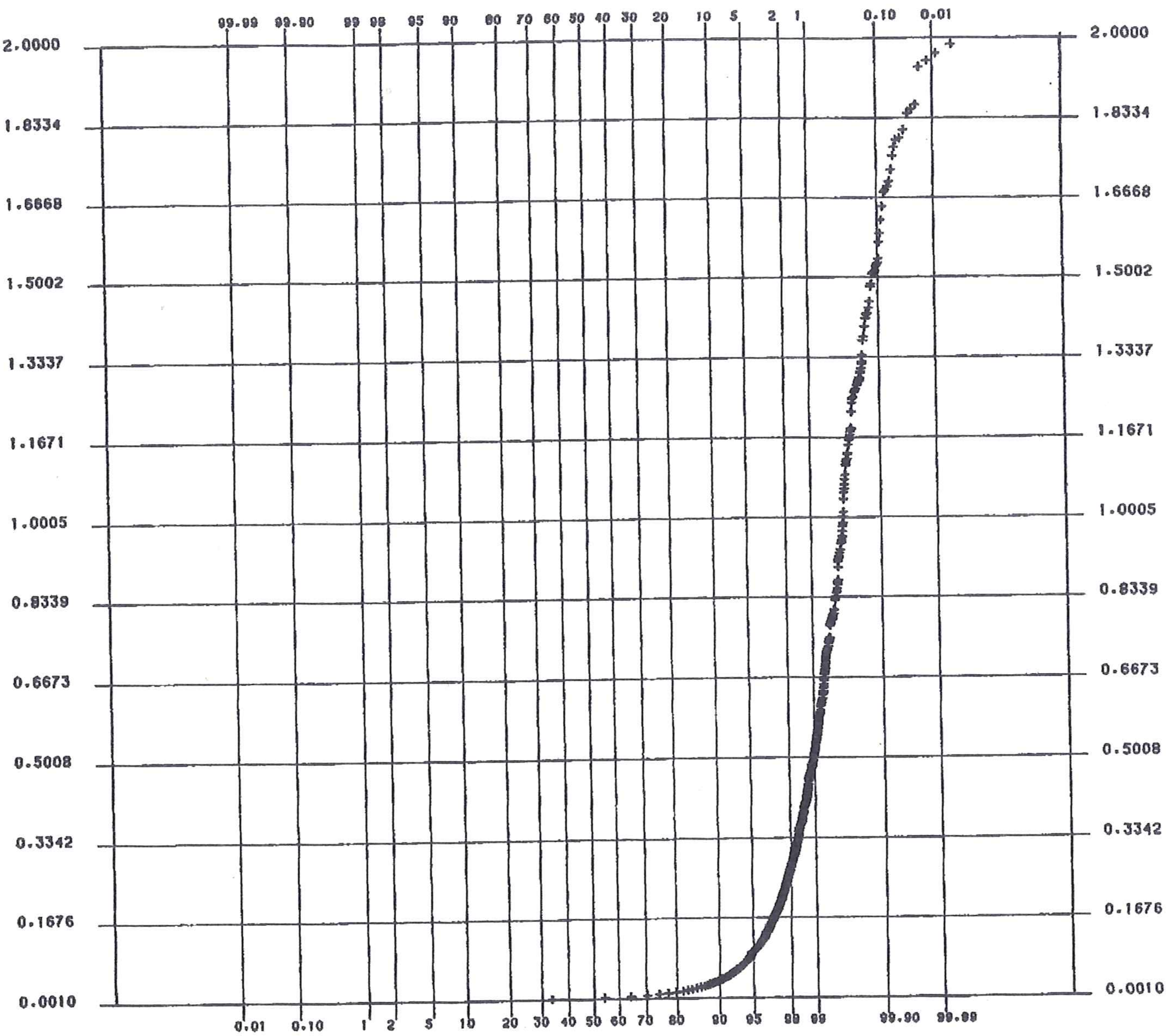
*** Current program execution:	Elapsed time (sec)	Date	Time
M401V1	7	11-18-94	13:11:54



** PROBABILITY DISTRIBUTION PLOT OF GOLD **

ITEM	GOLD	NATURAL LOGS	
NUMBER	24352	NUMBER	24352
MEAN	0.0360	MEAN	-5.2100
MINIMUM	0.0010	MINIMUM	-6.9080
MAXIMUM	13.7750	MAXIMUM	2.6230
VARIANCE	0.0670	VARIANCE	2.1300
ST.DEV.	0.2580	ST.DEV.	1.4590

ROSEBUD AU ASSAY LOG CUM PROB CURVE - ALL



** PROBABILITY DISTRIBUTION PLOT OF GOLD **

ITEM	GOLD
NUMBER	24298
MEAN	0.0270
MINIMUM	0.0010
MAXIMUM	2.0000
VARIANCE	0.0130
ST.DEV.	0.1130

ROSEBUD AU ASSAY CUM PROB - 0.001 TO 2.0 OPT AU

Hecla
MINING COMPANY
Centennial
1891-1991

Technical Services

Fax: (208) 769-4122

Date: 11/22/94

To: Charlie

From: Brett

Hecla Mining Company

Transmitting: 12 Pages
(Including Cover)

Operator:

Ag stats.

6500 Mineral Drive • Box C-8000 • Coeur d'Alene, Idaho 83814-1931 • 208/769-4100 • FAX 208/769-4107

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT ** 11-22-94 13:39:48

CUTOFF SILVR	SAMPLES ABOVE	PERCENT ABOVE	MEAN ABOVE	C.V.
.000	95759.3	100.0	.404	6.164
.050	71602.3	74.8	.531	5.402
.100	46050.9	48.1	.789	4.502
.150	29401.3	30.7	1.170	3.762
.200	20858.2	21.8	1.580	3.271
.250	16357.5	17.1	1.955	2.957
.300	13531.2	14.1	2.307	2.730
.350	11670.6	12.2	2.624	2.564
.400	10380.5	10.8	2.905	2.439
.450	9483.5	9.9	3.140	2.347
.500	8717.3	9.1	3.375	2.264
.550	8163.2	8.5	3.568	2.202
.600	7650.3	8.0	3.769	2.143
.650	7147.2	7.5	3.991	2.083
.700	6753.8	7.1	4.185	2.034
.750	6313.4	6.6	4.426	1.977
.800	5948.0	6.2	4.651	1.929
.850	5746.6	6.0	4.785	1.901
.900	5509.5	5.8	4.954	1.868
.950	5264.8	5.5	5.141	1.833
1.000	5094.1	5.3	5.281	1.808
1.050	4861.9	5.1	5.484	1.774
1.100	4712.9	4.9	5.623	1.751
1.150	4527.1	4.7	5.808	1.722
1.200	4336.4	4.5	6.012	1.692
1.250	4215.2	4.4	6.150	1.673
1.300	4070.2	4.3	6.324	1.649
1.350	3987.7	4.2	6.427	1.635
1.400	3884.6	4.1	6.561	1.618
1.450	3772.2	3.9	6.714	1.599
1.500	3665.3	3.8	6.867	1.580
1.550	3575.7	3.7	7.001	1.565
1.600	3493.8	3.6	7.128	1.550
1.650	3410.8	3.6	7.262	1.535
1.700	3317.2	3.5	7.419	1.518
1.750	3237.4	3.4	7.560	1.504
1.800	3177.7	3.3	7.668	1.492
1.850	3109.4	3.2	7.796	1.480
1.900	3056.4	3.2	7.899	1.470
1.950	2944.3	3.1	8.126	1.448
2.000	2908.3	3.0	8.202	1.441
2.050	2815.5	2.9	8.406	1.423
2.100	2735.9	2.9	8.590	1.407
2.150	2685.6	2.8	8.711	1.396
2.200	2624.7	2.7	8.863	1.384
2.250	2579.8	2.7	8.978	1.374
2.300	2522.2	2.6	9.132	1.362
2.350	2449.3	2.6	9.334	1.346
2.400	2419.3	2.5	9.421	1.339
2.450	2388.3	2.5	9.511	1.332
2.500	2352.8	2.5	9.618	1.324

MIN. DATA VALUE = .0100
MAX. DATA VALUE = 117.5000

C.V. = Coef. of variation = Standard deviation / mean
19567 Intervals used out of 47076

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT ** 11-22-94 13:39:48

HISTOGRAM AND FREQUENCY DISTRIBUTION OF ROSEBUD AG ASSAY STATS - ALL DATA

AVE. DATA VALUE = .404
C.V. (STD/MEAN) = 6.164
MIN. DATA VALUE = .010
MAX. DATA VALUE = 117.500

# FREQ.	CUM. FREQ	UPPER LIMIT	Histogram (0 20 40 60 80 100)
24157	.252	.050	+*************.
25551	.519	.100	+*************
16650	.693	.150	+*********
8543	.782	.200	+****
4501	.829	.250	+**
2826	.859	.300	+*
1860	.878	.350	+*
1291	.892	.400	+*
897	.901	.450	+
766	.909	.500	+
554	.915	.550	+
513	.920	.600	+
503	.925	.650	+
393	.929	.700	+
441	.934	.750	+
365	.938	.800	+
201	.940	.850	+
238	.942	.900	+
244	.945	.950	+
171	.947	1.000	+
232	.949	1.050	+
149	.951	1.100	+
186	.953	1.150	+
191	.955	1.200	+
121	.956	1.250	+
145	.957	1.300	+
82	.958	1.350	+
103	.959	1.400	+
113	.961	1.450	+
107	.962	1.500	+
89	.963	1.550	+
82	.964	1.600	+
83	.964	1.650	+
94	.965	1.700	+
80	.966	1.750	+
59	.967	1.800	+
69	.968	1.850	+
53	.968	1.900	+
112	.969	1.950	+
36	.970	2.000	+
93	.971	2.050	+
79	.971	2.100	+
50	.972	2.150	+
61	.973	2.200	+
45	.973	2.250	+
58	.974	2.300	+
73	.974	2.350	+
30	.975	2.400	+
31	.975	2.450	+
35	.975	2.500	+
2353	1.000	2.550	+*
95759	1.000		0 20 40 60 80 100

```
*** ---------------------------------------------*----------------------------------*
***                                              *  Project RUN#    835.            *
*** MEDS-401V1 - Revised on 22-MAR-93            *  Date started   11-22-94         *
***              Version # 10.4 -    3           *  Time started   13:39:48         *
***                                              *  Project Acct   N/A              *
*** ---------------------------------------------*----------------------------------*

*** Current LOGIN Session:   SRU =       0    TTY =  0HR  0MIN

-------------------------------------------------------------------------------------

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                  Copyright 1974-1991 MINTEC Inc
                    Release #10.4,  20-JAN-83

-------------------------------------------------------------------------------------

            DATA FILE ROSE10.DAT *    NO.  SIZE  UNTS  /UNT
            -------------------- *    ---  ----  ----  ----
            Project Control File *     10   510    51    10

-------------------------------------------------------------------------------------

*** Run File = RUN401.A     Print File = RPT401.NAG

Run line# 1--MEDS-401V1  10=ROSE10.DAT 11=ROSE11.DAT  3=RPT401.NAG;
Run line# 2--MEDS-401V1  12=ROSE12.DAT 30=DAT401.NAG

Run line# 3--**  SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT  **

Run line# 4--DOC    ROSEBUD AG ASSAY STATS - ALL DATA
Run line# 5--
Run line# 6--USR = BJH  /  11-22-94  13:38:03
Run line# 7--
Run line# 8--COM --------------------------------------------------
Run line# 9--COM    CLASSICAL STATISTICS ON ASSAY DATA
Run line#10--COM --------------------------------------------------
Run line#11--
Run line#12--IOP1 = 1 0 / FIRST AND LAST RECORD #'S FROM ASSAYS TO USE
Run line#13--IOP3 = 0 / -1=ALL DHS;0=PROJ COORD LIMITS; 1=BOUNDARY
Run line#14--IOP5 = 0 / 0=OMIT DELETED ASSAYS;  1=USE DELETED ASSAYS
Run line#15--IOP6 = 0 / 0=NO TRANSFORM;  1=LOG TRANSFORMATION
Run line#16--IOP7 = 0 / 0=NO PLOT; 1=PLOT FREQ DISTRIBUTION-M122 PLOT FILE
Run line#17--IOP8 = 51 / NUMBER OF CLASS INTERVALS (DEFAULT=20; MAX=100)
Run line#18--IOP9 = 0 / 1=PRINT STATS BY DRILLHOLE; 0=OMIT STATS BY DRILLHOLE
Run line#19--IOP12= 0 / 1=DON'T ACCUMULATE FREQ INTS
Run line#20--IOP13= 0 / 1=DON'T REPORT 1ST ITEM
Run line#21--
Run line#22--
Run line#23--PAR7 = 0. / VALUE OF THE FIRST FREQUENCY INTERVAL
Run line#24--PAR8 = .05 / CLASS INTERVAL FOR SILVR (BASE ITEM)
```

ROSEBUD PROJECT - PERSHING CO., NV

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AG ASSAY STATS - ALL DATA
Run line#25--PAR9 = .01 / MINIMUM VALUE OF SILVR ALLOWED
Run line#26--PAR10= 1. / MULTIPLIER FOR FIRST WEIGHT
Run line#27--
Run line#28--ITM01= GRADE SILVR / CONTROLLING ASSAY (BASE ASSAY)
Run line#29--ITM02= FACTR -AI- / 1ST WEIGHT ITEM
Run line#30--
Run line#31--END

DATA FILE ROSE11.DAT *	NO.	SIZE	UNTS	/UNT	
DRILL HOLE DATA FILE *	11	638	106	6	DIRECT: .

DATA FILE ROSE12.DAT *	NO.	SIZE	UNTS	/UNT	
COLLAR & SURVEY FILE *	12	638	49	13	DIRECT: .

Data file DAT401.NAG *	unit	size	from	program
SUMMARY TABLE file *	30			

PCF X,Y coordinate limits were used.

Elevation range of data accepted= 6500.0 3500.0

OMIT SILVR below minimum value = .010
ASSAYS = 1 SILVR

Column headed WEIGHT # is the sum of dh weights.
Column headed WTD. AVG is the weighted average.
Column headed STD. DEV is the standard deviation.

Base assay is SILVR

Weighting item -AI- X constant 1.000

ROSEBUD PROJECT - PERSHING CO., NV

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AG ASSAY STATS - ALL DATA

Statistical analysis of ROSE11.DAT assays based on SILVR
Minimum value= .0100 Elevations= 6500.0 3500.0

SILVR CUTOFF *	WEIGHT #	% INTERVALS * ABOVE CUTOFF *	WTD. AVG *	STD. DEV *	
.000	95759.3	100.0000	.404	2.491	SILVR
.050	71602.3	74.7732	.531	2.870	SILVR
.100	46050.9	48.0903	.789	3.552	SILVR
.150	29401.3	30.7033	1.170	4.401	SILVR
.200	20858.2	21.7819	1.580	5.169	SILVR
.250	16357.5	17.0819	1.955	5.781	SILVR
.300	13531.2	14.1304	2.307	6.299	SILVR
.350	11670.6	12.1874	2.624	6.729	SILVR
.400	10380.5	10.8402	2.905	7.085	SILVR
.450	9483.5	9.9035	3.140	7.369	SILVR
.500	8717.3	9.1033	3.375	7.641	SILVR
.550	8163.2	8.5247	3.568	7.859	SILVR
.600	7650.3	7.9891	3.769	8.078	SILVR
.650	7147.2	7.4637	3.991	8.313	SILVR
.700	6753.8	7.0529	4.185	8.512	SILVR
.750	6313.4	6.5930	4.426	8.753	SILVR
.800	5948.0	6.2114	4.651	8.969	SILVR
.850	5746.6	6.0011	4.785	9.096	SILVR
.900	5509.5	5.7535	4.954	9.253	SILVR
.950	5264.8	5.4980	5.141	9.423	SILVR
1.000	5094.1	5.3197	5.281	9.548	SILVR

RUN# 835. PAGE 4 METL 401V1 DATE 11-22-94 TIME 13:39:48

ROSEBUD PROJECT - PERSHING CO., NV

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AG ASSAY STATS - ALL DATA

Statistical analysis of ROSE11.DAT assays based on SILVR
Minimum value= .0100 Elevations= 6500.0 3500.0

SILVR CUTOFF *	WEIGHT #	% INTERVALS *	WTD. AVG *	STD. DEV *	
1.050	4861.9	5.0772	5.484	9.727	SILVR
1.100	4712.9	4.9216	5.623	9.848	SILVR
1.150	4527.1	4.7276	5.808	10.005	SILVR
1.200	4336.4	4.5284	6.012	10.174	SILVR
1.250	4215.2	4.4019	6.150	10.286	SILVR
1.300	4070.2	4.2504	6.324	10.426	SILVR
1.350	3987.7	4.1643	6.427	10.508	SILVR
1.400	3884.6	4.0566	6.561	10.614	SILVR
1.450	3772.2	3.9393	6.714	10.733	SILVR
1.500	3665.3	3.8276	6.867	10.851	SILVR
1.550	3575.7	3.7340	7.001	10.953	SILVR
1.600	3493.8	3.6485	7.128	11.048	SILVR
1.650	3410.8	3.5618	7.262	11.148	SILVR
1.700	3317.2	3.4641	7.419	11.264	SILVR
1.750	3237.4	3.3808	7.560	11.366	SILVR
1.800	3177.7	3.3184	7.668	11.445	SILVR
1.850	3109.4	3.2471	7.796	11.537	SILVR
1.900	3056.4	3.1918	7.899	11.610	SILVR
1.950	2944.3	3.0747	8.126	11.769	SILVR
2.000	2908.3	3.0371	8.202	11.822	SILVR
2.050	2815.5	2.9402	8.406	11.961	SILVR

RUN# 835. PAGE 5 METL 401V1 DATE 11-22-94 TIME 13:39:48

ROSEBUD PROJECT - PERSHING CO., NV

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AG ASSAY STATS - ALL DATA

Statistical analysis of ROSE11.DAT assays based on SILVR
Minimum value= .0100 Elevations= 6500.0 3500.0

SILVR CUTOFF *	WEIGHT #	% INTERVALS *	WTD. AVG *	STD. DEV *	
2.100	2735.9	2.8571	8.590	12.084	SILVR
2.150	2685.6	2.8045	8.711	12.164	SILVR
2.200	2624.7	2.7409	8.863	12.263	SILVR
2.250	2579.8	2.6940	8.978	12.338	SILVR
2.300	2522.2	2.6339	9.132	12.436	SILVR
2.350	2449.3	2.5578	9.334	12.563	SILVR
2.400	2419.3	2.5264	9.421	12.617	SILVR
2.450	2388.3	2.4941	9.511	12.673	SILVR
2.500	2352.8	2.4570	9.618	12.738	SILVR

MIN. DATA VALUE = .0100
MAX. DATA VALUE = 117.5000

RUN# 835. PAGE 6 METL 401V1 DATE 11-22-94 TIME 13:39:48

```
ROSEBUD PROJECT - PERSHING CO., NV
**  SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT  **
   ROSEBUD AG ASSAY STATS - ALL DATA
      Statistical analysis of drillhole assays based on SILVR
      Minimum value=      .0100   Elevations=  6500.0  3500.0
    RANGE                *         20        40        60        80       100
-------   --------       *---------+---------+---------+---------+---------+
    .0000     .0499 *XXXXXXXXXXXX.                                     *
    .0500     .0999 *XXXXXXXXXXXXX            .                        *
    .1000     .1499 *XXXXXXXXX                         .               *
    .1500     .1999 *XXXX                                  .           *
    .2000     .2499 *XX                                      .         *
    .2500     .2999 *X                                         .       *
    .3000     .3499 *X                                          .      *
    .3500     .3999 *X                                           .     *
    .4000     .4499 *                                            .     *
    .4500     .4999 *                                            .     *
    .5000     .5499 *                                             .    *
    .5500     .5999 *                                             .    *
    .6000     .6499 *                                             .    *
    .6500     .6999 *                                             .    *
    .7000     .7499 *                                              .   *
    .7500     .7999 *                                              .   *
    .8000     .8499 *                                              .   *
    .8500     .8999 *                                              .   *
    .9000     .9499 *                                              .   *
    .9500     .9999 *                                              .   *
   1.0000    1.0499 *                                              .   *
   1.0500    1.0999 *                                               .  *
   1.1000    1.1499 *                                               .  *
   1.1500    1.1999 *                                               .  *
   1.2000    1.2499 *                                               .  *
   1.2500    1.2999 *                                               .  *
   1.3000    1.3499 *                                               .  *
   1.3500    1.3999 *                                               .  *
   1.4000    1.4499 *                                               .  *
   1.4500    1.4999 *                                               .  *
   1.5000    1.5499 *                                               .  *
   1.5500    1.5999 *                                               .  *
   1.6000    1.6499 *                                               .  *
   1.6500    1.6999 *                                               .  *
   1.7000    1.7499 *                                               .  *
   1.7500    1.7999 *                                               .  *
   1.8000    1.8499 *                                               .  *
   1.8500    1.8999 *                                               .  *
   1.9000    1.9499 *                                               .  *
   1.9500    1.9999 *                                               .  *
   2.0000    2.0499 *                                                . *
   2.0500    2.0999 *                                                . *
   2.1000    2.1499 *                                                . *
   2.1500    2.1999 *                                                . *
   2.2000    2.2499 *                                                . *
   2.2500    2.2999 *                                                . *
   2.3000    2.3499 *                                                . *
   2.3500    2.3999 *                                                . *
   2.4000    2.4499 *                                                . *
   2.4500    2.4999 *                                                . *
   2.5000    2.5499 *X                                                .*
                     ---------+---------+---------+---------+---------+
                              20        40        60        80       100
```

RUN# 835. PAGE 7 METL 401V1 DATE 11-22-94 TIME 13:39:48

ROSEBUD PROJECT - PERSHING CO., NV

** SILVR ASSAY DATA STATISTICS FROM FILE ROSE11.DAT **

ROSEBUD AG ASSAY STATS - ALL DATA
Summary of assay intervals excluded

Number of assays BELOW MIN = 18561

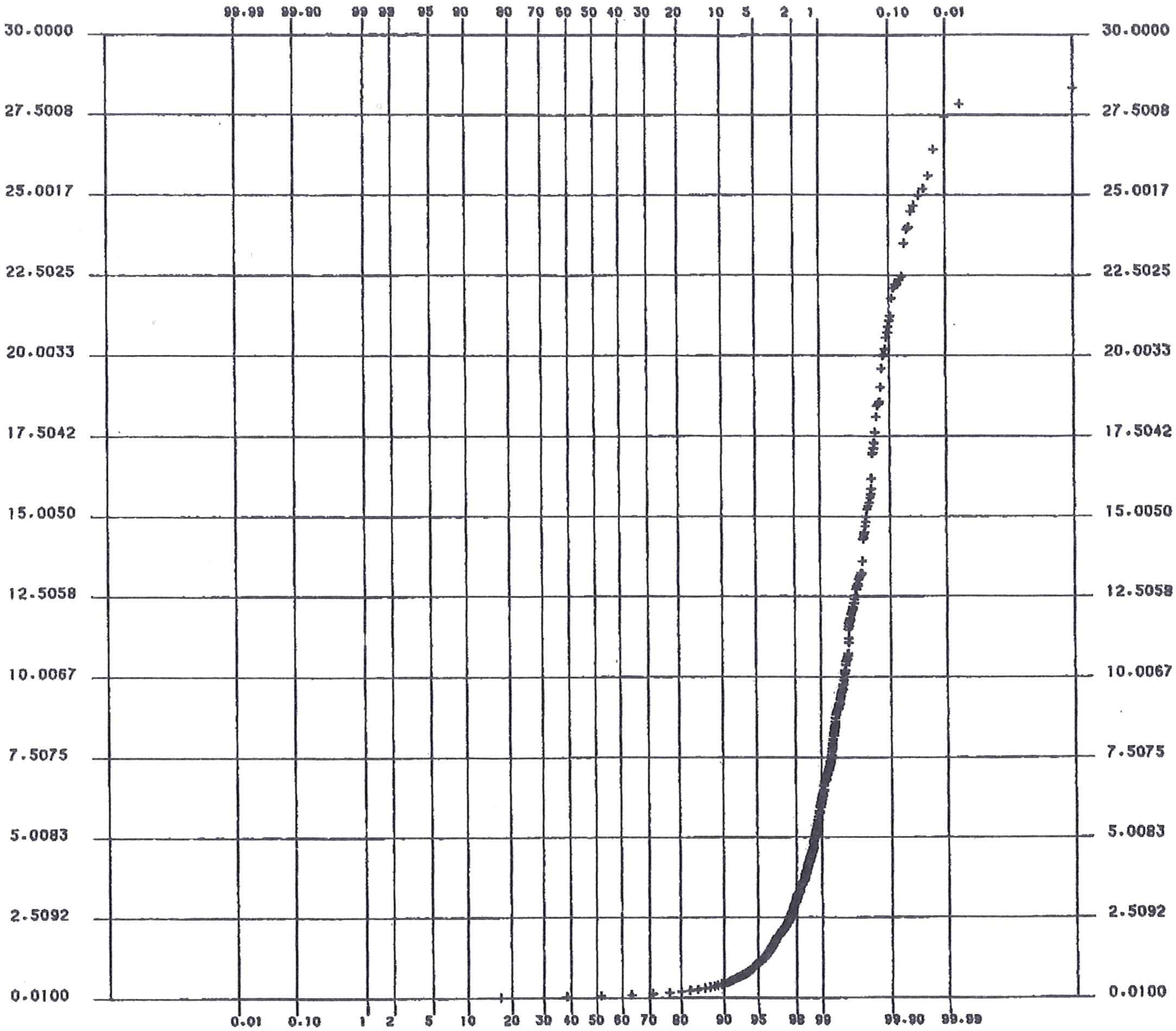
Number of ints OUTSIDE ELEVS= 681

Number of ints OUTSIDE AREA= 8267

19567 Intervals used out of 47076

		NO.	#IN	#OUT	FUNC
DATA FILE ROSE10.DAT--	--	10	5	1	0
DATA FILE ROSE11.DAT--	--	11	445	0	0
DATA FILE ROSE12.DAT--	--	12	38	0	0

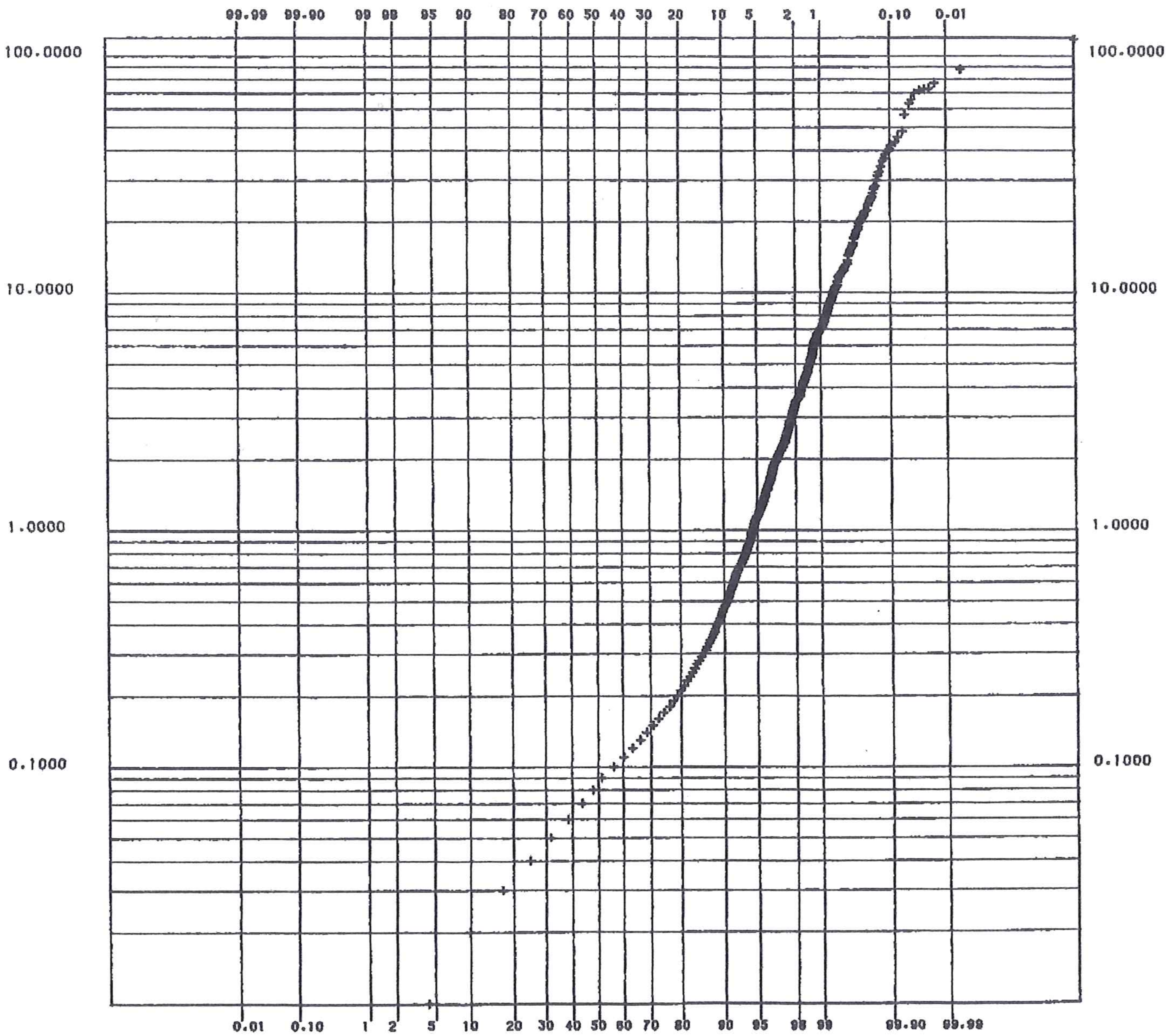
*** Current program execution:	Elapsed time (sec)	Date	Time
M401V1	7	11-22-94	13:39:55



** PROBABILITY DISTRIBUTION PLOT OF SILVR **

ITEM	SILVR
NUMBER	19527
MEAN	0.3470
MINIMUM	0.0100
MAXIMUM	28.3500
VARIANCE	1.9610
ST.DEV.	1.4000

ROSEBUD AG ASSAY CUM PROB - 0.01 TO 30.0 OPT AG



** PROBABILITY DISTRIBUTION PLOT OF SILVR **

ITEM	SILVR	NATURAL LOGS	
NUMBER	19559	NUMBER	19559
MEAN	0.4330	MEAN	-2.2910
MINIMUM	0.0100	MINIMUM	-4.6050
MAXIMUM	117.5000	MAXIMUM	4.7660
VARIANCE	7.1410	VARIANCE	1.6200
ST.DEV.	2.6720	ST.DEV.	1.2730

ROSEBUD AG ASSAY LOG CUM PROB - ALL DATA

MINTEC CUSTOMER SUPPORT FAX

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2590 N Alvernon Way
Tucson, AZ 85712-2421

DATE: July 13, 1995

TO: Steve Ristorcelli

COMPANY: Mine Development Associates
c/o Hecla Mine

FAX #: (702) 427-7781 **Number of pages in FAX:** 21

FROM: Cindy Bethard

RE: Plotting Non-Orthogonal Geology and Drillholes

I believe this topic is fully covered by Julia's notes on front end geology, presented at tne '95 Users' Seminar. There are 20 pages; I will attach them.

FRONT END GEOLOGY

Incorporating geology data into a project is an important step in the modeling process. In this workshop we will review the steps necessary to input both assay and geologic data into Medsystem's Files 11 and 9, input geologic data into VBM files and load into the model file (File 15), rotate the PCF, setup a nonorthogonal VBM's, and contouring data.

Two types of data can be loaded into MEDSYSTEM: 1) drillhole (length data) and composite data (point data), and 2) digitized string data. Digitized string data includes, pits, topography, contours, and geologic boundaries.

The distinction between assay data and composite data is that assay data is associated with a line segment, whereas composite data is data representing a point in space as each composite sample occurs at a specific Easting (X), Northing (Y), or elevation (Z).

I. INPUTTING ASSAY DATA

There are two types of samples used in Medsystem: LENGTH data and POINT data. "Length" data is stored in Medsystem File 11 and "point" data is stored in Medsystem File 9. "Length" data is drillhole assays; where each sample has assay values and geologic codes that represent the interval designated by the "from" and "-to-" for that sample interval. The Easting, Northing and elevation of the endpoints of the sample are calculated in the programs from the collar location and the downhole survey information stored in File 12.

"Point" data is only designated with an East, North, and elev. Usually, the drillhole assay values are composited into longer lengths and these composites are stored as "point" values.

Therefore, the types of data the geologist might have are either "Length" data or "Point" data. To decide what kind of data you are working with, use the following table as a guide:

DRILLHOLE DATA - Treated as LENGTH data (File 11).
COMPOSITE DATA - Treated as POINT data (File 9).
GEOCHEMICAL DATA - Treated as POINT data (File 9).
TRENCH DATA - Can be treated as either POINT data (File 9) or LENGTH data (File 11). To have trench data treated as POINT data, the geologist must provide the coordinates for each sample. Program DIGTRN will create a file of POINT data suitable for input into File 9. To have the trench data treated as LENGTH data, the geologist must provide the coordinates of the starting point of the trench and the changes in azimuth and dip along the trench. The post-processor program, AZDIP.FOR can be used to convert an X,Y,Z data file (such as that created by program DIGTRN) to a drillhole with multiple surveys in m201v1 format.
UNDERGROUND DATA - These may be channel samples along a drift or a face or maybe random samples. These can either be treated as LENGTH data (File 11)or POINT data (File 9). To have channel data treated as LENGTH data, the

geologist must provide the coordinates of the starting point of the channel and the changes in azimuth and dip along the channel. To have the underground data treated as POINT data, the geologist must provide the coordinates for each sample.

GEOPHYSICAL DATA - Treated as POINT data.

ROADCUT SAMPLES - Like trench data or channel samples, this data can be treated as either POINT (File 9) or LENGTH data (File 11). As above, POINT data, the geologist must provide the coordinates. Likewise, to treat as LENGTH data, the geologist must provide the coordinates of the starting point of the roadcut.

SOIL SAMPLES - Treated as POINT data.

A. Assay data:

Assay data is loaded into Medsystem file 11 using program m201v1. The assay data to be input into Medsystem must be in ascii format and in a specific sequence. The drillhole data ascii file must be in the following order:

1) Collar line
2) Optional survey lines
3) End of surveys lines (max 100 downhole surveys)
4) Assay intervals
5) End of assays line (a blank line or 0 0 ends the drillhole) REQUIRED.

Up to 99 items of assay information can be loaded into the assay file, but the input file can be no more than 88 spaces wide (or columns, including the DH-ID). To load more than assay items 99 items and/or the input file is wider than 88 characters, assay information in the "excess" columns can be input in a second program execution. Files 11 and 12 can be appended to; set both IOP's 1 and 2 equal to 0, this tells the program to load new data starting from one + the last assay or survey record.

This ascii data is loaded into the Medsystem Assay File 11 using program m201v1. Many companies have their own database and they must convert their data for "201" format. At the present time, there is no Medsystem program which converts assay data into "m201v1"-format.

One method available to get data into the correct format for input into Medsystem is to use the program, DHUTIL. Using DHUTIL, assay values and other codes can be input. The program outputs an ascii file suitable for loading into Medsystem. This is an interactive program where each interval of information is entered manually. Ascii data files can be generated of each individual drillhole or one data file containing all drillholes. The data files created for individual holes are useful for verification and editing. DIGED is only available on DOS machines.

An example of the format and necessary sequence order is shown on the next page (please refer to Vol. I of the Medsystem Documentation).

SAMPLE DRILLHOLE DATA FILE—DAT201.IA

	Collar East	Collar North	Collar Elev	Collar Azimuth	Collar Dip	Drillhole Length
SM-021	12250.00	12250.00	4294.10	90.000	-73.000	1720.0-Collar Data
SM-021	500.00	1000.00	500.00	92.000	-76.000	Survey Data
SM-021	1000.00	1500.00	500.00	88.000	-79.000	
SM-021	1500.00	1720.00	220.00	89.000	-75.000	
SM-021						
SM-021	0.00	20.00	20.00	0.00	0.000	Assay Data
SM-021	20.00	40.00	20.00	0.00	0.000	
SM-021	40.00	60.00	20.00	0.00	0.000	
SM-021	60.00	80.00	20.00	0.00	0.000	
SM-021	80.00	100.00	20.00	0.98	0.049	
SM-021	100.00	120.00	20.00	1.00	0.050	
SM-021	120.00	140.00	20.00	0.99	0.049	
SM-021	140.00	160.00	20.00	1.01	0.051	
	ASSAY FROM	ASSAY -TO-	ASSAY INTERVAL	T-CU	MOLY	
	Survey From	Survey To	Survey Length	Survey Azimuth	Survey Dip	

On the collar data and Survey data lines, the Easting is the X-coordinate and the Northing is the Y-coordinate. The Collar line has the total depth of the hole in addition to the azimuth and dip, like the downhole Survey Data lines. The Survey Data lines show survey intervals coded as straight-line segments. The azimuth and dip on the collar line cover the interval from the collar to the first survey line. If the drillhole is vertical or only has a collar survey, there will be no Survey Data lines. After the data has been loaded into files 11/12, it can be listed using program m204v1.

Once the ascii data is in the correct format, it should be checked -once again- prior to loading into Medsystem using program m200v1. Once you are satisfied that the data is indeed in the correct format it is loaded into Medsystem using program m201v1.

B. Composite Data:

Composite data is input into the Composite file (File 9) as point data. This data is created by the projection of data from various levels or locations to a single section or location, and is the weighted average of a set of samples that fall within a defined boundary. A boundary could be a bench, a seam or a geologic rock type. Drillhole assay data is composited by bench or by length (with or without respect to geologic codes). Composite data can come from many sources.

Program, DIGTRN creates an ascii file of digitized data in the correct format to load into Medsystem file 9 using m500v1. DIGTRN is only available on DOS machines.

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The ascii file must be in a specific format for input into the composite file 9:

LABEL X Y Z LENGTH ASSAY1 ASSAY2 ASSAY3 ..... ASSAY n

The label would be either the DH-IDENT or sample-ID. X is the Easting coordinate, Y is the Northing coordinate and Z is the elevation. The length refers the sample length this sample represents. For example, for a vertical drillhole the length is equal to the bench height, and for roadcut samples, this would be equal to the length of the sample channel. Below is an example of a sample input file for input into file 9 (from Vol. 1, p.500-5).

M500V1 SAMPLE INPUT

10	SM-010	12750.0	13250.0	4350.0	16.5	0.000	0.000	0.000
10	SM-010	12750.0	13250.0	4300.0	50.0	0.000	0.000	0.000
10	SM-010	12750.0	13250.0	4250.0	50.0	0.255	0.012	0.315
10	SM-010	12750.0	13250.0	4200.0	50.0	0.368	0.018	0.458
10	SM-010	12750.0	13250.0	4150.0	50.0	0.368	0.018	0.458
10	SM-010	12750.0	13250.0	4100.0	50.0	0.373	0.018	0.463
10	SM-010	12750.0	13250.0	4050.0	50.0	0.383	0.019	0.478
10	SM-010	12750.0	13250.0	4000.0	50.0	0.379	0.019	0.474
10	SM-010	12750.0	13250.0	3950.0	50.0	0.394	0.019	0.489
10	SM-010	12750.0	13250.0	3900.0	50.0	0.405	0.020	0.505
10	SM-010	12750.0	13250.0	3850.0	50.0	0.409	0.021	0.514
10	SM-010	12750.0	13250.0	3800.0	50.0	0.414	0.021	0.519
10	SM-010	12750.0	13250.0	3750.0	50.0	0.431	0.022	0.541
10	SM-010	12750.0	13250.0	3700.0	50.0	0.433	0.022	0.543
10	SM-010	12750.0	13250.0	3650.0	50.0	0.417	0.021	0.522
10	SM-010	12750.0	13250.0	3600.0	50.0	0.424	0.021	0.529
10	SM-010	12750.0	13250.0	3550.0	50.0	0.434	0.022	0.544
10	SM-010	12750.0	13250.0	3500.0	50.0	0.446	0.023	0.561
10	SM-010	12750.0	13250.0	3450.0	50.0	0.451	0.023	0.566
10	SM-010	12750.0	13250.0	3400.0	50.0	0.445	0.022	0.555
10	SM-010	12750.0	13250.0	3350.0	50.0	0.448	0.022	0.558
10	SM-010	12750.0	13250.0	3300.0	50.0	0.457	0.022	0.567
10	SM-010	12750.0	13250.0	3250.0	50.0	0.472	0.024	0.592
10	SM-010	12750.0	13250.0	3200.0	50.0	0.457	0.022	0.567
10	SM-010	12750.0	13250.0	3150.0	50.0	0.478	0.024	0.598
10	SM-010	12750.0	13250.0	3100.0	50.0	0.493	0.025	0.618
10	SM-010	12750.0	13250.0	3050.0	50.0	0.473	0.023	0.588
10	SM-010	12750.0	13250.0	3000.0	50.0	0.506	0.026	0.636
10	SM-010	12750.0	13250.0	2950.0	50.0	0.492	0.024	0.612
	DH-IDENT	EAST	NORTH	ELEV.	LNGTH	T-CU	MOLY	EQCU

The composite file may be appended to using m500v1 with or without data that has collar information. It is not mandatory that composite data have a reference back to file 12 (refer to IOP4 in the m500v1 documentation). For example, it is possible append blasthole data or other types of point data to the composite data file, after the composited exploration drillholes.

II. OBLIQUE ORE BODIES AND ROTATION:

When a project is initialized, usually the PCF limits are set using surveyed coordinates (ie, using state plane coordinates). Most of the time orebodies are not oriented orthogonally to these coordinates. Since it is easier for Medsystem to work with an orebody when it is orthogonal to the PCF, it is sometimes advantageous for the user to rotate the PCF or enter digitized geologic data into oblique (or nonorthogonal) VBM files. In addition, there are some Medsystem programs which access data only on orthogonal cross sections, such as m217v1, m607v1, m656v2/v4, m650ar/ip and m819v1, m829v1, and m830v1.

A. ROTATING A PCF:

The following are the necessary steps to rotate the PCF (refer also to both the m210v1 documentation and the Technical-200 sections in Vol. 1). <u>Before you begin, we recommend you make backup copies of your files 10, 11, 12 and 8/9.</u>

1) Define the Xmin, Xmax, Ymin, and Ymax for your rotated coordinate system.
- Also decide on the other coordinate rotation parameters, refer to m101v1.

2) Initialize a new file 12 with m102ts.
- Make sure that all of the item descriptors (or item labels) are the same as the original File 12. To check what items are in the original File 12, as well as their min, max, or precision, use m105ts.

2) Copy the old File 12 filename to the new File 12 filename.
- This copies the data in the old File 12 to the new File 12 (this preserves the original File 12).
- At this point, the new File 12 contains non-rotated drillhole surveys.

3) Run m104ts:
- **a) Use the LIST option.**
  - You need to find out how many data units are in the original File 12.
- **b) Use the EDIT option.**
  - Change the number of data units in the *new* File 12 to the value in the *original* File 12.
- **c) Use the new File 12 filename on the names line in program m210v1.**
  - The keeps the original File 12 intact and nonrotated.

4) Update the PCF variables:
Run m101v1 with the RUN=OLD option and define the following PCF values after the END line:

PCF21=	**XMIN for the rotated coordinate system**
PCF22=	**XMAX for the rotated coordinate system**

PCF25= YMIN for the rotated coordinate system
PCF26= YMAX for the rotated coordinate system

include these "optional" PCF items. These will be used by program, m210v1.

PCF33= X coordinate of reference point in the original coordinates
PCF34= Y coordinate of reference point in the original coordinates
PCF35= Angle of rotation; (+) is clockwise, and (-) is counterclockwise.
PCF36= X coordinate of reference point in the rotated coordinate system
PCF37= Y coordinate of reference point in the rotated coordinate system

- the "reference point" is usually the origin of the new, rotated coordinate system.
- this program will update the above PCF variables.

5) Run m210v1 to rotate the collar coordinates in the new File 12:

- Create a m210v1 run file.
- Specify the new File 12 filename on the names line in the run file.
- In the m210v1 run file you have the option to only list the rotated collar coordinates, or to store them into the new File 12.

6) After storing the rotated coordinates into the new File 12, verify the new collar coordinates are correct:

a) run m204v1 to produce a listing of the new File 12.

b) run m206v1 or m206v2 to produce a map of the new File 12.

- If there is a problem with the rotated coordinates, first check the variables specified as "optional" PCF items and verify that they are correct.

Figures 1 and 2 illustrate a case example for rotating a PCF, and sample m101v1 and m210v1 run files are attached (from the Tech 200 section of the Medsystem documentation). In this case, the PCF is rotated 33° east (clockwise from North) and the new origin will be 0 0. The new Xmax will be the difference in the distance between the old Xmax minus the old Xmin (3928.7E - 3090E ≅ 1000). The new Ymax will be the difference in distance between the old Ymax and the old Ymin (5551.6N - 5300N ≅ 300).

Example run101.rot -

```
MEDS-101V1    10=SAMP10.DAT    3=RPT101.ROT
SAMPLE METALS PROJECT

USR = ABC / 04-21-95

RUN = OLD

END
PCF21       0 /  XMIN
PCF22    1000 /  XMAX
PCF23      50 /  DX
PCF24      20 /  NX
```

```
PCF25       0 /  XMIN
PCF26     300 /  YMAX
PCF27      50 /  DY
PCF28       6 /  NX
PCF33    3090 /  X reference point in OLD coords
PCF34    5300 /  Y reference point in OLD coords
PCF35      30 /  ROTATION ANGLE (-)=counterclockwise, (+)=clockwise
PCF36       0 /  NEW X
PCF37       0 /  NEW Y
```

Example run210.rot -

```
MEDS-210V1   10=SAMP10.DAT   12=SAMP12.ROT   3=RPT210.ROT
***  ROTATE THE DRILLHOLES   ***

USR = ABC / 04-21-95
IOP6 = 1  / 0=ROTATE 1ST, 1=APPLY OFFSETS 1ST.
END
```

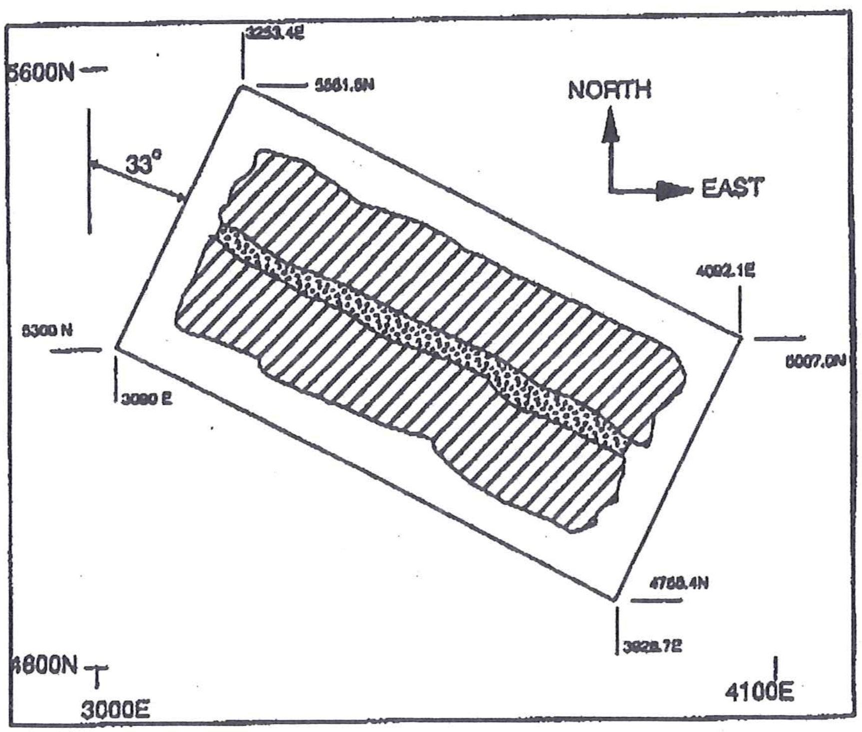

Figure 1. Existing Coordinate System

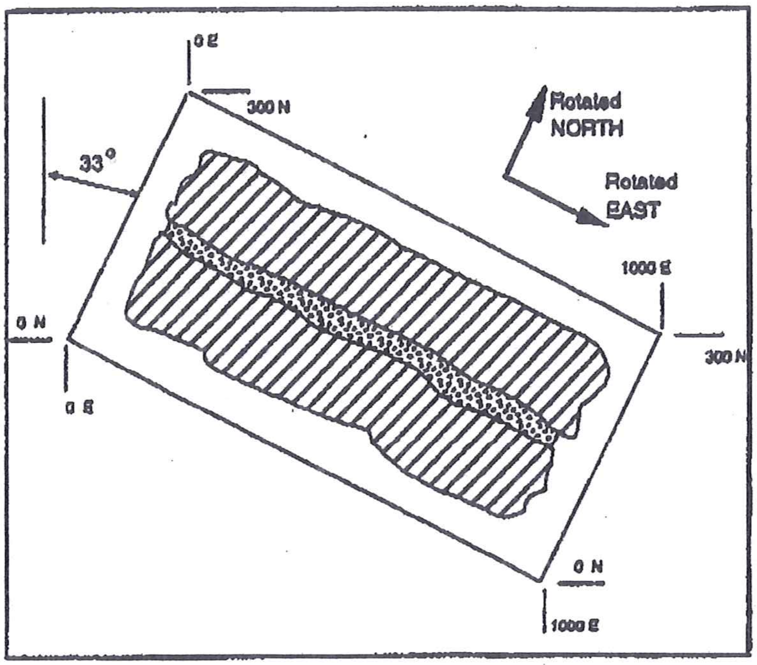

Figure 2. Rotated Coordinate System (positive rotation).

B. NONORTHOGONAL VBM's:

Geologists may begin a geologic interpretation by producing north-south or east-west cross sections. However, once the geometry of an orebody is established, cross sections are sometimes produced both perpendicular and parallel to the length of the orebody, oblique, or non-orthogonal to the PCF limits.

▸ **Creating a Nonorthogonal sectional VBM:**
The following are the steps you need to take to step up a nonorthogonal, or oblique VBM.

1) Initialize a new VBM file 25; run m102ts or use the procedure in Medtool.
   a) Since this is an oblique VBM, choose either 1 or 2 for West-East or South-North.
   b) Xmin = 0
   c) Xmax= the x distance along a section line (see Figure 3)
   d) Ymin and Ymax are equal to the min/max elevations of the cross section

2) Digitize the geologic features. In Medsystem there are two programs used for digitizing geologic data; m650ed or DIGED (available only on DOS machines).
   - Assign a plane number to each cross section. You can use an arbitrary number, ie: 100, 200, 300, etc, or you might use that cross section's real origin Easting or Northing.
   - If you did not digitize inside m650ed, load the digitized geologic features into the new

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nonorthogonal VBM using m649v1, or in m650ed, use the "ascii in" function in the Utilities sub-menu on the F1 menu.

VBM features are plotted using m654v1. Remember, when plotting cross section VBM features using m654v1, Ymin/max refers to elevation. Coding the blocks in File 15 (the 3-D model) with the geology on these sections is discussed in a later section of this workshop.

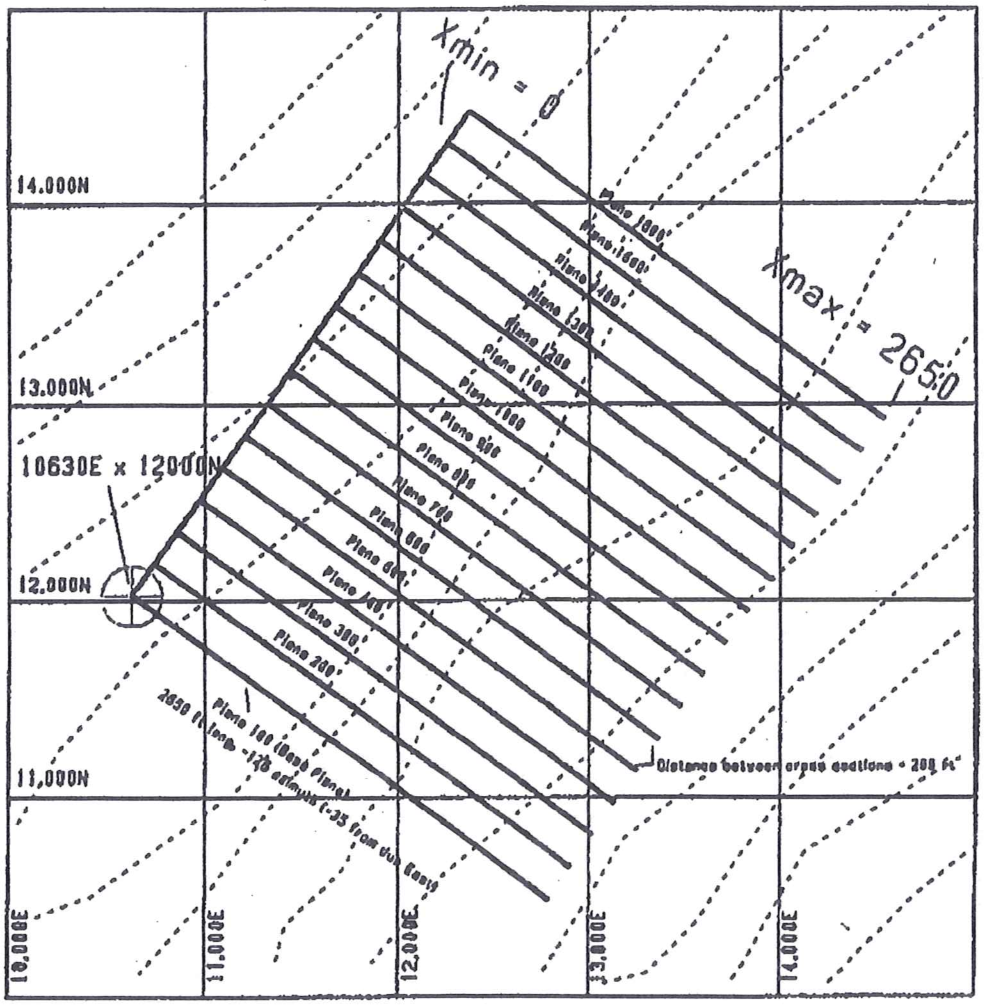


Figure 3. Plan view index map of a nonorthogonal VBM.

► **Determining the real end-point coordinates of the cross sections in the nonorthogonal VBM:**

To plot the geologic features in a nonorthogonal sectional VBM with other cross sectional information, the real end-points of the cross section of interest must be known. For example, the Advanced Procedure, SECPLT can be used to plot out geologic features, drillhole traces and pit outlines. One method of determining the real end-point coordinates are of the cross sections in a sectional, nonorthogonal VBM, is to create an index map of the section lines in an existing plane VBM (ie, in the 25.top VBM file). Remember, the Advanced Procedures were written to help the user plot out several pieces of information in one run. The steps for this method are:

1) To begin, either the "real" coordinates of the end points of one of the nonorthogonal sections must be known, or the coordinates for one end point, the length of the section and the azimuth must be known.

2) In m650ed, go to the F2 menu and select "new feature" to create the first cross section line in the plane VBM. This line will consist of two points: the beginning section end point and the end section point.

a) Enter a previously unassigned feature code (ie, 1) and use a plane number within your range of benches (we recommend either the Zmax or Zmin elevation in your project's PCF to keep this data on planes which usually don't contain other features).

b) When you are prompted to digitize a string of data, you can either a) -in absolute coordinate mode- simply type in the Easting and Northing coordinates (separated by a either a space or a coma) of the section's beginning end point, then type in the section's final end point, or b) - in dist/angle mode- enter the X-distance and azimuth of the section line. You should now have a 2-node feature, or line.

c) From the "multi-ops" sub-menu, select the "Offset Feature" option. Enter the distance offset increment between cross sections. Note that a negative offset will place an identical line to the right (or south in the example) and a positive offset will place an identical line to the left (or north in the example). Repeat this step for as many sections you have in your nonorthogonal VBM.

d) Use the "ascii out" option under the Utilities sub-menu on the F1 menu and dump the feature code for your section lines (ie, 1) for the plane they occur on.

The results in an ascii file listing the Easting and Northing coordinates of the cross section end points.

Before the data from a nonorthogonal VBM can be loaded into the 3-D solid modeling program, m670v1, plane orientation data must be assigned to this VBM. To set plane orientation data to a VBM, go into m670v1 and select the "object slice" option from the menu, followed by "edit orien". Fill in the panels accordingly for your VBM. Please refer to pages 670-5 through 670-7 for a thorough explanation on how to specify plane orientation to a VBM file.

III. INPUTTING GEOLOGIC CODES:

Geologic codes are entered into Medsystem either as numeric codes or alphanumeric codes directly into Files 11 or 9, OR as digitized string data from cross sections or plan maps. Having the geologic codes in both the assay and composite files is useful for many reasons, including plotting, geostatistics and control in modeling.

A) Entering Geologic Codes directly into the assay file or composite file.

Geologic codes come are interpretive geologic information and might include information about lithology and alteration. Both numeric and alphanumeric codes can be stored into Files 11 or 9.

Geologic codes can be entered into File 11 in m201v1, but an easier way is to use program m205v1. By using m205v1, only the downhole changes in geologic codes need to be specified for each drillhole rather than having a code for each interval (as in m201v1-format). Program m205v1 can also be used to enter both numeric or alphanumeric geologic codes (see IOP5, p.205-7, in the Medsystem Documentation). The proper format for inputting geologic code data consists is:

	DH-IDENT	FROM	CODE	
For example:	SM-008	0.0	1	**Puts code 1 in the interval 0 - 80.**
	SM-008	80.0	2	**Puts code 2 in the interval 80 - 620.**
	SM-008	620.0	3	**Puts code 3 in the interval 620 - 1460.**
	SM-008	1460.0		**If 1460 is not the bottom of the drillhole, the program puts a -2 (missing) in the remaining records.**

This table of geologic codes should be continuous over the drillhole; no gaps should be present and a blank line separates the holes.

The code for each interval is determined by a majority rule. If more than 50% of an assay interval is within a geologic interval, it will receive the majority geologic code. If your geologic data is very detailed and the majority code is unsatisfactory, you might consider either using a smaller assay interval size or consider storing such detailed geologic data in another File 11. It is possible to have multiple File 11's.

The m205v1 input data file can also be used to enter geologic codes to both File 11 (via program m205v1) or File 9 (using program m505v1). If the geologic codes have already been input into File 11, they can be transferred to the composite (File 9) using program m505v1.

1) About Alphanumeric geologic codes:

Alphanumeric codes are initialized with the minimum and maximum values set to 0 and a precision equal to -1. In Medsystem, alphanumeric codes are only used for plotting (without the advantage of color coding), and cannot be used as data filters in range/omit statements. Whether plotting, listing or dumping alphanumeric codes, the correct edit descriptor must be specified in the format statement (format=A4). Within Medsystem, the major restriction to using alphanumeric geologic codes are the enormous storage requirements in comparison to using numeric codes.

If alphanumeric geologic codes have been input, but not numeric (or vice versa), there is a procedure (p20804.dat) already in Medtool which will convert alphanumeric geologic codes to numeric codes and vice versa. The procedure requires a file of equivalent codes for the program to read. That file must be in the following format, where AAAA is the alphanumeric code and IIII is the corresponding integer code and a space separates the two fields.

AAAA IIII

for example:

QAL	10
TQLV	20
JKGD	50
DMLS	70

B) Inputting Digitized Geologic Data

Digitized geologic data can come from a variety of sources. Within Medsystem there are two programs used to digitize geologic information; DIGED (available on DOS machines) or within the VBM-editor (the m650-series programs). Geologic data on either cross sections or plan maps can be digitized into Medsystem.

Program m650ar is a great way to digitize features into a sectional VBM using data in File 11. To use this program, slice files of drillhole data must be created first using program m819v1. Then, execute program m650ar and initialize AR. Using this program, the geologist can quickly compute tons and grade for user-defined areas based on drillhole information. An excellent write-up on this program was included in the 1994 User's Seminar notes.

A) Coding File 11 assay intervals from VBM features using m217v1:

Drillhole assay intervals that intersect geologic features found in a cross sectional VBM can be coded using program, m217v1. Feature codes can be assigned from any sectional VBM plane to the drillhole intervals in File 11 on that section, to the drillhole intervals on other sections using a search distance, or assign geologic codes from VBM features to specific, selected drillholes. This program allows the use of the same numeric feature code used for the features in the VBM or alias codes can be used (ie, feature code 100 in the VBM might be aliased to the number 5 for that particular interval in File 11). Up to 60 VBM feature codes can be used.

B) Loading Digitized Geologic Data to the model File 15:

Geologic information is input into File 15 to allow for geologic matching during the interpolation process. For example, if you only want those composites within a specific rock type to be used to estimate the grade of a block within that same rock type, this is called Geologic Matching. To get geologic data into the model from digitized VBM data, the following steps are suggested:

1) Calculate block codes from the VBM features using one of the m656-series programs.

The m656 programs calculate block codes based on features in either plane VBM's or orthogonal VBM's. It is possible to calculate block codes for all the features at once, or calculate the codes one feature at a time. Programs m656v1 and v3 calculate block codes from features on plane (horizontal) VBM's, and m656v2 and v4 calculate block codes from sectional VBM's. Additionally, versions 1 and 2 calculate the block majority code, whereas versions 3 and 4 have the option to compute model percentages.

(a) Transforming data in a Nonorthogonal VBM to Orthogonal:

If the digitized geologic features are in a nonorthogonal sectional VBM, this data must first be put into a form suitable for the m656 program. First, there must be an orthogonal (plane or cross sectional) VBM already initialized and ready to load the geologic data. Either of the methods described below will get the geologic data into a VBM file the m656 programs can read.

(1) run m655v1 or v2. These programs calculate the intersections of the geologic features on crossing VBM planes and generates plot files showing these intersections. We recommend the user make this plot file into a metafile. Then, in m650ed, you can bring up this metafile and use it as a template to create the same geologic features in the plane or orthogonal VBM.

(2) run m670v1. Create a 3-D solid of the geologic data in the nonorthogonal VBM. Then slice that solid with an existing plane or orthogonal VBM file.

2) Load the calculated block codes into the model using m610v1

Program m610v1 loads integer data and m610v2 loads real (floating point) data. If the codes for several features were calculated in one program run, they can be loaded to File 15 in one run. If the codes were calculated by feature individually, then they would be loaded one file at a time. This method may be advantageous when loading by majority code and there are several features which occur one inside the other (ie, as in grade shells which occur inside one another).

Once the geologic codes have been loaded into the model file, they should be checked and verified they were loaded correctly by plotting out a series of cross sections and plan maps. Most commonly, blocks which are not coded will remain unset (-2) for that item. In this case, or if any other errors are found, go back into the plane or orthogonal VBM file and correct any errors there. Then re-calculate the block codes and re-load them.

3) Backload the geologic codes from the model blocks to the composite file

Once the blocks have been verified and are coded correctly, it is possible to backload the geologic information to the composite file (File 9) using program, m617v1. During the interpolation step, you may elect to use geologic matching: where only assay data that has the same geologic code in the composite file is used to estimate the grade of a block with the same or matching geologic code. This is one example as to why one might want to code the composite file based on information stored in the model blocks.

IV. CONTOURING GEOCHEMICAL AND GEOLOGIC DATA

This section will focus on the different methods available to contour geochemical or geologic data, all items in the assay, composite or model files, and review the necessary steps. Geochemical data can be contoured either by modeling this type of data or by using the contouring the values as point data. The best way of contouring geochemical data is to model it and assign block values using the interpolation programs (m620v1 or m624v1).

Geologic data can be contoured to create structure contour maps, isopach maps, etc. These are plots or VBM-ready files created using the programs which create surfaces from 3-D drillhole points and gridded surfaces.

A) Contouring geochemical assay data

Contouring geochemical data is a useful tool in helping the geologist to target ore zones. Contouring assay values and creating GradeXThickness maps are common tools used by geologists.

The contouring programs in Medsystem are m607v1 (contours model items) and m607v4 (contours point data). The latter program requires input in the form of X, Y, Z (assay value) and uses the triangulation method for contouring (as opposed to simple gridding).

When using the m607v1/v4 programs to contour drillhole data, the data points are located spatially closer together in one hole than to other drillholes, and the resulting plot may appear somewhat skewed. Interpolating the geochemical values to model blocks will smooth the data laterally, resulting in a better, estimation.

(1) Contouring Model Data

One of the best ways to "contour" geochemical data is to model the data using the interpolation programs, m620v1 (IDW or polygonal) or krige the values using m624v1. One of the biggest advantages to using the interpolation programs is the ability to range or limit on particular geologic zones within the model file or composite file. Once blocks have been estimated, the user can either plot out a model plan map, color-coded by cutoff ranges or plot model contours. Both of these options are available as procedures through Medtool.

Once the model blocks have been estimated using the geochemical data in the composite file, they can be contoured using the option in Medtool, "Plot Model Contours" (procedure, p60701.dat). This procedure will create either a plot file or a VBM-ready file (using the option to output a contour trace file). Executing this procedure through Medtool, the plan view plot is the default option, although this program allows the option to contour model data on cross section. The user must edit the m607v1 run file specifying either S-N section to contour or W-E section (IOP10). The example run file, shown below, was created to contour data on the section 12250N (= row number 45).

Example run607.con:

```
MEDS-607V1  10=samp10.DAT  15=samp15.DAT  3=RPT607.LA;
MEDS-607V1  30=PLT607.PBA  31=DAT607.OA
**  CONTOUR OF CUTOT FROM 3-D MODEL  **

USR = abc /  04-21-95
IOP2 =  0 / 0=CONTOUR, 1=CONT & PREVIEW, 2=PREVIEW ONLY
IOP3 =  0 / 0=NO TRACE, 1=TRACE FILE   <= Create a VBM-ready file
IOP4 =  1. 100. / FIRST AND LAST COLUMNS <= ROW #'s for S-N sections
IOP6 =  1. 100. / FIRST AND LAST ROWS   <= BENCH #'s for W-E sections
IOP8 = 45 / THE MODEL BENCH OR SEAM TO BE REFERENCED (DEFAULT=1)
COM          This would be the ROW # for W-E sections, or the COL # for S-N sections.
IOP9 = 0 / # OF INTERIOR LINEAR INTERPOLATIONS FOR EACH GRID CELL (MAX=7)
IOP10= 1 / 0=PLAN VIEW; <= TYPE OF VIEW.  Plan view is the default when run through Medtool
COM        1=W-E SECTION;
COM       -1=S-N SECTION
IOP11= 201 / FEATURE CODE FOR TRACE FILE
IOP12= 0 / 0=DRAW BORDER ONLY;
COM        1=DRAW BORDER AND LABEL THE CORNERS
IOP13= 0 / 0=USE MAP LIMITS; 1=USE BOUNDARY
IOP14= 1 / 0=ASCII PLOT FILE, 1=BINARY PLOT FILE
IOP15= 2 / NUMBER OF DECIMAL PLACES
IOP16= 2 / PEN NUMBER FOR CONTOURS (DEFAULT = 2)
PAR1 = 0. .1   /  MINIMUM CONTOUR & INCREMENT <= Required!
PAR9 = 10.     /  ZMAX=MAXIMUM CONTOUR LEVEL
PAR10= 0. 10. / ZMIN & ZMAX FOR TRACE FILE
PAR12= 0      / 0=STANDARD LINE SEGMENTS,
COM             >0=DASHED LINES,
COM             <0=SMOOTHED LINES
PAR13=  5.    / ANNOTATION FREQUENCY
PAR14= .15    / ANNOTATION SIZE
PAR15= 200.   / PLOT SCALE
GET15= CUTOT  / ITEM TO PLOT
ITM01= MODEL CONTOURS
END
```

To view this plot on the screen, be sure to edit MAP command in the appropriate run122 file using the correct Xmin/Xmax and Ymin/Ymax, or use the Advanced Procedure, ANYPLT to preview this plot.

(2) Contouring Geochemical "Point" Data

In Medsystem, it is best to contour particular planes of "point" data , otherwise data will overlap and will not be contoured properly.

(1) contouring File 11 data -

Data in the assay file (File 11) is not in "point data" form. For these reasons, it is simpler and easier to contour composite data [section (2) below]. However, it is not impossible to contour File 11 data, but some preparation must be completed outside of Medsystem.

1) Use m219v1 and dump out the assay item you wish to contour (ie, "cutot" = total copper).
The resulting output file, dat219.oa, will contain X, Y, Z, from, -to-, cutot values.

2) If you want to contour data on a particular cross section;
Depending on the sections direction, sort on a range of Northings or Eastings, then delete the data which occurs outside of the plane of interest.

3) Create and edit a m607v4 run file appropriately; making sure the format statement will allow the program to read the proper columns of data.

(2) contouring File 9 data -

Contouring File 9 data is simpler:

1) run m507v1 and output the items: East, North, Assay Item (ie, totcu)
   - If you want to contour data on a particular plane or cross section, either use a boundary file after the END line or range on the particular Easting, Northing and Elevation the data of interest lies within.
   - Edit the output file, adding a '0 0' at the end of the output file.

Example run507.sec

```
MEDS-507V1   10=SAMP10.DAT   9=SAMP09.DAT   12=SAMP12.DAT;
MEDS-507V1   19=DAT507.SEC   3=RPT507.SEC
**  DUMP 3-D COMPOSITES DATA FROM FILE SAMP09.DAT

USR = abc   /   04-21-95
COM -----------------------------------------------------
COM   C O M P O S I T E    D U M P    F U N C T I O N
COM -----------------------------------------------------
IOP1   = 1 0 / RECORD #'S FOR FILE 12 SURVEYS TO BE USED
IOP3   = -1  / -1=ALL DHS; 0=WITHIN PCF LIMITS; 1=WITHIN SPECIFIED BOUNDARY IOP6
= 0    / 1=SELECT BY DH ID

COM   3-D COMPOSITE ITEMS ORDER FOR OUTPUT
GET09 = EAST ELEV. CUTOT
FMT1  = (I5,1X,10A1,3F10.2,7F7.3)
ITM01 = NORTH RANGE 12000. 12500.
ITM02 = CUTOT RANGE 0. 99999.
END
```

2) run m607v4, to contour the data generated in the first step.
   - use the data from m507v1 generated in the previous step.
   - verify the MAP= line in the m607v4 run file. Be sure that the coordinates match whatever plane of data you are wanting to contour data on. For example, if the final result will be contours of an assay item on a particular cross section, the Ymin and Ymax are equal to the elevation.

Example run607.sec

```
MEDS-607V4  -10=TEMP  3=RPT607.SEC 19=DAT507.SEC 30=PLT607.SEC
**  CONTOUR DAT507.SEC USING TRIANGULATION

USR = jab
IOP1 = 0 /0=NO BOUNDARY REQUIRED
IOP2 = 100 / DXX MULTIPLIER
IOP3 = 2 / 0=FREE FORMAT READ XYZ, 1=USE FMT1 & ALF1
IOP4 = 0 / 0=OUTPUT IS PLOT FILE, 1=OUTPUT IS VBM DATA
IOP5 = 0 / IF IOP4=1, FEATURE CODE FOR VBM DATA
IOP6 = 1 / IF IOP4=0, 0=ASCII PLOT FILE, 1=BINARY PLOT FILE
IOP7 = 2 / NUMBER OF DECIMAL PLACES IN LABEL
IOP8 = 1 / PEN NUMBER FOR CONTOURS

PAR1 = 0./ MAXIMUM TRIANGLE SIZE

PAR5 = 100. / CONTOUR INTERVAL
PAR6 = 0.0  /INTERVAL BETWEEN INDEX CONTOURS
PAR7 = 0.   / LOWER LIMIT OF CONTOUR ELEVATION
PAR8 = 999999. / UPPER LIMIT OF CONTOUR ELEVATION
PAR9 = 7    / SMOOTHING FACTOR FOR CONTOURS

PAR10= 0.   / CONSTANT TO BE ADDED TO X COORDINATE
PAR11= 0.   / CONSTANT TO BE ADDED TO Y COORDINATE
PAR12= 0.   / MINIMUM VALUE TO ACCEPT FOR CONTOURING
PAR14= 100. / ANNOTATION FREQUENCY
PAR15= 0.08 / ANNOTATION SIZE

MAP = 10000. 15000. 200. 2600. 4600. 200.

COM ALF1 = XVAL YVAL VALUE
COM FMT1 = (12X,3F12.3)
FMT1 = 16X,3F10.2

I-O = 0 / DEBUG
END
```

3) View the plot file generated in step 2) above, using the Advanced Procedure, ANYPLOT.

B) Contouring GradeXThickness Composite Data

Data from the composite file (File 9) is used to create this plot.

1) Initialize File 9 (the composite file) with the grade items, thickness item, and the contour item.
   - the grade item is the assay item (ie, totcu = total copper)
   - the thickness item is lngth in File 9.
   - the contour item should be initialized with a maximum equal to the maximum length X the maximum value of the grade item (i.e., cugt)

2) run m501v1 for fixed length compositing.
   - Attached is an example run501 file. Be sure to add or edit the highlighted portions.

Example run501.gt

```
MEDS-501V1   10=samp10.DAT   11=samp11.dat 12=samp12.dat;
MEDS-501V1    9=samp09.dat    3=rpt501.1a
**  COMPOSITE DRILLHOLE DATA    **

USR = abc  /   04-21-95  14:55

IOP1 =   1   0   / M12  & N12 LIMITS
IOP3 =   1   / START LOCATION FOR COMPOSITES IN FILE 9
IOP4 =  -1   / 0=COMPOSITE DH IN PCF LIMIT; -1=ALL DHS; 1=SPECIAL BOUND
IOP5 =  -1   / 0=PCF TOES; N=READ TABLE; -1=CALC. A TABLE
IOP6 =   0   / 0=STD. OUTPUT  &   1=PRINT DETAILS
IOP11=   1   / 1=FIXED LENGTH COMPOSITE

PAR1  = 4600   / ZMAX
PAR2  = 2600   / ZMIN
PAR3  =   50   /  DZ
PAR10= 2000   / FIXED LENGTH ((max lngth)

ITM01 = GRADE totcu totcu    / 1st grade to composite
ITM02 = THICK  LNGTH         / COMPOSITE THICKNESS
ITM03 = DEPTH  -TO-          / COMPOSITE DH DEPTH
ITM04 = ZMID   mid           / store mid-point elevation
ITM05 = totcu range .5 9999 / range of values to use

I-O = 1 / TYPE A LINE FOR EACH DH
END
```

3) run m508rp to calculate the item, cugt: cugt=totcu*lngth

4) run m507v1 and output the item: East, North, Assay Item (ie, cugt)
   - If you want to contour data on a particular plane or cross section, either use a boundary file after the END line or range on the particular Easting, Northing and Elevation the data of interest lies within.
   - Edit the output file, adding a '0 0' at the end of the output file.

5) run m607v4, to contour the data generated in the first step.
   - use the data from m507v1 generated in the previous step.
   - verify the MAP= line in the m607v4 run file. Be sure that the coordinates match whatever plane of data you are wanting to contour data on. For example, if the final result will be contours of an assay item on a particular cross section, the Ymin/max are equal to the elevation.

6) View the plot file generated in step 2) above, using the Advanced Procedure, ANYPLOT.

B) Contouring geologic data

Geologic data stored in either File 11 or 9 can be contoured either by creating surfaces from 3-D pierce points or by gridding surfaces (using File 13, the 2-D model file).

(1) Creating Surfaces from 3-D Drillhole Points

This procedures generates a plot or VBM-ready file of a geologic surface based on the geologic codes in either File 11 or File 9. An example of this type of surface would be structure contour map, and is easily created through Medtool. Simply choose the procedure, to "Contour a DH Surface" [p20306.dat]: Choose either the upper or lower surface of the geologic zone in question and create a plan-view plot or a VBM-ready file.

Example run607.dh1

```
MEDS-607V4  10=SAMP10.DAT  19=DAT203.XYZ  30=DAT650.501  3=RPT607.DH1 ** CONTOUR
DH COLLAR ELEVATIONS - ASCII FILE INPUT **

COM FILE 30 IS A 122 USERF FILE

USR  =abc  / 04-21-95
IOP1 = 0    / 0=NO BOUNDARY FILE, 1=USE BOUNDARY FILE
IOP2 = 100 / DXX MULTIPIER
IOP3 = 1    / 0=FREE FORMAT READ XYZ, 1=USE FMT1 & ALF1
IOP4 = 1    / 0=OUTPUT IS USERF FILE, 1=OUTPUT IS VBM DATA
IOP5 = 501 / IF IOP4=1, FEATURE CODE FOR VBM DATA
IOP6 = 0    / IF IOP4=0, 0=ASCII PLOT FILE, 1=BINARY PLOT FILE
IOP7 = 0    / NUMBER OF DECIMAL PLACES OF CONTOUR LABEL (DEFAULT = 0)
IOP8 = 1    / PEN NUMBER
IOP9 =   / PEN NUMBER OF HIGHLIGHT

PAR1 = 1000. / MAXIMUM TRIANGLE SIZE (A SEARCH RADIUS OF 30 METRES)
PAR2 = 5.0   / DATA GRID SIZE
PAR5 = 20.   / CONTOUR INTERVAL
PAR6 = 0.    / INTERVAL BETWEEN INDEX CONTOURS
PAR7 = 2600. / LOWER LIMIT OF CONTOUR ELEVATION
PAR8 = 4600. / UPPER LIMIT OF CONTOUR ELEVATION
PAR9 = 5.0   / SMOOTHING FACTOR FOR CONTOURS

PAR10= 0.    / CONSTANT TO BE ADDED TO X COORDINATE
PAR11= 0.    / CONSTANT TO BE ADDED TO Y COORDINATE
PAR12= 2600. / MINIMUM VALUE TO ACCEPT FOR CONTOURING

PAR14= 0. / ANNOTATION FREQUENCY (DEFAULT = 10)
PAR15= 0. / ANNOTATION LABEL SIZE (DEFAULT = 0.07)

COM CMD = INCL LOCPT FILE BOUND.DAT

MAP  = 10000. 20000. 500.  9150. 15000.  500. / X1-X2, Y1-Y2, SCALE
ALF1 = XCOORD YCOORD ZCOORD
FMT1 = ( 10X, 2F12.2, F9.2 )
I-O = 0 / MODIFY THE VARIABLE ITDBUG IF SET GREATER THAN 1
END
```

(2) Gridding a Surface

Gridding a surface utilizes File 13 data. Creating an isopach map is one example of how gridding a surface would be used in contouring geologic data. File 13 should already have been initialized with the following additional items; items for both the upper and lower surfaces ("surf1" and "surf2") which have the same elevations as initialized for topography ("topog"), and an item for the difference between these surfaces (ie, "iso1").

1) Generate VBM-ready files of both the upper and lower surfaces of a particular geologic zone based on the codes in either File 11 or File 9.

- Use the procedure described in the previous section, "Contour a DH Surface".

2) Load these features into a plane VBM.

3) Grid these two VBM features, using the procedure in Medtool, "Gridding from VBM Contours and DTM - m657v1/m635v1" [p65702.dat].
   - Do not extend the surface to be contoured to the PCF limits.
   - The resulting output from these programs is a file of gridded elevations, suitable for input into File 13.
   - Load this gridded data into the appropriate item (ie, surf1 and surf2) in File 13.

4) Use m612rp to calculate the difference between the elevations of the upper and lower surfaces in File 13 (ie, iso1 = surf1 - surf2).

5) Contour the resulting item, "iso1" using procedure, p60702.dat found in Medtool under either group list: 2-D topography, "Plot 2D Grid Contour", OR Advanced Procedures, "Contour Gridded Data".

Example run607.iso

```
MEDS-607V3  10=SAMP10.DAT  13=SAMP13.DAT  3=RPT607.ISO;
MEDS-607V3  30=PLT607.ISO
**  CONTOUR OF SURFACE FROM FILE 13  **

USR = abc  /  04-21-95

IOP1 = 0  / USE FILE 13
IOP2 = 0  / 0=BINARY OUTPUT, 1=ASCII OUTPUT
IOP3 = 0  / 0=OMIT BOUNDARY CHECKING, 1=USE BOUNDARY CHECKING
IOP4 = 1. 100. / COLUMNS
IOP6 = 1. 100. / ROWS
IOP9 = 1 / 0=OMIT AXES, 1=DRAW X,Y,Z AXES
IOP10= 0 / 0=PLAN VIEW LOOKING NORTH
IOP12= 0 / 1=READ PEN TRANSLATION NUMBERS, 0=NO TRANSLATION
IOP13= 0 / NUMBER OF ELEVATION INCREMENTS FOR COLORING (DEFAULT=32000)
IOP14= 1 / 0=SCALE BASED ON DATA MIN/MAX, 1=SCALE BASED ON PAR14-PAR15

PAR1 =   85. / VIEW LOOKING NORTH AT THESE DEGREES WEST
PAR2 =   30. /  VIEW DOWN AT THESE DEGREES
PAR10=   34. / PLOT SIZE IN PLOTTER UNITS
PAR12=    0  / MINIMUM VALUE FOR COLORING
PAR13=   20. / ELEVATION INCREMENT THAT TRIGGERS A COLOR CHANGE
PAR14=    0. / MINIMUM OF THE TOPO FOR PLOTTING
PAR15=  500. / MAXIMUM OF THE TOPO FOR PLOTTING

ITM5   = ISO1 RANGE 0. 2000.
ITM6   = ISO1 COLOR 1 16
GET13  = ISO1 / SURFACE ITEM

END
```

2.0 opt Au is 30', use 1.0 opt cutoff only with a 45' limiting range).

- Alternatives include indicator kriging or outlier restricted kriging (the ORK procedure was outlined in a paper presented at 23rd APCOM by A. Arik from Mintec).

- Run interpolation for each grade item using range limiting whereby only blocks with corresponding percentage >0 are assigned grade.

10) Grade & Tonnage calculation within blocks:

Avg. Au Grade = (AU1*P1)+(AU2*P2)+...+(AU5*P5)

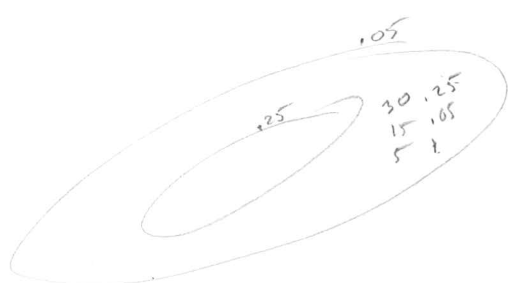
Tons = (P1*SPG1)+(P2*SPG2)+...+(P5*SPG5)*Volume*Conversion Factor
or assign average specific gravity to each block to simplify tons calculation

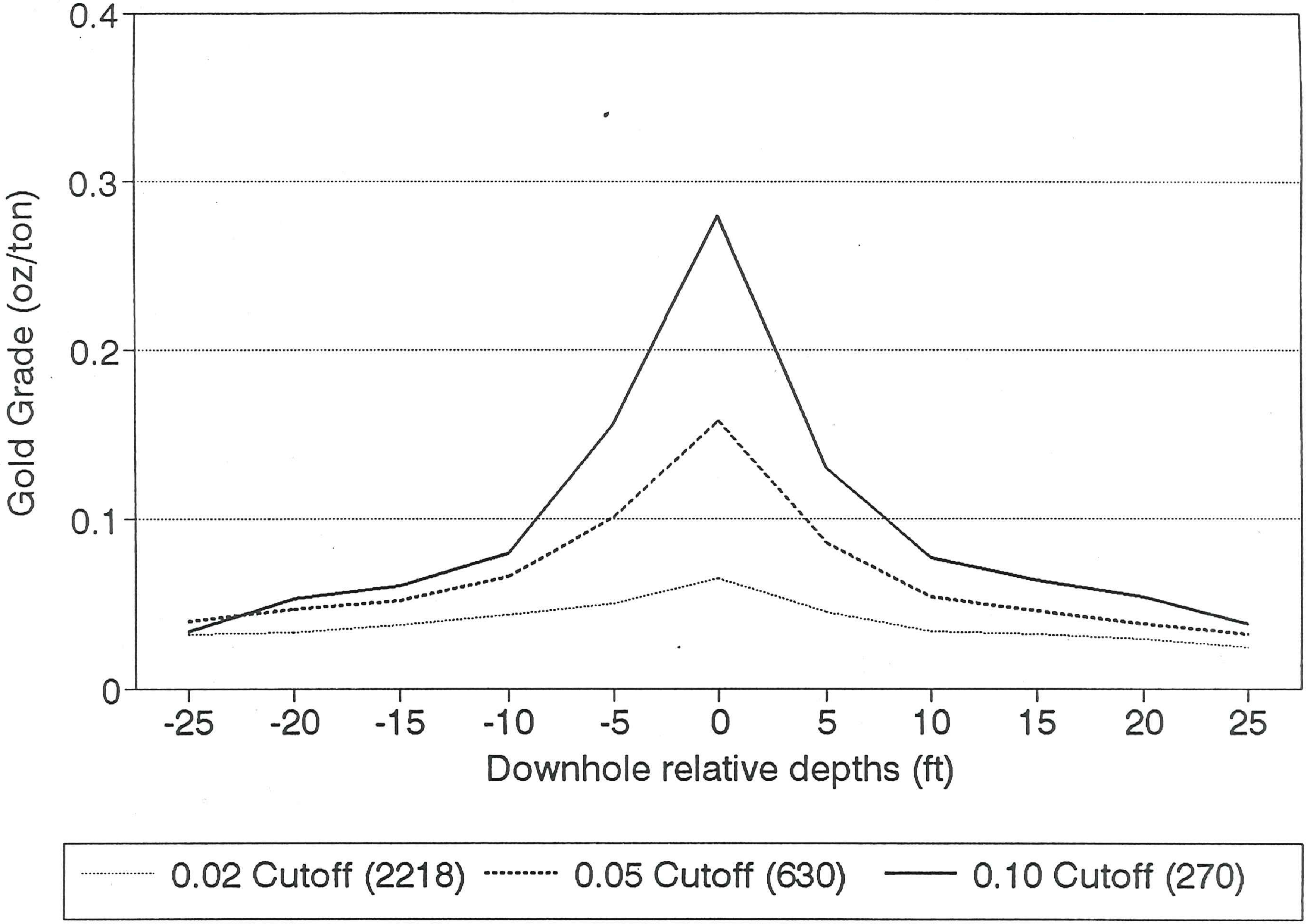
11) Ag Grade Interpolation:

- Ideally we would follow the same general procedure as for Au, but with time running short we may have to come up with a shortcut (open to suggestions).

Let me know if I misunderstood anything concerning our discussions or if there are any questions or comments.

BJH





0.4
0.3
0.2
0.1
0
Gold Grade (oz/ton)
-25
-20
-15
-10
-5
0
5
10
15
20
25
Downhole relative depths (ft)
0.02 Cutoff (2218)
0.05 Cutoff (630)
0.10 Cutoff (270)

DECAY STUDY

HECLA MINING COMPANY

December 9, 1994

MEMORANDUM TO: Charlie Muerhoff / Steve Ristorcelli

FROM: Brett Holmes BJH

SUBJECT: **Rosebud Block Modelling - Proposed Procedure**

In order to summarize our discussions from last Wednesday, I've developed a list of steps required to build a MEDS block model according to my understanding of the issues as follows:

1) Digitize sectional interpretations of grade domains as closed clockwise polygonal shapes with right hand coding and snapping points on coincident boundaries using M650.

2) Use M655V1 to calculate plane intersections of sectional features digitized in step 1 and plot on a 10' vertical increment.

3) Manually draw plan view interpretation of domains using intersection plots as a guide and redigitize as above.

4) Use M656V3 to calculate the domain code and the percentage of each domain within each block.

5) Initialize a block model file to include the following items:

Grade Item	Block % Item	Definitions
AU1	P1	All areas outside defined zones
AU2	P2	.01 - .05 opt Au
AU3	P3	.05 - .25 opt Au
AU4	P4	.25 - .60 opt Au
AU5	P5	+.60 opt Au

6) Load block percentages with M610.

7) Assign domain codes directly to assay file rock item with M217V1.

8) Composite grade and domain code using 10' fixed length comps calculated from the collar and honoring the domain code (no crossing of domain boundaries with comps).

9) Grade Interpolation:

- Easiest solution to using two high grade cutoffs for search limiting is to average the distance and use only the lower cutoff (ie. if 1.0 opt Au cutoff has 60' range and

Hecla Mining Company
Rosebud Project

October 28, 1994

Memo to: Ron Clayton

From: Charlie Muerhoff Charlie

Subject: Schedule for Rosebud Resource Estimate

The schedule for completing the January, 1995 Rosebud resource estimate is as follows:

Nov. 9: South and East Zones analytical, formational, and survey data to Brett Holmes (includes data acquired from both drilling and development).

Nov. 10-16: Brett will input data, run preliminary statistics (cumulative frequency, histograms of Au and Ag grades), run the procedure files and manufacture the full set of cross-sections for the South Zone. Cross-section files will be sent to Rosebud Project office for plotting.

Nov. 16: All available North Zone drill hole analytical, formational, and survey data to Brett Holmes.

Nov. 17-22: Brett will input data and generate sections for the North and East Zones. Cross-section files will be sent to Rosebud Project office for plotting.

Nov. 17-30: Cross-sectional geologic interpretation (C. Muerhoff, C. Wineteer).

Determine mineral/grade domains on cross-sections for grade modelling (S. Ristorcelli, C. Muerhoff).

Dec. 1-9: Digitize geologic boundaries (structure, lithology, etc.) and/or assay boundaries into MEDS (B. Holmes ± C. Muerhoff).

Dec. 10-16: Compose 3-D model in MEDS and slice onto bench plan maps (B. Holmes).

Dec. 17-30: Generate and plot MEDS level maps with pertinent geology, mineral zones, and composite data; redigitize pertinent geology and mineral zones onto bench plan maps. Check for geologic and analytical accuracy (B. Holmes, C. Muerhoff ± S. Ristorcelli).

Dec. 17-Jan. 6: Complete cross-sectional reserve calculations (C. Muerhoff).

Jan. 1-7: MEDS geostatistics and grade estimate (B. Holmes ± S. Ristorcelli).

Jan. 7-15: Mine Development Associates final review and audit (S. Ristorcelli).

Hecla Mining Company internal review and audit (R. Tschauder, F. Stahlbush).

Jan. 15-19: Prepare final document (C. Muerhoff).

Jan. 20: Submit final document to R. Clayton.

The resource estimate will include South Zone underground drill hole data (92 holes), surface drill hole data (11 holes) and underground development data, East Zone drill hole data (20 holes), 70% of the North Zone drill hole data, and all of the pre-existing LAC drill hole data.

CALL ME AN ENGINEER WILL YOU!

Drilling in the North Zone has been much slower than anticipated due to the poorer than expected drilling conditions. Therefore, five of the 16 North Zone holes will not be completed in time to include the data in this first pass of the resource estimate. Two of the drill holes are located internal to the current North Zone ore boundaries, designed to confirm continuity of ore grades between existing LAC drill holes, which would increase the confidence level in this portion of the North Zone. The other three drill holes are located along the periphery of the current boundary and would serve to either extend the ore-grade boundary (i.e., expand the resource) of the North Zone or provide a more accurately-defined assay boundary.

Please be aware that the above dates are not carved in stone (except January 20) and are subject to minor changes as the project progresses. Steve Ristorcelli will advise and assist Brett with the statistical modelling and determining the proper krieging method, in addition to being available throughout the project for consultation and on-going review, as requested.

cc: D. Gray
R. Tschauder
F. Stahlbush
B. Holmes
S. Ristorcelli, MDA

GRADE DOMAINS

1. 0.010 - 0.049 opt Au - blue
2. 0.050 - 0.249 opt Au - green
3. 0.250 - 0.599 opt Au - pink
4. 0.600 + opt Au - purple

} Applies to South Zone blocks on HW of South Ridge Fault & all East & North Zone blocks.

5. 0.010 - 0.049 opt Au - blue
6. 0.050 - 0.249 opt Au - green
7. 0.250 - 0.599 opt Au - pink
8. 0.600 + opt Au - purple

} Applies to South Zone blocks within & in FW of South Ridge Fault.

9. Alluvium / overburden (no color)
10. < 0.010 opt Au ; i.e., waste (no color)

you may see some blocks in the FW of the fault with domains of 1 - 4, depending on the interpeted style of mineralization.

Used 1-4 for HW of SRF
5 - 8 in & FW of SRF

11 - For East mineralization

ROSEBUD ASSAY FILE ITEMS

NAME	MIN	MAX	PRECISION
REF#	0	1000	1.
FROM	0	2000	0.1
-TO-	0	2000	0.1
-AI-	0	2000	0.1
GOLD	0	20	0.001
SILVR	0	150	0.01
EQAU	0	20	0.001
AUCN	0	20	0.001
AGCN	0	150	0.01
CUCN	0	1	0.001
C	0	1	0.01
SIO2	0	1	0.01
SB	0	1	0.01
CLAY	0	1	0.01
SPGR	0	5	0.01
ROCK	1	25	1.
ZONE	1	25	1.
EXTRA	1	25	1.

ROSEBUD COMPOSITE FILE ITEMS

NAME	MIN	MAX	PRECISION
REF#	0	1000	1.
EAST	480000	484500	0.1
NORTH	2202000	2205500	0.1
ELEV.	4200	6100	0.1
-TO-	0	2000	0.1
LNGTH	0	10	0.1
GOLD	0	20	0.001
SILVR	0	150	0.01
EQAU	0	20	0.001
ROCK	0	25	1.
ZONE	0	25	1.
EXTRA	0	25	1.

ROSEBUD PROJECT 1994 10' X 10' BLOCK MODEL

CREATED 12-02-94 & UPDATED 12-02-94 15:55:45

P R O J E C T   C O N T R O L   F I L E   ROSE10.DAT

(239) = TOE ELEVATION OF LEVEL #189 = 4210.0 HEIGHT = 10.0
(240) = TOE ELEVATION OF LEVEL #190 = 4200.0 HEIGHT = 10.0

*** Current program execution:	Elapsed time (sec)	Date	Time
M101V1	0	12-02-94	15:55:45

Hecla
MINING COMPANY
Centennial
1891-1991

Technical Services

Fax: (208) 769-4122

Date: 12/9/94

To: Charlie (wherever you are)

From: Brett

Hecla Mining Company

Transmitting: 3 Pages
(Including Cover)

Operator:

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Hecla
MINING COMPANY
Centennial
1891 - 1991

Technical Services

Fax: (208) 769-4122

Date: 9/2/94

To: Charlie Muerhoff

Rosebud

From: B. Holmes

Hecla Mining Company

Transmitting: 3 Pages
(Including Cover)

Operator:

Charlie -

Here's my stab at input formats for the DH assay + survey files. Questions / Comments?

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Rosebud Project
DH Assay Sample Input File

BJH
09/02/94

DH ID	FROM	TO	-AI-	AU1	AU2	AU3	AU(avg)	AUCN	AG	% C	% SILICA	% Hg	% Cu	% Sb	% CLAY	RQD
KM3	0.0	5.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.01	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
KM3	5.0	10.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.01	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
KM3	10.0	15.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.03	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
KM3	15.0	20.0	5.0	-1.0	-1.0	-1.0	0.020	-1.0	0.04	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
KM3	20.0	25.0	5.0	-1.0	-1.0	-1.0	0.149	-1.0	0.07	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
KM3	25.0	30.0	5.0	-1.0	-1.0	-1.0	0.002	-1.0	0.03	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	0.0	5.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	5.0	10.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.13	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	10.0	15.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.12	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	15.0	20.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.10	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	20.0	25.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	25.0	30.0	5.0	-1.0	-1.0	-1.0	0.002	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	30.0	35.0	5.0	-1.0	-1.0	-1.0	0.002	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	35.0	40.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	40.0	45.0	5.0	-1.0	-1.0	-1.0	0.000	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL17C	45.0	50.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	6.0	11.5	5.5	-1.0	-1.0	-1.0	0.003	-1.0	0.17	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	11.5	18.0	6.5	-1.0	-1.0	-1.0	0.002	-1.0	0.19	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	18.0	24.5	6.5	-1.0	-1.0	-1.0	0.002	-1.0	0.16	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	24.5	29.5	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	29.5	34.5	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	34.5	38.4	3.9	-1.0	-1.0	-1.0	0.002	-1.0	0.19	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL40C	38.4	41.6	3.2	-1.0	-1.0	-1.0	0.006	-1.0	0.12	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL41C	0.0	5.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL41C	5.0	10.0	5.0	-1.0	-1.0	-1.0	0.002	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL41C	10.0	15.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.00	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
RL41C	15.0	20.0	5.0	-1.0	-1.0	-1.0	0.001	-1.0	0.11	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0

Rosebud Project
DH Survey Sample Input File

BJH
09/02/94

DH ID DH ID	EASTING FROM	NORTHING TO	ELEVATION -Al-	AZIMUTH AZIMUTH	DIP DIP	DEPTH	
							<"COLLAR SURVEY ITEMS" <"DOWNHOLE SURVEY ITEMS"
KM3	482194.6	2204028.0	5335.0	276	-88.0	974.5	<"COLLAR SURVEY"
KM3	400.0	600.0	200.0	300	-87.3		<"DOWNHOLE SURVEY"
KM3	600.0	800.0	200.0	301	-87.2		<"DOWNHOLE SURVEY"
KM3	800.0	974.5	174.5	288	-86.0		<"DOWNHOLE SURVEY"
RL17C	481803.5	2204370.0	5275.4	144	-61.0	1065.0	
RL17C	50.0	200.0	150.0	141	-62.5		
RL17C	200.0	450.0	250.0	143	-66.0		
RL17C	450.0	650.0	200.0	144	-70.5		
RL17C	650.0	800.0	150.0	146	-71.0		
RL17C	800.0	982.5	182.5	150	-71.5		
RL17C	982.5	1065.0	82.5	147	-71.5		
RL40C	481364.0	2203538.0	5248.8	186	-58.0	610.0	
RL40C	102.5	305.0	202.5	172	-57.5		
RL40C	305.0	505.0	200.0	170	-58.8		
RL40C	505.0	610.0	105.0	170	-60.1		
RL41C	481366.5	2203548.0	5248.8	115	-67.0	624.0	
RL41C	45.8	91.5	45.7	116	-65.5		
RL41C	91.5	225.0	133.5	116	-66.0		
RL41C	225.0	400.0	175.0	114	-66.7		
RL41C	400.0	550.0	150.0	112	-67.8		
RL41C	550.0	624.0	74.0	110	-68.8		

do we need z from & to?

what about the shot taken @ the eoh?

Hecla
MINING COMPANY
Centennial
1891 - 1991

Technical Services

Fax: (208) 769-4122

Date: 9/2/94

To: Charlie Muerhoff

Rosebud

From: B. Holmes

Hecla Mining Company

Transmitting: 3 Pages
(Including Cover)

Operator: ______________

Charlie -

Here's the memo that goes w/ the sample input sheets I sent earlier.

6500 Mineral Drive • Box C-8000 • Coeur d'Alene, Idaho 83814-1931 • 208/769-4100 • FAX 208/769-4107

HECLA MINING COMPANY

September 2, 1994

MEMORANDUM TO: FRED STAHLBUSH

FROM: BRETT HOLMES BJH

SUBJECT: MEETING W/ STEVE RISTORCELLI / MDA

A meeting was held in the offices of Mine Development Associates (MDA) in Reno, NV on Tuesday, August 30, 1994 to discuss reserve modelling issues at the Rosebud Project. Present at the meeting were Steve Ristorcelli, Charlie Muerhoff, and myself. The primary purpose was to discuss the mechanics of the reserve compilation and MDA's role in auditing the results. The following topics were discussed:

- DH data entry - who will do it, what items will be compiled, and in what format.
- Geologic interpretive features - same issues as above.
- Reserve reporting issues - proven/probable vs. measured/indicated/inferred.
- Modelling limits, block size, grid rotation.

Concerning the first topic, Charlie reported that no drillhole information has been entered into a computer input file as of the meeting date. Therefore, it was suggested to Charlie that a temporary data entry person be hired at the site to enter the information as it is received. It was decided that the drillhole data should be entered in two separate Lotus files, one for assays and the other for surveys. Suggested sample formats are attached.

As the data is entered, the files will be periodically sent to Technical Services, where I will enter the info. into MEDS and build plot files of the updated sections. These section files will be returned to the Rosebud office where interpretive features will be added. The completed sections will then be shipped once again to Technical Services for entry into MEDS. The interpretive features will be used to define zones of mineralization for statistics and modelling purposes.

One block model of sufficient size to encompass all areas of interest is envisioned. Blocks 10 feet in the horizontal dimensions and a vertical height to be determined after studying optimum composite lengths was anticipated. We will not rotate the grid to some artificial mine grid that no one will understand in the future (state plane coordinates).

Mr. Ristorcelli informed us that it would be the opinion of his firm that the reserves reported at the conclusion of this modelling effort would not be reportable as proven and probable reserves. Until actual stope boundaries are placed on the blocks and economic extraction is demonstrated, the results will fall into the resource categories of Measured, Indicated, and

Inferred. This model should be considered a global model representing the in place geologic resource without mining constraints of ore loss or dilution being imposed. Further work would be required to demonstrate proven and probable ore reserves. Steve was asked to send a memo stating Mine Development Associates' policy regarding reserve reporting and the criteria associated with the various reserve categories.

BJH

ATTACHMENTS

CC: Charlie Muerhoff
Don Gray

SURVEY STATIONS LISTING FROM DATABASE rosebud

station_id	station_fr	level	y	x	z_back	z_flo
DDS16	RB-49	DESTROYED	2203892.578	481719.830	4656.33	4645.
DDS18	RB-49	DESTROYED	2203964.305	481773.545	4658.37	4643.
DDS19	RB-49	DESTROYED	2204008.645	481803.561	4659.00	4645.
DDS3	RB-35	DESTROYED	2203391.812	481292.023	4752.69	4739.
DDS4	RB-35	DESTROYED	2203426.155	481326.873	4746.29	4731.
RB-T1A	RB-35	DESTROYED	2203425.029	481324.923	4746.11	4730.
RB-T2A	RB-37	DESTROYED	2203500.773	481392.139	4730.32	4716.
TP-94-01	E7-93	DESTROYED	2203022.369	479713.152	5086.58	5086.
TP-94-02	TP-94-01	DESTROYED	2202988.312	479696.707	5079.46	5079.
XC1	RB-49	DESTROYED	2203851.712	481851.654	4658.05	4647.

SURVEY STATIONS LISTING FROM DATABASE rosebud

station_id	station_fr	level	y	x	z_back	z_flo
D-1-94	RB-35	DRILL	2203351.139	481277.265	4759.82	4746.
D-10-94	RB-37	DRILL	2203452.887	481377.327	4736.87	4736.
D-11-94	RB-37	DRILL	2203452.892	481377.355	4735.14	4735.
D-12-94	RB-37	DRILL	2203452.971	481377.389	4731.48	4731.
D-13-94	DDS6	DRILL	2203498.055	481404.867	4730.60	4730.
D-14-94	DDS6	DRILL	2203495.954	481407.471	4731.62	4731.
D-15-94	DDS6	DRILL	2203494.061	481409.832	4730.88	4730.
D-16-94	DDS6	DRILL	2203491.695	481412.615	4728.98	4728.
D-17-94	DDS6	DRILL	2203489.845	481414.717	4726.21	4726.
D-18-94	DDS6	DRILL	2203489.509	481415.234	4722.27	4722.
D-19-94	RB-40	DRILL	2203538.022	481456.584	4710.30	4710.
D-2-94	RB-35	DRILL	2203348.348	481281.723	4758.85	4745.
D-20-94	RB-40	DRILL	2203538.958	481455.080	4719.95	4719.
D-21-94	RB-40	DRILL	2203541.776	481451.033	4726.03	4726.
D-22-94	RB-40	DRILL	2203544.666	481446.514	4723.26	4723.
D-23-94	DD8	DRILL	2203563.836	481481.377	4705.46	4705.
D-24-94	DD8	DRILL	2203563.675	481481.363	4708.65	4708.
D-25-94	DD8	DRILL	2203563.525	481481.614	4710.10	4710.
D-26-94	DD8	DRILL	2203564.121	481480.360	4717.13	4717.
D-27-94	DD8	DRILL	2203569.752	481471.806	4713.94	4713.
D-29-94	RB-41	DRILL	2203602.740	481517.464	4701.04	4701.
D-3-94	DDS3	DRILL	2203373.276	481306.381	4753.54	4753.
D-30-94	RB-41	DRILL	2203602.642	481517.521	4703.98	4703.
D-31-94	RB-41	DRILL	2203603.858	481516.283	4711.11	4711.
D-32-94	RB-41	DRILL	2203611.123	481506.055	4709.15	4709.
D-33-94	DDS10	DRILL	2203634.176	481547.762	4693.32	4693.
D-34-94	DDS10	DRILL	2203634.159	481547.566	4695.47	4695.
D-35-94	DDS10	DRILL	2203634.489	481547.024	4700.10	4700.
D-36-94	DDS10	DRILL	2203637.201	481544.104	4704.79	4704.
D-37-94	DDS10	DRILL	2203640.224	481540.844	4703.64	4703.
D-4-94	DDS3	DRILL	2203370.775	481308.629	4748.69	4748.
D-43-94	DDS12	DRILL	2203712.749	481619.694	4676.91	4676.
D-44-94	DDS12	DRILL	2203712.905	481619.467	4679.02	4679.
D-45-94	DDS12	DRILL	2203713.908	481617.940	4685.14	4685.
D-46-94	DDS12	DRILL	2203717.992	481611.278	4686.75	4686.
D-47-94	DDS13	DRILL	2203745.344	481651.938	4669.42	4669.
D-48-94	DDS13	DRILL	2203748.258	481648.242	4678.40	4678.
D-49-94	DDS13	DRILL	2203751.401	481643.186	4678.20	4678.
D-7-94	DDS4	DRILL	2203405.778	481365.798	4740.89	4740.
D-8-94	RB-37	DRILL	2203454.210	481375.735	4740.15	4740.

SURVEY STATIONS LISTING FROM DATABASE rosebud

station_id	station_fr	level	y	x	z_back	z_flo
DDF11	RB-44	FACE	2203676.281	481611.880	4687.97	4687.
DDF13	DDS13	FACE	2203748.650	481653.733	4670.90	4670.
DDF14	DDS14	FACE	2203797.888	481682.055	4662.51	4662.
DDF15	DDS15	FACE	2203840.561	481715.128	4654.83	4654.
DDF16	DDS16	FACE	2203868.157	481732.274	4651.27	4651.
DDF18	DDS18	FACE	2203950.357	481794.780	4652.15	4652.
DDF19	DDS19	FACE	2203997.636	481822.533	4651.93	4651.
DDF8	DDS8	FACE	2203563.994	481481.095	4705.37	4705.
DDF9	RB-41	FACE	2203602.774	481517.230	4700.45	4700.
DFE1	RB-49	FACE	2204015.621	481807.453	4649.44	4649.
F1	RB-01	FACE	2202877.542	479807.559	5060.22	5060.
F10	RB-18	FACE	2202502.329	480474.255	4940.40	4940.
F11	RB-21	FACE	2202694.846	480651.141	4888.26	4888.
F12	RB-23	FACE	2202856.795	480783.675	4858.16	4858.
F13	RB-25	FACE	2202985.360	480902.079	4832.06	4832.
F14	RB-27	FACE	2203095.475	481005.219	4810.43	4810.
F15	RB-29	FACE	2203233.384	481131.606	4778.96	4778.
F16	RB-29	FACE	2203085.800	481064.922	4811.68	4811.
F17	RB-31	FACE	2203388.841	481277.506	4747.81	4747.
F18	RB-35	FACE	2203348.780	481283.093	4753.58	4753.
F19	RB-35	FACE	2203431.191	481335.318	4738.01	4738.
F2	RB-04	FACE	2202800.531	479855.120	5043.82	5043.
F20	RB-T1A	FACE	2203407.422	481361.819	4745.49	4745.
F21	RB-37	FACE	2203553.455	481446.399	4713.29	4713.
F22	RB-41	FACE	2203551.942	481444.671	4709.09	4709.
F23	RB-41	FACE	2203697.771	481581.680	4683.32	4683.
F24	RB-44	FACE	2203784.396	481655.607	4663.52	4663.
F25	DDS14	FACE	2203911.069	481743.228	4653.60	4653.
F3	RB-05	FACE	2202706.236	479928.298	5024.11	5024.
F4	RB-09	FACE	2202702.403	479948.096	5022.17	5022.
F5	RB-09	FACE	2202546.205	480092.181	4988.41	4988.
F6	RB-11	FACE	2202485.927	480186.906	4972.02	4972.
F7	RB-13	FACE	2202478.489	480303.669	4956.99	4956.
F8	RB-16	FACE	2202522.941	480426.606	4933.23	4933.
F9	RB-18	FACE	2202591.970	480554.991	4909.60	4909.
XCF1	RB-49	FACE	2203853.287	481840.458	4653.10	4653.
XCF2	XC1	FACE	2203782.935	481944.846	4654.52	4654.

SURVEY STATIONS LISTING FROM DATABASE rosebud

station_id	station_fr	level	y	x	z_back	z_flo
RB-01	TP-94-02	DECLINE	2202933.820	479759.943	5076.82	5062.
RB-04	RB-01	DECLINE	2202876.250	479805.062	5065.14	5051.
RB-05	RB-04	DECLINE	2202783.606	479877.679	5047.61	5033.
RB-09	RB-05	DECLINE	2202597.858	480023.389	5009.28	4995.
RB-11	RB-09	DECLINE	2202536.204	480094.090	4994.11	4980.
RB-13	RB-11	DECLINE	2202488.328	480198.751	4977.23	4963.
RB-16	RB-13	DECLINE	2202483.633	480309.241	4961.23	4948.
RB-18	RB-16	DECLINE	2202514.769	480420.520	4944.23	4930.
RB-21	RB-18	DECLINE	2202599.048	480552.829	4918.46	4904.
RB-23	RB-21	DECLINE	2202703.330	480649.350	4894.61	4881.
RB-25	RB-23	DECLINE	2202858.483	480793.023	4863.22	4849.
RB-27	RB-25	DECLINE	2202993.790	480918.344	4836.56	4823.
RB-29	RB-27	DECLINE	2203094.466	481011.679	4817.63	4803.
RB-31	RB-29	DECLINE	2203229.489	481136.662	4787.93	4773.
RB-35	RB-31	DECLINE	2203364.706	481261.824	4759.78	4746.
RB-37	RB-35	DECLINE	2203465.423	481355.152	4739.02	4725.
RB-40	RB-37	DECLINE	2203547.472	481431.078	4721.02	4708.

@ 1960 mag declination = 18° E

Δ = ± 1' / yr

@ 1994 → 34' change → 18° 34' → 18½° declination

for void in canyon

geotech holes ~~a~~ asked for 20; did 12

trenching / test pits ½ zone

~~need~~

- make every column one space ~~less~~ more than largest value.

MEDS ITEMS

Data Entry

Au Ag (weighted average for different methods of assaying)

carbon (% or degree of intensity - scale of 1 to 10? etc..)

silicification

geochem clay content (% or relative)

CN leach analysis.

- Mineral zone (stockwork vs. stratiform)
- Rock Type

later on

Format

hole ID - from - to - interval - then items above

hole ID ~~azimuth dip~~ X Y Z azimuth dip depth

hole ID azimuth dip depth

disregard surface

* call Terramatrix - do we want geotech sections from MEDS?

Density values will be plotted on sections

Meds -1 undefined "0" for less than detection

-2 no data

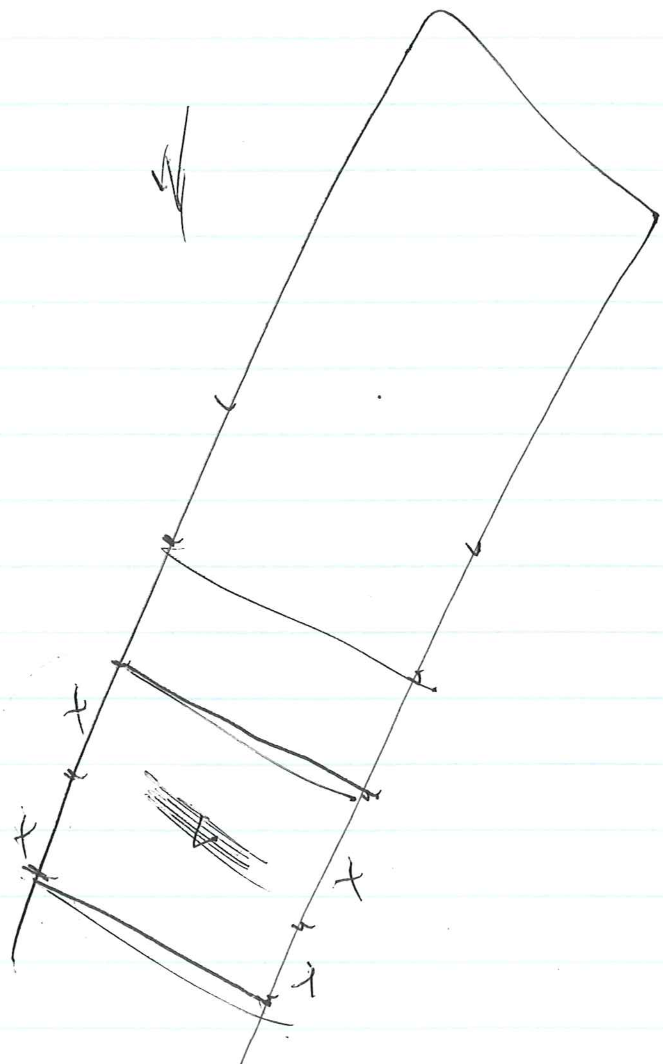
* check about data entry person for a month or two.

goes into same file as assay data

~~Lithology~~

- Formation,
- stratigraphic marker beds
- Au
- Ag

first set ? sections



Creation of MEDSYSTEM metafile overlays from TRIPOD graphical output

Ron R. Parent, P. Geol.

Gregg River Resources Ltd., Bag Service 5000, Hinton, Alberta T7V 1V6, Canada

Abstract

TRIPOD is a geological mapping package developed by the University of Alberta and distributed through GAIA Resources of Calgary. It is used for the quick and accurate storage and retrieval of geological information both from outcrop (natural and pit excavations) and drillholes. Detailed analysis of structural information including bedding, faults, joints and cleavage orientation can be carried out. This analysis is very helpful in creating down-plunge cross sections. This is especially useful in areas with steeply plunging fold axes, where it is necessary to project mapping and blasthole information even from as little as 5 metres onto section parallel to the local fold plunge.

The Gregg River Mine is situated within the foothills of the Rocky Mountain Thrust and Fold Belt. The sedimentary strata were highly deformed during the late stages of the Laramide Orogeny. This deformation created a series of upright to tightly overturned coal bearing synclines known as the Cadomin-Luscar coalfield.

Currently at Gregg River we use TRIPOD to store and retrieve all pit mapping and blasthole information. Through the development of an in-house program we have been able to create MEDSYSTEM metafile overlays of this data for use with sectional VBM data using the program M122MF.

We create VBMs for operating pits using a 10 metre cross section spacing. These sections are usually interpolated from drilling on 50 to 100 metre spacings. The result, for a pit with a 2 kilometre strike length, is a VBM with 200 sections. A number of steps must be carried out to arrive at a MEDSYSTEM metafile overlay for a particular section. Carrying each step out for every section would be very tedious. A program was developed to aid in this repetitive task. It creates a batch file that, when run on a PC workstation after a preliminary series of setup steps, will: 1) run TRIPOD to create the output; 2) run our in-house program (TRIMETA) to create M122 run file and; 3) run M122MF to create the metafile overlay for each cross section required.

Paper cross sections are re-plotted periodically depending upon the amount of changes to the geological model that are required. When cross section updates of paper copies are produced, the program M126MF is used to create USERF files for plotting.

Once all the metafiles have been created for a particular pit area, interactive on screen editing of VBM data can be carried out accurately and with great ease. Periodic updating of metafile overlays and associated VBM data as new information is acquired is routinely carried out. Accurate bench plans can then be created from this up to date VBM data to help the blasting engineers design their patterns.

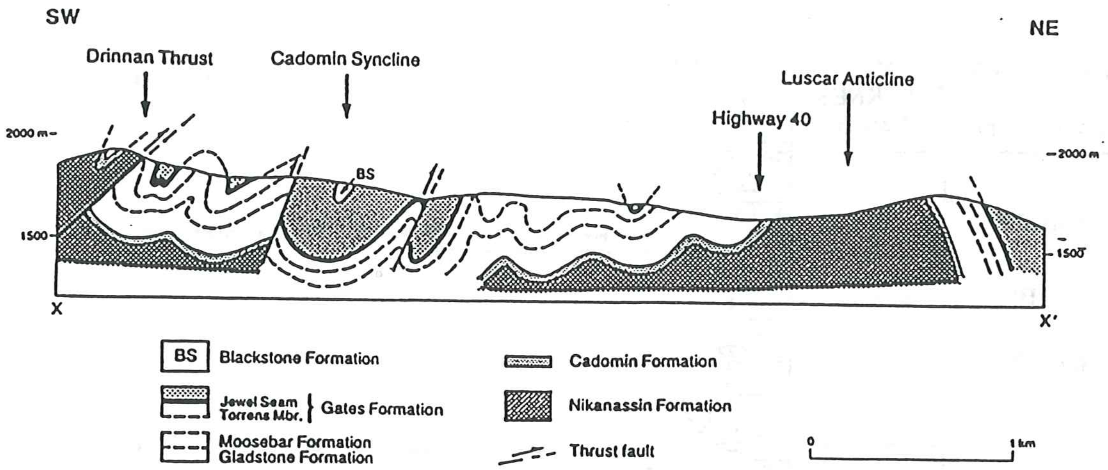


Figure 2. Regional cross section through Cadomin-Luscar coalfield (Langenberg, MacDonald, and Kalkreuth, 1989).

Several stratigraphic marker horizons exist within the stratigraphic column. Each of these horizons, be they coal seams, formation contacts, or member boundaries, are assigned what is known as a "horizon code" (figure 3). Geological information can then be retrieved selectively by structural data type (bedding, joints, cleavage, fault, folds, or stratigraphic position information from drillholes), horizon code and area for producing cross sections (vertical and down plunge) and maps.

STRUCTURAL DATA ANALYSIS

Once geological mapping and blasthole information has been obtained in the field, it is incorporated into existing databases. In cases where local strike is essentially constant (i.e., no folding -- or folds plunge less than 5 degrees), most stratigraphic positional and structural data can be projected perpendicular to the orientation of the cross section. However, in some cases folds plunge upwards of 30 degrees. The exact trend and plunge of local and regional fold axes can be obtained from stereographic projections and cylindrical domain analyses performed using TRIPOD. In instances like this it is necessary to project structural information parallel to the local fold axis even for distances of less than 5 metres. The result is a down plunge projection of information onto a vertical cross section (figure 4). Plotting by hand in cases like this would be very time consuming indeed.

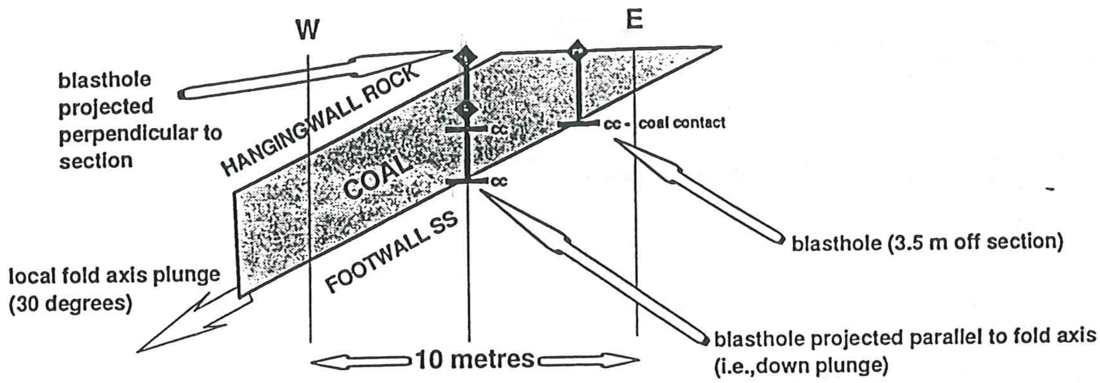


Figure 4. Schematic longitudinal cross section showing effects of down plunge projection.

OVERLAYING TRIPOD GRAPHICAL OUTPUT

One of our primary concerns before obtaining TRIPOD was how we were going to be able to incorporate the use of this software with MEDSYSTEM. I had discussed this problem with another TRIPOD user who uses LYNX. He had recently done essentially the same thing. The result was a program written in Microsoft C language called TRIMETA. This program takes TRIPOD output in an HPGL (Hewlitt-Packard Graphics Language) file and converts it to an M122MF run file. This run file is then used to create the metafile overlay for a particular section. The newly created metafile can then be used to update cross sectional VBM data. We currently create VBMs for operating pits using a 10 metre cross section spacing. These sections are usually interpolated from drilling on 50 to 100 metre spacings. The result, for a pit with a 2 kilometre strike length, is a VBM with over **200** sections.

A summary of all the steps required to produce a single TRIPOD metafile overlay for VBM editing is shown in figure 5. These steps are often repetitive for a series of related sections. As a consequence of this repetitiveness, a program was developed to create a batch files for use on the PC workstation containing TRIPOD. This batch file will carry out the entire procedure from executing TRIPOD to produce graphical output to creating the metafile overlay required for VBM editing.

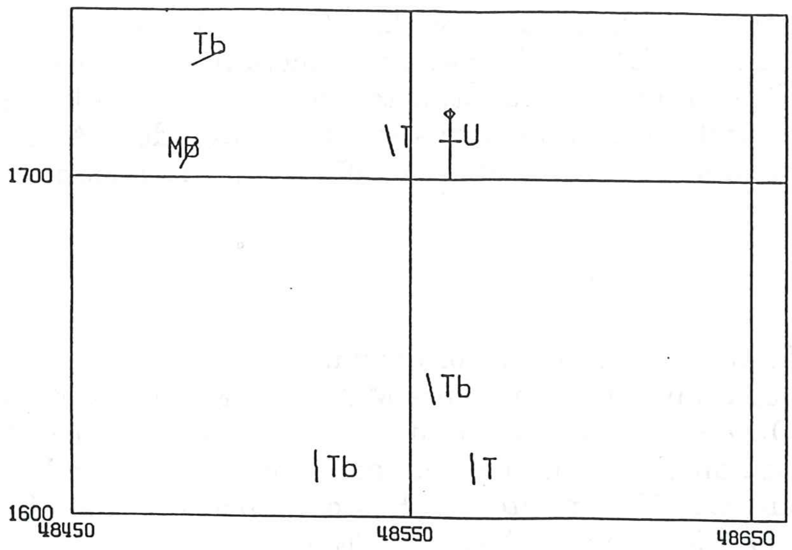


Figure 6. TRIPOD cross section plot of mapping and blasthole information.

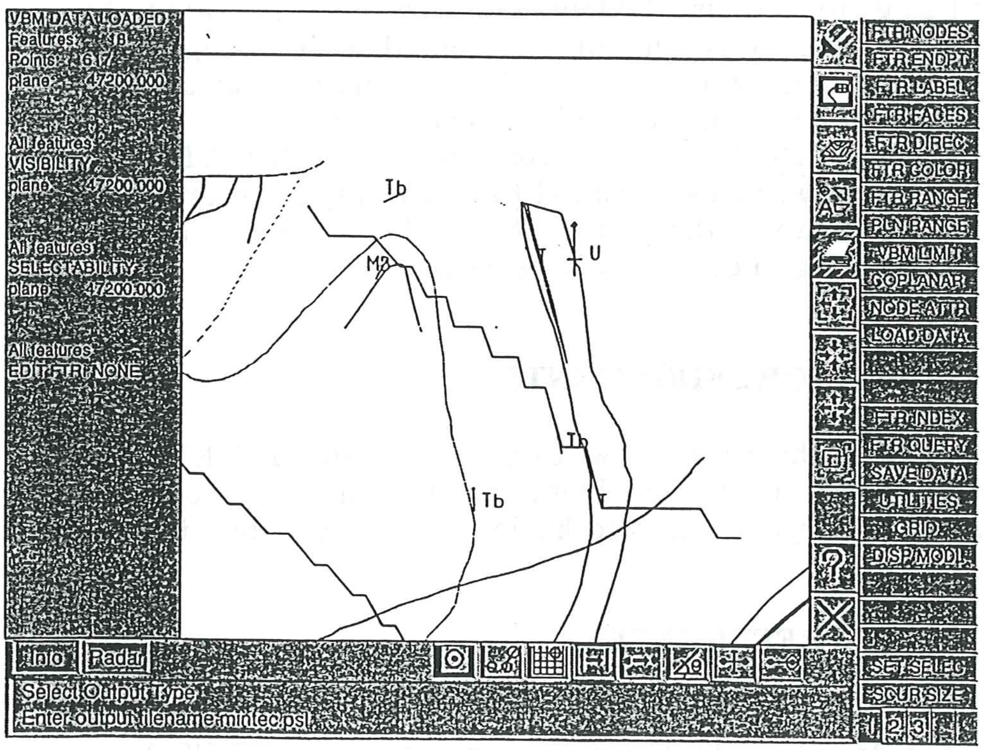


Figure 7. VBM Editor with TRIPOD metafile overlay.

Langenberg, W., Macdonald, D. and Kalkreuth, W., 1989. Geology and Coal Quality of the Cadomin-Luscar Coal Field, Alberta; Alberta Research Council Open File Report 1989-09, 71 p.

Brett/Charlie: Comments. Don

HECLA MINING COMPANY

May 13, 1994

MEMORANDUM TO: Charlie Muerhoff

FROM: Brett Holmes BJH

SUBJECT: **Rosebud Reserve Compilation Work Scope**

The following represents my attempt to define a work scope for the Rosebud reserve compilation project. I envision the following tasks:

1) Assays returned to Rosebud project office from the lab in Lotus format.

2) Rosebud personnel combine assays with lithologic and survey information in a format compatible with MEDSYSTEM input format (attached).

3) When enough data has been received to warrant the building of a section, the Lotus DH input file will be transferred to the corporate office, preferably via modem to the Local Area Network (LAN).

4) The information is then loaded into MEDSYSTEM by B. Holmes and a section (or sections) generated along with any statistics that may be appropriate.
→ discuss: what & how will we establish modelling parms use of current data;

5) The section will be transferred in ACAD DXF compressed format to the Rosebud project area on the LAN.

6) Rosebud personnel will download the section file from the LAN and C. Muerhoff will add interpretations to the ACAD file.

7) The finished ACAD section file with interpretive features is transferred back to the corporate LAN via modem and the boundaries necessary to grade modelling are entered into MEDS VBM (variable block model) format.

8) Once the geologic model is built in MEDS, grade modelling can proceed.

The turnaround time at corporate for initially building the section should be about a day. Since the building of the MEDS geologic model will be ongoing, it is anticipated that grade modelling can begin a day or two after the final section is received. Building the grade model and outputting bench plans will take two to three weeks depending on problems encountered and revisions made. The final product (bench plans) can be provided in hardcopy and/or ACAD electronic form depending on your needs.

How do we allow for 3-d reconciliation of geologic/ore shapes? We will model to a cutoff grade or series of cut-grade or will we model to limits of grade?

Let me know if you have any suggestions or additions to this list. I'll be gathering any files

Fine tune MRA model or re-do. If we generate model w/ existing data.

available from Larry Allen's work at Mine Reserve Associates and laying the groundwork for the modelling effort.

BJH

Attachments

cc: D. Gray
F. Stahlbush

SETTING UP DRILLHOLE DATA

The order of drillhole data should be:

1. Collar line
2. Optional survey lines
3. End of surveys line (DH-IDENT followed by blanks)
4. Assay intervals (one per line)
5. End of assays line (blank)

1. COLLAR LINE

There are two possible forms of the collar line. If the data contains six field bearing and dip angles (IOP10= 0 in M201V1), you must specify data in the following order:

Variable	Description
DH	DH identification: max. of 10 columns
XC	Easting of the collar
YC	Northing of the collar
ZC	Elevation of the collar
IY	True heading (N,S) indicator (*)
ADEG	Degrees of the bearing angle
AMIN	Minutes of the bearing angle
IX	True heading (E,W) indicator (*)
DDEG	Degrees of the dip angle
DMIN	Minutes of the dip angle
TLEN	Total length of the drillhole

(*) The true heading indicators (IX & IY above) are blank for north azimuths.

If the data contains two field bearing and dip angles (IOP10= 1 in M201V1), you must specify data in the following order:

Variable	Description
DH	DH identification: max. of 10 columns
XC	Easting of the collar
YC	Northing of the collar
ZC	Elevation of the collar
AZIM	Azimuth of hole (from north)
DIP	Dip of hole
TLEN	Total length of the drillhole

The format statement (FMT1) for reading the data may be whatever you desire. However, all variables must be included in the format, even if they are blank. Additional items can follow the required items listed.

Example of six field angle format:

(10A1,3F10.2,A1,F8.0,F1.0,A1,F6.0,F1.0,F8.0)

DH-IDENT, XC,YC,ZC, N-S bearing indicator, deg. of bearing, min. of bearing, E-W bearing indicator, deg. of dip, min. of dip, total length

Example of two field angle format:

(10A1,3F10.2,1X,F7.2,1X,F6.2,F8.0)

DH-IDENT, XC,YC,ZC, azimuth, dip, total length

2. **SURVEY LINES (OPTIONAL)**

There is no need to specify survey lines for drillholes that do not have downhole surveys. If a hole does have downhole surveys, you can specify the survey lines using either the six field bearing and dip format or the two field azimuth and dip format. However, you must use the same format that was specified for the collar line.

Six field bearing and dip

Variable	**Description**
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at start of survey
TO	Depth at end of survey
LENGTH	Length of survey interval
IY	True heading N-S indicator
ADEG	Degrees of Bearing angle
AMIN	Minutes of Bearing angle
IX	True heading E-W indicator
	DDEG Degrees of drillhole dip angle
DMIN	Minutes of drillhole dip angle

Two field azimuth and dip

Variable	**Description**
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at start of survey
TO	Depth at end of survey
LENGTH	Length of survey interval
AZIM	Azimuth of survey (from north)
DIP	Dip of survey

The only difference between a survey and a collar line is that FROM, TO and LENGTH are entered instead of XC, YC and ZC. The exact same columns must be used for both the collar data and the survey data lines.

The successive survey intervals must be continuous down the drillhole. The entire length of the drillhole should be covered by survey intervals, even if there is no assay data for a given survey interval.

3. END OF SURVEYS LINE

Enter the DH-IDENT on this line. The remainder of the line is blank.

4. ASSAY INTERVAL LINES

The data on the assay interval lines can be in any order and any format as long as the DH-IDENT is first. The input format for assay intervals is specified with FMT2 in the run file.

Variable	Description
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at the start of interval
-TO-	Depth at the end of interval
-AI-	Interval length (for checking)
label	Item such as 1st grade value
label	Item such as 2nd grade value
.	
.	
label	Last item

Item -AI- need not be entered if you do not plan to store it in File 11. Items DH-IDENT, FROM and -TO- must be entered. Items can be assay values, ratios, physical or engineering parameters, geologic codes, lease codes, etc. Extra items can be specified which are not part of the data to be stored in File 11. These extra items will be ignored when data for each assay interval is stored on the file.

Missing values are specified by entering data that is less than the minimum value for the item, i.e. if the minimum value for Cu is 0.0, use -1.0 in the Data File to specify a missing value.

A blank in this Data File will be read by the program as a zero value. This will be treated as missing only if the item minimum is greater than zero.

Items that are specified in the MEDSYSTEM Data File, but are not input with M201V1,will be treated as undefined values.

Geology codes can be entered with M201V1 or can be added later with M205.

5. BLANK LINE

Enter a blank line to end input followed by a new collar line for the next drillhole.

M200V1 SAMPLE RUN FILE #1

```
MEDS-200V1      10=SAMP10.DAT      19=DAT201.IA        3=RPT200.LA
** TEST PREPARED DH DATA FOR EXTREME VALUES **

USR    =  ABC
COM    --------------------------
COM    METALS PROJECT
COM    --------------------------
COM    CHECK DRILLHOLE DATA, PROVE FORMATS, DETERMINE
COM    DATA LIMITS, AND LOOK FOR DATA HOT SPOTS.

IOP3   =  19 / N=UNIT# TO READ DATA; 0=DATA IN RUN FILE

IOP10  =  1 / 0=FULL SURVEY ANGLES, 1=SIMPLE ANGLES

COM    INPUT FORMATS FOR DH SURVEY AND ASSAY DATA
FMT1   =  (1X,10A1,3F10.2,2F10.3,F10.1)
FMT2   =  (1X,10A1,3F10.2,F9.2,F11.3)

COM    ASSAY ITEM ORDER WITHIN INPUT DATA
INP11  =  FROM -TO- -AI- T-CU MOLY

I-O    =  1 / 1=LIST SINGLE LINE FOR EACH DRILLHOLE

END
T-CU   0.0 1.0
MOLY   0.0 0.5
```

SAMPLE DRILLHOLE DATA FILE—DAT201.IA

	Collar East	Collar North	Collar Elev	Collar Azimuth	Collar Dip	Drillhole Length	
SM-021	12250.00	12250.00	4294.10	90.000	-73.000	1720.0	-Collar Data
SM-021	500.00	1000.00	500.00	92.000	-76.000		Survey Data
SM-021	1000.00	1500.00	500.00	88.000	-79.000		
SM-021	1500.00	1720.00	220.00	89.000	-75.000		
SM-021							
SM-021	0.00	20.00	20.00	0.00	0.000		Assay Data
SM-021	20.00	40.00	20.00	0.00	0.000		
SM-021	40.00	60.00	20.00	0.00	0.000		
SM-021	60.00	80.00	20.00	0.00	0.000		
SM-021	80.00	100.00	20.00	0.98	0.049		
SM-021	100.00	120.00	20.00	1.00	0.050		
SM-021	120.00	140.00	20.00	0.99	0.049		
SM-021	140.00	160.00	20.00	1.01	0.051		
	ASSAY FROM	ASSAY -TO-	ASSAY INTERVAL	T-CU	MOLY		
	Survey From	Survey To	Survey Length	Survey Azimuth	Survey Dip		

Creation of MEDSYSTEM metafile overlays from TRIPOD graphical output

Ron R. Parent, P. Geol.

Gregg River Resources Ltd., Bag Service 5000, Hinton, Alberta T7V 1V6, Canada

Abstract

TRIPOD is a geological mapping package developed by the University of Alberta and distributed through GAIA Resources of Calgary. It is used for the quick and accurate storage and retrieval of geological information both from outcrop (natural and pit excavations) and drillholes. Detailed analysis of structural information including bedding, faults, joints and cleavage orientation can be carried out. This analysis is very helpful in creating down-plunge cross sections. This is especially useful in areas with steeply plunging fold axes, where it is necessary to project mapping and blasthole information even from as little as 5 metres onto section parallel to the local fold plunge.

The Gregg River Mine is situated within the foothills of the Rocky Mountain Thrust and Fold Belt. The sedimentary strata were highly deformed during the late stages of the Laramide Orogeny. This deformation created a series of upright to tightly overturned coal bearing synclines known as the Cadomin-Luscar coalfield.

Currently at Gregg River we use TRIPOD to store and retrieve all pit mapping and blasthole information. Through the development of an in-house program we have been able to create MEDSYSTEM metafile overlays of this data for use with sectional VBM data using the program M122MF.

We create VBMs for operating pits using a 10 metre cross section spacing. These sections are usually interpolated from drilling on 50 to 100 metre spacings. The result, for a pit with a 2 kilometre strike length, is a VBM with **200** sections. A number of steps must be carried out to arrive at a MEDSYSTEM metafile overlay for a particular section. Carrying each step out for every section would be very tedious. A program was developed to aid in this repetitive task. It creates a batch file that, when run on a PC workstation after a preliminary series of setup steps, will: 1) run TRIPOD to create the output; 2) run our in-house program (TRIMETA) to create M122 run file and; 3) run M122MF to create the metafile overlay for each cross section required.

Paper cross sections are re-plotted periodically depending upon the amount of changes to the geological model that are required. When cross section updates of paper copies are produced, the program M126MF is used to create USERF files for plotting.

Once all the metafiles have been created for a particular pit area, interactive on screen editing of VBM data can be carried out accurately and with great ease. Periodic updating of metafile overlays and associated VBM data as new information is acquired is routinely carried out. Accurate bench plans can then be created from this up to date VBM data to help the blasting engineers design their patterns.

INTRODUCTION

The availability of software for the quick and accurate storage and retrieval of structural geological information is relatively limited. The University of Alberta's structural geology department recognized this deficiency several years ago and Dr. Henry Charlesworth, along with a few graduate students, set out to develop TRIPOD. TRIPOD is "A microcomputer program for storing, retrieving, displaying and analyzing orientation, stratigraphic and positional data from drillholes, outcrops and seismic lines." Several coal mines and oil companies in Alberta and British Columbia are presently using TRIPOD in their daily operations. One of the major advantages of this program is that the program saves the geologist from much tedious and time-consuming work. It also enables the use of sophisticated procedures that are difficult if not impossible to carry out graphically (Charlesworth et al, 1989).

The Gregg River Mine is situated in the foothills of the Rocky Mountain Thrust and Fold Belt adjacent to Jasper National Park in west-central Alberta (figure 1). The strata in the area were highly deformed during the late stages of the Laramide Orogeny creating a series of upright to tightly overturned coal bearing synclines known as the Cadomin-Luscar coalfield (figure 2).

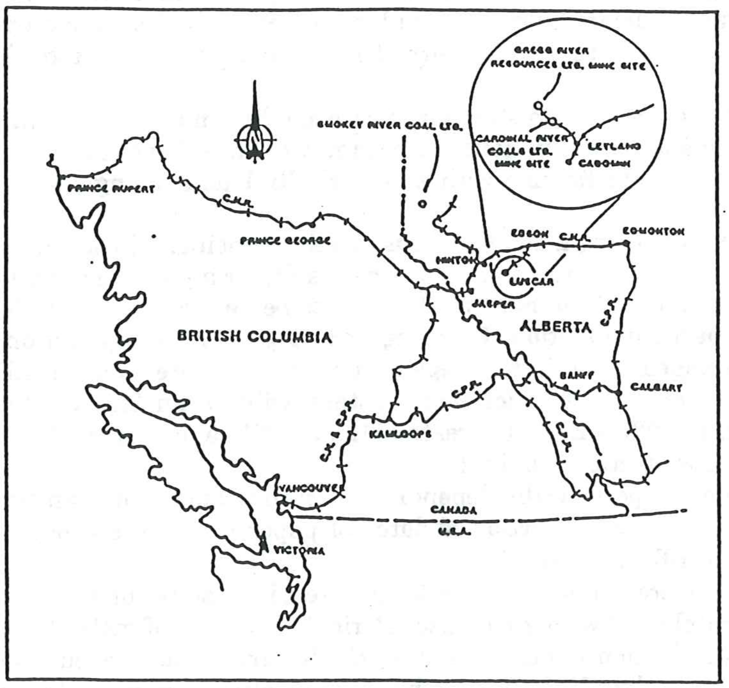


Figure 1. Location map.

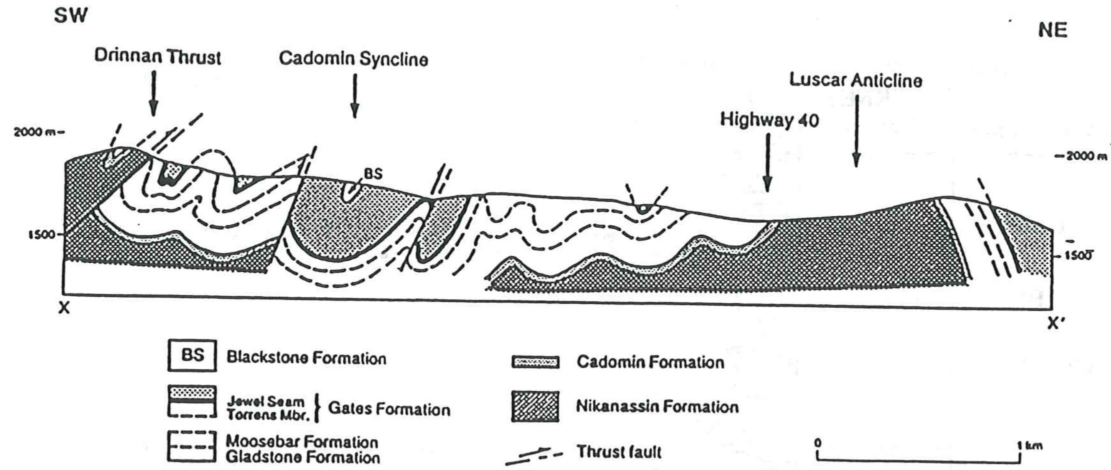


Figure 2. Regional cross section through Cadomin-Luscar coalfield (Langenberg, MacDonald, and Kalkreuth, 1989).

Several stratigraphic marker horizons exist within the stratigraphic column. Each of these horizons, be they coal seams, formation contacts, or member boundaries, are assigned what is known as a "horizon code" (figure 3). Geological information can then be retrieved selectively by structural data type (bedding, joints, cleavage, fault, folds, or stratigraphic position information from drillholes), horizon code and area for producing cross sections (vertical and down plunge) and maps.

STRUCTURAL DATA ANALYSIS

Once geological mapping and blasthole information has been obtained in the field, it is incorporated into existing databases. In cases where local strike is essentially constant (i.e., no folding -- or folds plunge less than 5 degrees), most stratigraphic positional and structural data can be projected perpendicular to the orientation of the cross section. However, in some cases folds plunge upwards of 30 degrees. The exact trend and plunge of local and regional fold axes can be obtained from stereographic projections and cylindrical domain analyses performed using TRIPOD. In instances like this it is necessary to project structural information parallel to the local fold axis even for distances of less than 5 metres. The result is a down plunge projection of information onto a vertical cross section (figure 4). Plotting by hand in cases like this would be very time consuming indeed.

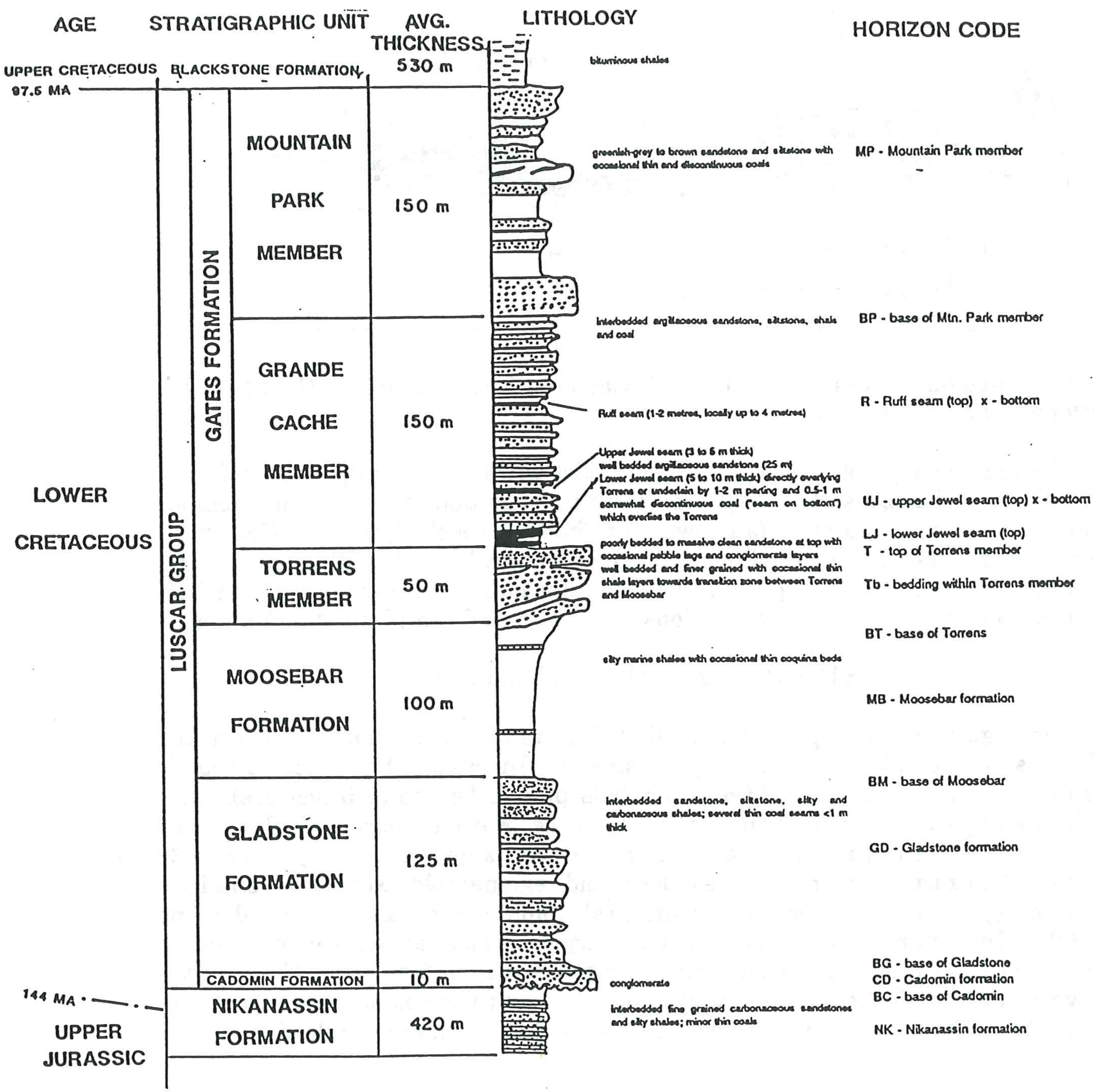


Figure 3. Stratigraphic column with assigned TRIPOD horizon codes.

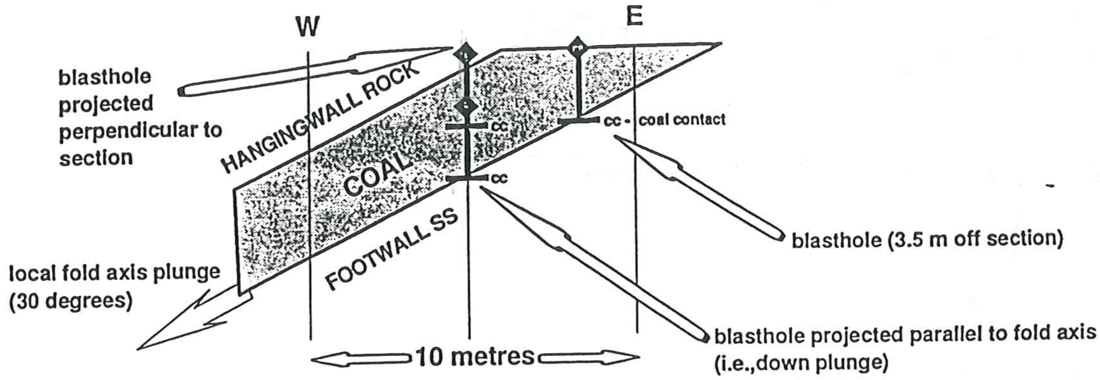


Figure 4. Schematic longitudinal cross section showing effects of down plunge projection.

OVERLAYING TRIPOD GRAPHICAL OUTPUT

One of our primary concerns before obtaining TRIPOD was how we were going to be able to incorporate the use of this software with MEDSYSTEM. I had discussed this problem with another TRIPOD user who uses LYNX. He had recently done essentially the same thing. The result was a program written in Microsoft C language called TRIMETA. This program takes TRIPOD output in an HPGL (Hewlitt-Packard Graphics Language) file and converts it to an M122MF run file. This run file is then used to create the metafile overlay for a particular section. The newly created metafile can then be used to update cross sectional VBM data. We currently create VBMs for operating pits using a 10 metre cross section spacing. These sections are usually interpolated from drilling on 50 to 100 metre spacings. The result, for a pit with a 2 kilometre strike length, is a VBM with over **200** sections.

A summary of all the steps required to produce a single TRIPOD metafile overlay for VBM editing is shown in figure 5. These steps are often repetitive for a series of related sections. As a consequence of this repetitiveness, a program was developed to create a batch files for use on the PC workstation containing TRIPOD. This batch file will carry out the entire procedure from executing TRIPOD to produce graphical output to creating the metafile overlay required for VBM editing.

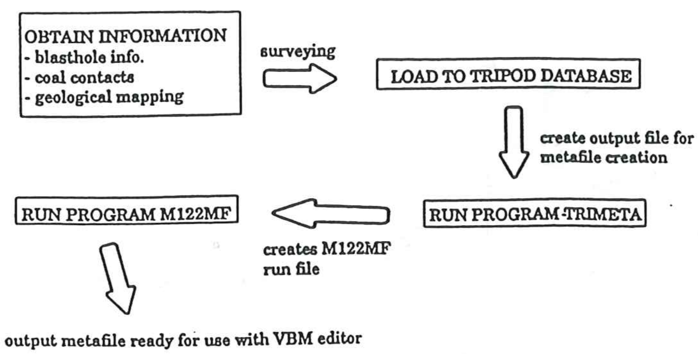


Figure 5. Steps involved in metafile creation.

An added bonus to this metafile creation is that a USERF file for plotting this information on paper sections can be created by running the program M126MF. This procedure can be quite tedious as it cannot be run for several USERF files at a time. It is, however, better than what had to be carried out earlier to produced plot overlays. This early method involved resetting the plotter origin and sending a second plot that would be overtop of the first one. The resulting data would sometimes be offset slightly.

APPLICATIONS IN DAILY ACTIVITIES

Geological information is gathered on a regular basis as mining progresses. Information obtained includes such things as coal sample locations, coal contacts determined by ripping the pit floor with a bulldozer, pit mapping, and coal encountered in blastholes.

Positional data for this information is surveyed and provided to the geologists in the form of ASCII files containing coordinate information and miscellaneous survey information. Through another in-house program known as BLASTOC, we extract the coordinate information from these files and create data files which then can be added to existing TRIPOD databases. In some instances, such as for pit mapping information, these files have to be edited to add orientation information recorded in the field. For some blasthole pickups, coal depth information can be read directly from specially encoded labels in the survey files.

For a series of mapped points, such as coal contacts, mini sections containing information for each paper section are usually produced and underlain on a light table and traced onto the appropriate section (figure 6). As well, for each point, the metafile for the associated 10 metre section is updated in the VBM and any necessary changes made (figure 7). Thus an updated paper copy and VBM are always present. This may seem like duplicating procedures, but it would be impractical to update paper sections, which are required occasionally by the engineers, on a regular basis.

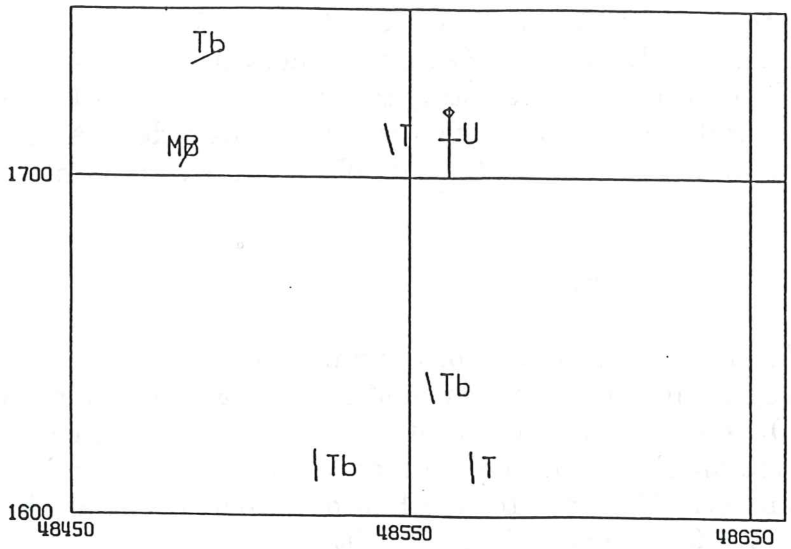


Figure 6. TRIPOD cross section plot of mapping and blasthole information.

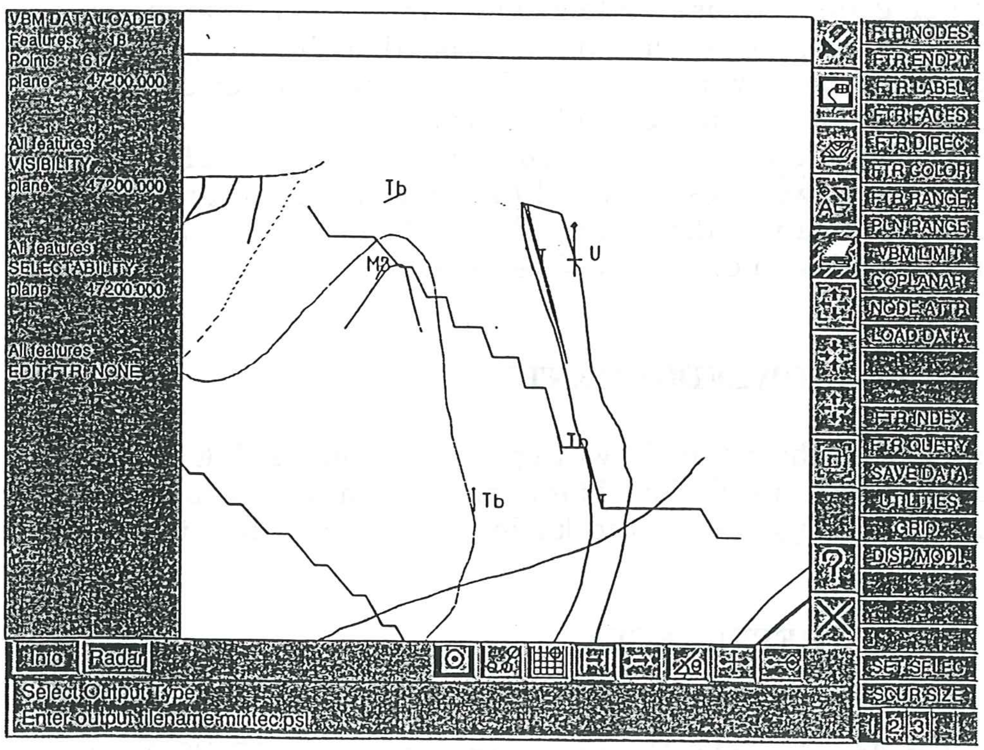


Figure 7. VBM Editor with TRIPOD metafile overlay.

One of the problems with updating metafile overlays for the VBM editor is the size of the metafile index file PROJMETA.NDX. Once new metafiles are created to replace old ones, the M122MF program adds the listing to the bottom of the file. This makes it necessary to edit the index file in order to keep things in order. Also the large size of this files and the number of associated metafiles requires a lot of time to load.

SUMMARY

TRIPOD is a very useful computer program for the quick and accurate storage, analysis and retrieval of geological information. Since MEDSYSTEM does not have the capabilities which TRIPOD does and vice-versa, it would seem only logical that the two would complement one another. Through the development of an in-house program at Gregg River Resources Ltd.'s minesite near Hinton, Alberta, we have been able to produce metafile overlays for use with MEDSYSTEM.

The ability to create these metafiles have greatly increased the accuracy of our geologic models. Geologic information regarding the position and thickness of coal seams and other geologic features can be accurately located on section by applying the methods set out here. Thus the inherent inaccuracies that are part and parcel of hand plotting and digitizing are now, for all intents and purposes, eliminated. As well, information required by other mine planning sections (blasting, long range planning, etc.) can be retrieved quickly and easily. This information can then be analyzed numerous ways depending upon the required application.

The successful interfacing of TRIPOD graphical output with MEDSYSTEM has resulted in increased accuracy as well as substantial time savings for all involved. Hopefully the procedure for creating these metafiles will become even more streamlined in the future, resulting in even more time savings.

ACKNOWLEDGEMENTS

I would like to thank Mr. Ashley Tam for writing the program TRIMETA. As well I would like to thank L. Savoie and G. Gould for supporting my desire to obtain TRIPOD when I first started at Gregg River. It took a lot of convincing, but it's paid off.

REFERENCES

Charlesworth, H.A.K., Guidos, J., Gold, C. and Wynne, D., 1989. TRIPOD 4.0, a microcomputer program for storing, retrieving, displaying and analyzing orientation, stratigraphic and positional data from drillholes, outcrops and seismic lines; Computer Manual, University of Alberta, 111 p.

Langenberg, W., Macdonald, D. and Kalkreuth, W., 1989. Geology and Coal Quality of the Cadomin-Luscar Coal Field, Alberta; Alberta Research Council Open File Report 1989-09, 71 p.

HECLA MINING COMPANY

June 24, 1994

MEMORANDUM TO: Don Gray

FROM: Fred Stahlbush

SUBJECT: **Brett Holmes - Rosebud Project Reserve Compilation Charges**

Background

Up to June 16, 1994 Brett Holmes has been charging his time and travel expenses related to the Rosebud Project to the Rosebud Engineering Residual account (not charged to the operation). It is my understanding the Rosebud Project has made the decision to commission Brett to work with Charlie on the reserve compilation and the purpose of this memo is to supply you with a cost estimate of the work.

Cost Estimate

Attached is a schedule for the Technical Services personnel under my direction. Please note Brett's estimate of time associated with the Rosebud. My time estimate for Rosebud work was generated from a brief conversation with Ron Clayton a week ago. This spreadsheet is located @ H:\HOME\TECH\FSFCST and is always available for your review. The spreadsheet also includes several other columns of information (presently hidden columns on the spreadsheet) for any given month and will be updated at least monthly.

Cost estimate for 1994

Labor $ 24,700

This is estimate by assuming 173 hours available per month X % of time expected for Rosebud X $30/hour (Brett's wages + benefits, no engineering burden included)

Travel $ 3,000

Assumption made Brett will travel to Mine Development Associates once in late June and most likely once during the reserve audit in late December. I have added another trip assuming he may need to travel to the site to work with Charlie, Wes, etc. during the compilation and that your people at Rosebud are not going to have spare time available for travel.

Total Cost Estimate $ 28,000

...t prepared in January of 1994 reflects a cost of $ 25,000 + 15% contingency or ...nsultants. Obviously Brett's charges and Mine Development Associates charges ...s amount.

Items of Note

- The budgets prepared in January 1994 assumed South Zone drilling and reserve compilation only. East and Far East Zones drilling and reserve compilation costs were under Exploration; East Zone in 4th Quarter 1994 and Far East in 1st Quarter 1995.

- Mr. Tschauder's recommendation for consultant costs at budgeting time was $ 100,000. This was reduced most likely because there was no time available for a detailed estimate and $ 100,000 just flat seemed too high.

- It will be very difficult, if not impossible, to logically allocate Brett Holmes' and Mine Development Associates' time to the South, East and Far East Zones (Rosebud Capital Costs, Rosebud Exploration Costs).

Opinion/Recommendations

- Include this memo with the AFE(s), scope changes, and/or forecasts associated with geology/exploration of the Rosebud property for explanation of the document.

- Create a line item for Reserve Compilation - CDA, Consultants

Action Required

- Agree with cost estimate for work performed by Brett Holmes and tell Fred Stahlbush, no formal notification required.

- Disagree and provide direction.

cc: Brett Holmes
George Wilhelm

File Name:
c:\wp51\fswp\rsbd\holmes1

SCHEDULE OF ACTIVITIES - 1994

NOTE: FORECAST % AND ACTUAL HOURS ARE UNPROTECTED CELLS

06/24/94
FILE: C:\FSLOTUS\TS\FSFCST
FILE: H:HOME\TECH\FSFCST

PERSONNEL	ACTIVITY	JUN FORECAST	JUL FORECAST	AUG FORECAST	SEP FORECAST	OCT FORECAST	NOV FORECAST	DEC FORECAST
FRED STAHLBUSH	AMERICAN GIRL	20%	20%	10%	10%	20%	10%	10%
STRENGTHS - U/G	GREENS CREEK	5%	10%	20%	25%	25%	25%	25%
MINE PLANNING	GROUSE CREEK	10%	10%	10%	5%	5%	5%	10%
PROPERTY EVALUATION	MISC. EVALUATIONS	20%	20%	5%				
ENGINEERING ACCOUNTING	REPUBLIC	5%	5%	5%	5%	5%	5%	5%
MARGIN	T/S ACCOUNTING	5%	5%	5%	5%	5%	5%	5%
ELEMENTARY MET. ACC'TING	MANAGING	15%	15%	5%	15%	15%	15%	15%
FEASIBILITY PLANNING	ROSEBUD				20%	25%	25%	25%
COMMUNICATION								
MINING METHODS								
PRIORITIZING PROJECTS								
	PROFESSIONAL DEVELOPMENT			25%				
	VACATION		13%	13%				
	OTHER	20%	2%	2%	15%	0%	10%	5%
TOTAL		100%	100%	100%	100%	100%	100%	100%
DON GRAY	ROSEBUD	100%	100%	100%	100%	100%	100%	100%
STRENGTHS - SURFACE & U/G								
DETAILED MINE PLANNING								
PROPERTY EVALUATION								
PROJECT MANAGEMENT								
FEASIBILITIES								
COMPUTERS								
MINING METHODS								
ORGANIZATION								
	PROFESSIONAL DEVELOPMENT							
	VACATION							
	OTHER	0%	0%	0%	0%	0%	0%	0%
TOTAL		100%	100%	100%	100%	100%	100%	100%
BRETT HOLMES	AMERICAN GIRL	20%	10%	10%	10%	10%		
STRENGTHS - SURFACE	ROSEBUD RESERVES	60%	60%	50%	50%	75%	90%	90%
MINE MODELING	ICC	6%		10%		10%		
RESERVE COMPILATION	GROUSE RESERVES						10%	10%
SURFACE MINE PLANNING								
EQUIPMENT OPTIMIZATION								
PROPERTY EVALUATION								
MINE COST ESTIMATING								
	PROFESSIONAL DEVELOPMENT							
	VACATION	14%	10%	10%				
	OTHER	0%	20%	20%	40%	5%	0%	0%
TOTAL		100%	100%	100%	100%	100%	100%	100%
GEORGE HUFFORD	AU HUNTER EXPL/ PROPOSAL	100%	50%					
STRENGTHS - SURFACE	LF MODELLING		50%	100%	10%			
ORGANIZATION	LA CHOYA RESERVE					50%	75%	100%
RESERVE COMPILATION								
SAMPLING								
MET. BALANCE								
	PROFESSIONAL DEVELOPMENT							
	VACATION						25%	
	OTHER	0%	0%	0%	90%	50%	0%	0%
TOTAL		100%	100%	100%	100%	100%	100%	100%

DISTRIBUTION:
ABOVE PERSONNEL
GEORGE WILHELM
LARRY DREW

HECLA MINING COMPANY

May 2, 1994

MEMORANDUM TO: Charlie Muerhoff

FROM: Brett Holmes BJH

SUBJECT: **Rosebud Reserve Compilation**

Fred Stahlbush asked me to make some suggestions/recommendations regarding the accumulation of core log data and construction of a grade model for the Rosebud Project. However, in order to build a meaningful scope of work I need more information on what types of data are considered important for your project. The following list of questions come immediately to mind regarding your program at Rosebud:

1) Will the logging form include core recovery and RQD along with a graphic log indicating joint/fracture/bedding orientation? Any value to point load testing?

2) Are there lithologies being logged that may not be modelled that you know of (potential for combining rock types for grade modelling with similar characteristics)?

3) What items other than rock type and assay will be important to the grade model (structure, weathering, alteration, water table)?

4) Will all of the core go to testing or will a portion be retained? Photographs?

5) Will drillhole ID's differentiate underground holes from surface holes?

6) What information does Mine Reserves Assoc. have and do we have copies of all electronic files generated during their reserve work?

7) Will the assay lab provide data in electronic form? If so, do we have modem access? labs

8) Will someone at the site be available to build the input database for modelling (Mintec has utility programs available to assist in this process)?

9) What information is desired on the cross sections for interpretation?

I currently have a copy of the drillhole data provided by Equinox in June 1993 which I forwarded to Larry Allen at Mine Reserves. I noticed a file of downhole lithologies with this package. I would suggest as a starting point that the rock types be combined with the assay information and comparative statistics be run between lithologies (if it hasn't already been done and you think useful data could be obtained).

Supply input format

With answers to these questions and others that are bound to come up I'll have a better idea of what your objectives are and how I can best be of help to you. I would suggest that whoever is going to be responsible for the underground layout work be involved in the process of defining the key elements of the grade model so that their needs are met. I look forward to providing whatever assistance I can to your project.

BJH

cc: D. Gray
F. Stahlbush

Hecla MINING COMPANY Centennial 1891-1991

Technical Services

Fax: (208) 769-4122

Date: 5/13/94

To: Charlie Muerhoff

Rosebud Project

From: B. Holmes

Hecla Mining Company

Transmitting: 7 Pages
(Including Cover)

Operator: ____________________

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HECLA MINING COMPANY

May 13, 1994

MEMORANDUM TO: Charlie Muerhoff

FROM: Brett Holmes BJH

SUBJECT: **Rosebud Reserve Compilation Work Scope**

The following represents my attempt to define a work scope for the Rosebud reserve compilation project. I envision the following tasks:

1) Assays returned to Rosebud project office from the lab in Lotus format.

2) Rosebud personnel combine assays with lithologic and survey information in a format compatible with MEDSYSTEM input format (attached).

3) When enough data has been received to warrant the building of a section, the Lotus DH input file will be transferred to the corporate office, preferably via modem to the Local Area Network (LAN).

4) The information is then loaded into MEDSYSTEM by B. Holmes and a section (or sections) generated along with any statistics that may be appropriate.

5) The section will be transferred in ACAD DXF compressed format to the Rosebud project area on the LAN.

6) Rosebud personnel will download the section file from the LAN and C. Muerhoff will add interpretations to the ACAD file.

7) The finished ACAD section file with interpretive features is transferred back to the corporate LAN via modem and the boundaries necessary to grade modelling are entered into MEDS VBM (variable block model) format.

8) Once the geologic model is built in MEDS, grade modelling can proceed.

The turnaround time at corporate for initially building the section should be about a day. Since the building of the MEDS geologic model will be ongoing, it is anticipated that grade modelling can begin a day or two after the final section is received. Building the grade model and outputting bench plans will take two to three weeks depending on problems encountered and revisions made. The final product (bench plans) can be provided in hardcopy and/or ACAD electronic form depending on your needs.

Let me know if you have any suggestions or additions to this list. I'll be gathering any files available from Larry Allen's work at Mine Reserve Associates and laying the groundwork for the modelling effort.

BJH

Attachments

cc: D. Gray
F. Stahlbush

SETTING UP DRILLHOLE DATA

The order of drillhole data should be:

1. Collar line
2. Optional survey lines
3. End of surveys line (DH-IDENT followed by blanks)
4. Assay intervals (one per line)
5. End of assays line (blank)

1. COLLAR LINE

There are two possible forms of the collar line. If the data contains six field bearing and dip angles (IOP10= 0 in M201V1), you must specify data in the following order:

Variable	Description
DH	DH identification: max. of 10 columns
XC	Easting of the collar
YC	Northing of the collar
ZC	Elevation of the collar
IY	True heading (N,S) indicator (*)
ADEG	Degrees of the bearing angle
AMIN	Minutes of the bearing angle
IX	True heading (E,W) indicator (*)
DDEG	Degrees of the dip angle
DMIN	Minutes of the dip angle
TLEN	Total length of the drillhole

(*) The true heading indicators (IX & IY above) are blank for north azimuths.

If the data contains two field bearing and dip angles (IOP10= 1 in M201V1), you must specify data in the following order:

Variable	Description
DH	DH identification: max. of 10 columns
XC	Easting of the collar
YC	Northing of the collar
ZC	Elevation of the collar
AZIM	Azimuth of hole (from north)
DIP	Dip of hole
TLEN	Total length of the drillhole

The format statement (FMT1) for reading the data may be whatever you desire. However, all variables must be included in the format, even if they are blank. Additional items can follow the required items listed.

Example of six field angle format:

(10A1,3F10.2,A1,F8.0,F1.0,A1,F6.0,F1.0,F8.0)

DH-IDENT, XC,YC,ZC, N-S bearing indicator, deg. of bearing, min. of bearing, E-W bearing indicator, deg. of dip, min. of dip, total length

Example of two field angle format:

(10A1,3F10.2,1X,F7.2,1X,F6.2,F8.0)

DH-IDENT, XC,YC,ZC, azimuth, dip, total length

2. SURVEY LINES (OPTIONAL)

There is no need to specify survey lines for drillholes that do not have downhole surveys. If a hole does have downhole surveys, you can specify the survey lines using either the six field bearing and dip format or the two field azimuth and dip format. However, you must use the same format that was specified for the collar line.

Six field bearing and dip

Variable	Description
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at start of survey
TO	Depth at end of survey
LENGTH	Length of survey interval
IY	True heading N-S indicator
ADEG	Degrees of Bearing angle
AMIN	Minutes of Bearing angle
IX	True heading E-W indicator
	DDEG Degrees of drillhole dip angle
DMIN	Minutes of drillhole dip angle

Two field azimuth and dip

Variable	Description
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at start of survey
TO	Depth at end of survey
LENGTH	Length of survey interval
AZIM	Azimuth of survey (from north)
DIP	Dip of survey

The only difference between a survey and a collar line is that FROM, TO and LENGTH are entered instead of XC, YC and ZC. The exact same columns must be used for both the collar data and the survey data lines.

The successive survey intervals must be continuous down the drillhole. The entire length of the drillhole should be covered by survey intervals, even if there is no assay data for a given survey interval.

3. END OF SURVEYS LINE

Enter the DH-IDENT on this line. The remainder of the line is blank.

4. ASSAY INTERVAL LINES

The data on the assay interval lines can be in any order and any format as long as the DH-IDENT is first. The input format for assay intervals is specified with FMT2 in the run file.

Variable	Description
DH-IDENT	Drillhole identification (max. of 10 columns)
FROM	Depth at the start of interval
-TO-	Depth at the end of interval
-AI-	Interval length (for checking)
label	Item such as 1st grade value
label	Item such as 2nd grade value
.	
.	
label	Last item

Item -AI- need not be entered if you do not plan to store it in File 11. Items DH-IDENT, FROM and -TO- must be entered. Items can be assay values, ratios, physical or engineering parameters, geologic codes, lease codes, etc. Extra items can be specified which are not part of the data to be stored in File 11. These extra items will be ignored when data for each assay interval is stored on the file.

Missing values are specified by entering data that is less than the minimum value for the item, i.e. if the minimum value for Cu is 0.0, use -1.0 in the Data File to specify a missing value.

A blank in this Data File will be read by the program as a zero value. This will be treated as missing only if the item minimum is greater than zero.

Items that are specified in the MEDSYSTEM Data File, but are not input with M201V1,will be treated as undefined values.

Geology codes can be entered with M201V1 or can be added later with M205.

5. BLANK LINE

Enter a blank line to end input followed by a new collar line for the next drillhole.

M200V1 SAMPLE RUN FILE #1

```
MEDS-200V1      10=SAMP10.DAT     19=DAT201.IA       3=RPT200.LA
** TEST PREPARED DH DATA FOR EXTREME VALUES **

USR    =  ABC
COM    ----------------------------
COM    METALS PROJECT
COM    ----------------------------
COM    CHECK DRILLHOLE DATA, PROVE FORMATS, DETERMINE
COM    DATA LIMITS, AND LOOK FOR DATA HOT SPOTS.

IOP3   =  19 / N=UNIT# TO READ DATA; 0=DATA IN RUN FILE

IOP10  =  1 / 0=FULL SURVEY ANGLES, 1=SIMPLE ANGLES

COM    INPUT FORMATS FOR DH SURVEY AND ASSAY DATA
FMT1   =  (1X,10A1,3F10.2,2F10.3,F10.1)
FMT2   =  (1X,10A1,3F10.2,F9.2,F11.3)

COM    ASSAY ITEM ORDER WITHIN INPUT DATA
INP11  =  FROM -TO- -AI- T-CU MOLY

I-O    =  1 / 1=LIST SINGLE LINE FOR EACH DRILLHOLE

END
T-CU   0.0 1.0
MOLY   0.0 0.5
```

SAMPLE DRILLHOLE DATA FILE – DAT201.IA

	Collar East	Collar North	Collar Elev	Collar Azimuth	Collar Dip	Drillhole Length	
SM-021	12250.00	12250.00	4294.10	90.000	-73.000	1720.0	Collar Data
SM-021	500.00	1000.00	500.00	92.000	-76.000		Survey Data
SM-021	1000.00	1500.00	500.00	88.000	-79.000		
SM-021	1500.00	1720.00	220.00	89.000	-75.000		
SM-021							
SM-021	0.00	20.00	20.00	0.00	0.000		Assay Data
SM-021	20.00	40.00	20.00	0.00	0.000		
SM-021	40.00	60.00	20.00	0.00	0.000		
SM-021	60.00	80.00	20.00	0.00	0.000		
SM-021	80.00	100.00	20.00	0.98	0.049		
SM-021	100.00	120.00	20.00	1.00	0.050		
SM-021	120.00	140.00	20.00	0.99	0.049		
SM-021	140.00	160.00	20.00	1.01	0.051		
	ASSAY FROM	ASSAY -TO-	ASSAY INTERVAL	T-CU	MOLY		
	Survey From	Survey To	Survey Length	Survey Azimuth	Survey Dip		