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ROSEBUD OFFICE

60008726

NEWMONT GOLD COMPANY

Memorandum

To: Rosebud Exploration

May 1, 1998

From: Nigel Phillips

Subject: Down Hole Induced Polarization Survey

Summary

During the second half of April, 1998, a down hole IP survey was carried out on hole RS-425 at East Dreamland, northwest of the Rosebud Mine. A small chargeable feature was located at about 1952 feet. This small feature could be near to the hole and reflect a small sulfide bearing body or fault.

Introduction

The object of this survey was to detect a chargeable body relating to a gold intercept in hole RS-425 in order to help direct a follow-up drill program.

In good conditions a down hole IP survey can detect chargeable bodies of significant contrast within a 500-ft radius of the hole and give an azimuth along with a rough estimate of distance.

Procedure

Two current dipoles (north-south and east-west) and four non-polarizable potential electrodes were positioned on the surface. Locations of the Current electrodes with respect to RS-425 are shown in Figure 1. The current dipoles are located at a distance away from the drill hole equal to approximately thee times the depth of the hole. This is in order to produce a plane wave that will propagate perpendicular to the earth's surface in the vicinity of the drill hole. A fifth down hole potential electrode (probe) was lowered down the hole. The drill rods were removed from the hole as metallic objects interfere with the survey. Steel casing was left in the hole to a depth of 1500 ft. Initially perforated PVC pipes were lowered into the hole to help the probe travel up and down. These were removed because of problems when removing the drill rods. The rock proved to be competent enough not to collapse on the probe when the drill rods and PVC were removed. Readings were taken at 50-ft intervals from a depth of 1460 ft to 2300 ft. The transmitting waveform had a frequency of 0.125 Hz. A current (I) of 6.91 amps was injected into the ground through the current electrodes and the primary voltage (Vp) and chargeability (Ma) readings were measured at sixteen different depths.

The primary voltages should have values such that a zero potential line is straddled by at least one potential electrode. During the survey the potential electrodes were moved to accommodate this. Readings were made at two depths with both electrode configurations to help processing.

Data Processing

The raw data is shown in Appendix I. Using Equation 1 secondary voltages can be determined from the raw data. Secondary voltages are used to determine the theoretical secondary voltage at the zero potential line (Vs0) that gives a magnitude and azimuth to a polarized body.

Equation 1.

$$Vs = (Ma \times Vp) / I$$

It was determined that one of the potential electrodes was leaking and producing erroneous data. This data was removed during processing. Appendix II contains the processed data.

Results

Figure 2 shows four curves plotted against depth. The first two plots are the secondary voltages in the north-south and the east-west directions. Simple vector construction produces a magnitude and an azimuth as shown in the last two plots.

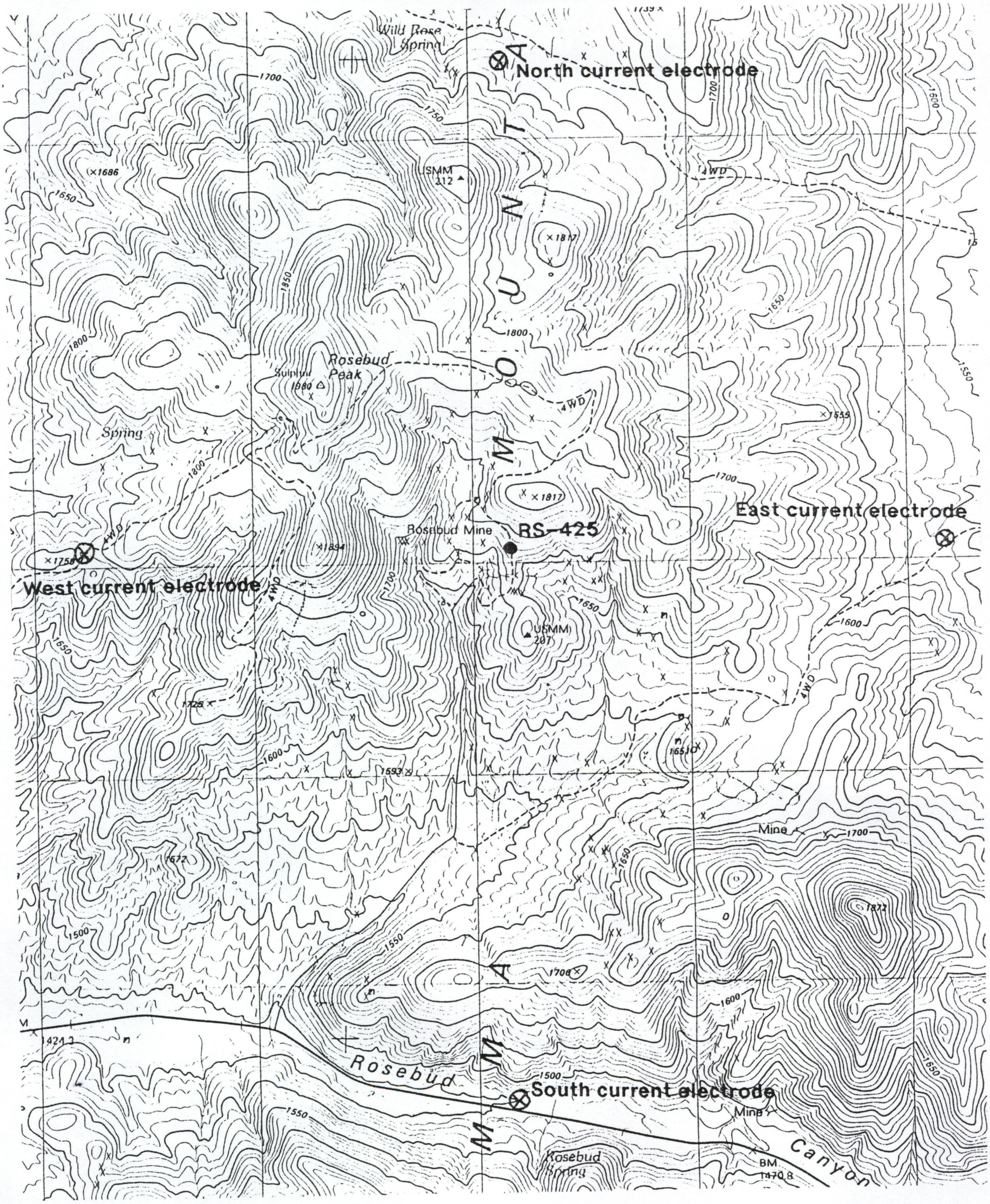
A feature centered around 1952 ft was detected by two readings with the north-south dipole configuration and by one reading with the east-west dipole configuration. The small number of readings that reflect this feature suggests that it is small and near to the drill hole. The data suggest the gold intercept is not related to a large sulfide bearing body within 500 ft of the hole. The readings at 1952 ft with the east-west dipole configuration is very noisy and a variation in that reading could significantly change the value of the azimuth thus making determination of a direction to the feature inaccurate.. The change in secondary voltage between 1500 and 1558 ft is caused by the presence of the drill casing. Consistent increasing chargeability with depth may reflect the chargeable properties of the carbonaceous Auld Lang Syne underlying the volcanic package. There is good correlation with results from the two potential electrode configurations and the overlap can be seen in the plot. The smooth nature of the data confirms that the survey had little noise to mask large features.

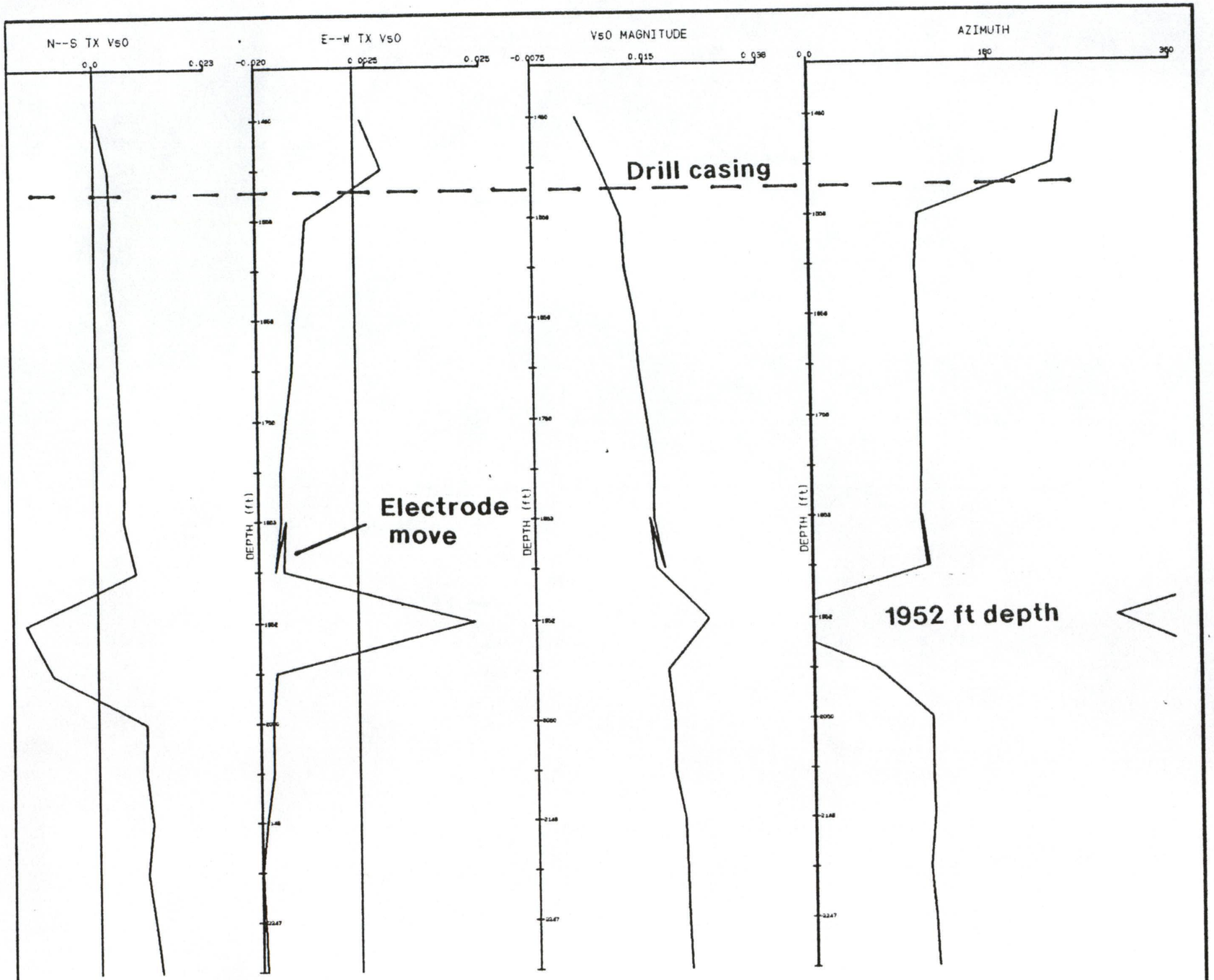
This survey technique is designed to detect large chargeable bodies to one side of a drill hole. It should be noted that large bodies symmetrically positioned on each side of a drill hole would be immeasurable.

Recommendations

It is not recommended that the detection of the small feature at a depth of 1952 ft be used to direct a drilling program. This is because of the size of the feature and the nature of the data making the azimuth indeterminable. This survey can be considered a technical success and more of these surveys should prove useful in the future. Future surveys should be tried without the use of PVC. This will decrease the expense and increase the speed of the survey. Because of the logistics of laying out the current electrodes, it is recommended that future down hole surveys of this type be conducted in several holes at once.

Figure 1.
Location of current electrodes and drill hole RS-425.
1:24,000, from Sulphur USGS Quad sheet.





RS-425 Figure 2.

NEWMONT EXPLORATION LTD

DOWN HOLE IP SURVEY

Vs0 MAGNITUDE/AZIMUTH PLOTS

Appendix I

Raw Data

File: RS-425.xls

Rosebud Down Hole I.P. survey

4/27/98

Dipole	Depth [m]	Curre [A]	V(n2) [mV]	M(n2) [msec]	V(n1) [mV]	M(n1 [msec]	V(s1) [mV]	M(s1) [msec]	V(s2) [mV]	M(s2) [msec]
N-S	445	6.9	-0.0875	-84	-0.5774	-27.2	-1.15	-29	-1.6	-28.3
E-W	445	6.9	-0.5228	-65	-1.13	-51	1.72	-41.6	2.24	-39.9
N-S	460	6.9	0.2654	62.5	-0.2202	-103.9	-793.4	-39.1	-1.25	-27.6
E-W	460	6.9	-0.1965	-305.4	-0.7977	-95.8	1.38	-73.6	1.89	-67.9
N-S	475	6.9	0.6238	34.2	0.1359	136.4	-0.4403	-50.8	-0.8937	-39
E-W	475	6.9	-0.1705	374.2	-0.4406	-177.4	1.02	-95.8	1.54	-77.4
N-S	490	6.9	0.6978	17.6	0.2131	83.2	-0.3586	-81.6	-0.8164	-33.3
E-W	490	6.9	-0.2563	249.6	-0.3522	-223.1	0.9347	-113.4	1.45	-85.9
N-S	505	6.9	0.781	15.3	0.288	63.4	-0.283	-130.7	-0.7406	-58.9
E-W	505	6.9	-0.3365	222.8	-0.2678	-332.2	0.851	-127	1.37	-97.5
N-S	520	6.9	0.8455	30	0.3645	67.9	-0.211	-158.2	-0.6684	-57.9
E-W	520	6.9	-0.4334	179.6	-0.1707	-545.4	0.7592	-136.1	1.28	-97.2
N-S	535	6.9	0.9	29.3	0.42	66.7	-0.1522	-229.4	-0.6103	-71
E-W	535	6.9	-0.5085	161.5	-0.0943	-1048.5	0.679	-168.8	1.2	-116.5
N-S	550	6.9	0.962	29.8	0.4826	62.7	0.0897	-442.3	-0.5471	-85.6
E-W	550	6.9	-0.6018	147.3	0.0002	NR	0.5817	-205.6	1.1	-129.7
N-S	**565**	**6.9**	**1.04**	**43.3**	**0.55**	**62.2**	**-0.0256**	**NR**	**-0.4795**	**-76.7**
E-W	**565**	**6.9**	**-0.6948**	**125**	**0.0895**	**1142.4**	**0.4936**	**-234.8**	**1.01**	**-134.9**
N-S	**580**	**6.9**	**1.08**	**38.1**	**0.5945**	**63.9**	**-0.0231**	**NR**	**-0.4351**	**-144.9**
E-W	**580**	**6.9**	**-0.7833**	**117.1**	**0.1792**	**590.5**	**0.4045**	**-300.9**	**0.9227**	**-156**
N-S	565	6.9	1.04	43.3	0.55	62.2	-0.0256	NR	-0.4795	-76.7
E-W	565	6.9	-3.76	11.2	-2.93	17.4	-0.6952	127.1	0.0905	1114.4
N-S	580	6.9	1.08	38.1	0.5945	63.9	-0.0231	NR	-0.4351	-144.9
E-W	580	6.9	-3.84	9.4	-3.01	16.6	-0.7841	112.2	0.18047	621.6
N-S	595	6.9	1.14	34.8	0.6595	64	0.0866	-130.5	-0.3695	586
E-W	595	6.9	-3.95	118	-3.12	17.2	-0.8851	1.3	0.2764	381.3
N-S	610	6.9	1.203	33.8	0.7198	62.1	0.1472	-171.9	-0.3061	381.9
E-W	610	6.9	-4.04	9.9	-3.21	16.7	-0.9802	98.1	0.379	293.4
N-S	625	6.9	1.246	36.5	0.76092	68.1	0.1876	356.8	-0.26998	-256.4
E-W	625	6.9	-4.13	9.8	-3.3	16.6	-1.07	92.7	0.4658	249.5
N-S	640	6.9	1.3	35.9	0.814	60.8	0.2438	260.3	-0.2135	-320.2
E-W	640	6.9	-4.23	12.4	-3.4	18.2	-1.17	86.3	0.5632	206.8
N-S	655	6.9	1.341	40.9	0.8574	68.9	0.2836	258.3	-0.1725	-438.8
E-W	655	6.9	-4.31	10.9	-3.48	16.3	-1.244	84.7	0.6429	186.4
N-S	670	6.9	1.372	36.1	0.8889	65.7	0.3167	214.6	-0.1362	-480.3
E-W	670	6.9	-4.37	10.6	-3.54	17.7	-1.31	83.2	0.7055	173.6
N-S	685	6.9	1.401	47.3	0.9169	75.5	0.3446	213.3	-0.1134	-687.4
E-W	685	6.9	-4.43	13.1	-3.61	18.2	-1.373	80	0.769	166.8
N-S	700	6.9	1.424	47.7	0.9378	79.2	0.36426	228	-0.09406	-899
E-W	700	6.9	-4.5	13.4	-3.665	19.4	-1.43	75.7	0.8301	151.1

Appendix II

Processed Data

File RS425-1.DAT

DPL	D(ft)	PTS	Vpn1	Vpn2	Vpn3	Vpn4	Vsn1	Vsn2	Vsn3	Vsn4
1	1460	4	-0.1268E-01	-0.8368E-01	-0.1667E+00	-0.2319E+00	0.1065E-02	0.2276E-02	0.4833E-02	0.6562E-02
2	1460	3	-0.7577E-01	0.2493E+00	0.3246E+00	0.0000E+00	0.4925E-02	-0.1037E-01	-0.1295E-01	0.0000E+00
1	1509	4	0.3846E-01	-0.3191E-01	-0.1150E+00	-0.1812E+00	0.2404E-02	0.3316E-02	0.4496E-02	0.5000E-02
2	1509	3	-0.2848E-01	0.2000E+00	0.2739E+00	0.0000E+00	0.8697E-02	-0.1472E-01	-0.1860E-01	0.0000E+00
1	1558	4	0.9041E-01	0.1970E-01	-0.6381E-01	-0.1295E+00	0.3092E-02	0.2686E-02	0.3242E-02	0.5051E-02
2	1558	3	-0.2471E-01	0.1478E+00	0.2232E+00	0.0000E+00	-0.9247E-02	-0.1416E-01	-0.1727E-01	0.0000E+00
1	1607	4	0.1011E+00	0.3088E-01	-0.5197E-01	-0.1183E+00	0.1780E-02	0.2570E-02	0.4241E-02	0.3940E-02
2	1607	3	-0.3714E-01	0.1355E+00	0.2101E+00	0.0000E+00	-0.9271E-02	-0.1536E-01	-0.1805E-01	0.0000E+00
1	1656	4	0.1132E+00	0.4174E-01	-0.4101E-01	-0.1073E+00	0.1732E-02	0.2646E-02	0.5361E-02	0.6322E-02
2	1656	3	-0.4877E-01	0.1233E+00	0.1986E+00	0.0000E+00	-0.1087E-01	-0.1566E-01	-0.1936E-01	0.0000E+00
1	1706	4	0.1225E+00	0.5283E-01	-0.3058E-01	-0.9687E-01	0.3676E-02	0.3587E-02	0.4838E-02	0.5609E-02
2	1706	3	-0.6281E-01	0.1100E+00	0.1855E+00	0.0000E+00	-0.1128E-01	-0.1497E-01	-0.1803E-01	0.0000E+00
1	1755	4	0.1304E+00	0.6087E-01	-0.2206E-01	-0.8845E-01	0.3822E-02	0.4060E-02	0.5060E-02	0.6280E-02
2	1755	3	-0.7370E-01	0.9841E-01	0.1739E+00	0.0000E+00	-0.1190E-01	-0.1661E-01	-0.2026E-01	0.0000E+00
1	1804	4	0.1394E+00	0.6994E-01	-0.1300E-01	-0.7929E-01	0.4155E-02	0.4385E-02	0.5750E-02	0.6787E-02
2	1804	3	-0.8722E-01	0.8430E-01	0.1594E+00	0.0000E+00	-0.1285E-01	-0.1733E-01	-0.2068E-01	0.0000E+00
1	1853	3	0.1507E+00	0.7971E-01	-0.6949E-01	0.0000E+00	0.6526E-02	0.4958E-02	0.5330E-02	0.0000E+00
2	1853	3	-0.1007E+00	0.7154E-01	0.1464E+00	0.0000E+00	-0.1259E-01	-0.1680E-01	-0.1975E-01	0.0000E+00
1	1902	3	0.1565E+00	0.8616E-01	-0.6306E-01	0.0000E+00	0.5963E-02	0.5506E-02	0.9137E-02	0.0000E+00
2	1902	3	-0.1135E+00	0.5862E-01	0.1337E+00	0.0000E+00	-0.1329E-01	-0.1764E-01	-0.2086E-01	0.0000E+00
1	1853	3	0.1507E+00	0.7971E-01	-0.6949E-01	0.0000E+00	0.6526E-02	0.4958E-02	0.5330E-02	0.0000E+00
2	1853	3	-0.5449E+00	-0.4246E+00	-0.1008E+00	0.0000E+00	-0.6103E-02	-0.7389E-02	-0.1281E-01	0.0000E+00
1	1902	3	0.1565E+00	0.8616E-01	-0.6306E-01	0.0000E+00	0.5963E-02	0.5506E-02	0.9137E-02	0.0000E+00
2	1902	3	-0.5565E+00	-0.4362E+00	-0.1136E+00	0.0000E+00	-0.5231E-02	-0.7241E-02	-0.1275E-01	0.0000E+00
1	1952	4	0.1652E+00	0.9558E-01	0.1255E-01	-0.5355E-01	0.5750E-02	0.6117E-02	-0.1638E-02	-0.3138E-01
2	1952	3	-0.5725E+00	-0.4522E+00	-0.1283E+00	0.0000E+00	-0.6755E-01	-0.7777E-02	-0.1668E-03	0.0000E+00
1	2001	4	0.1743E+00	0.1043E+00	0.2133E-01	-0.4436E-01	0.5893E-02	0.6478E-02	-0.3667E-02	-0.1694E-01
2	2001	3	-0.5855E+00	-0.4652E+00	-0.1421E+00	0.0000E+00	-0.5797E-02	-0.7769E-02	-0.1394E-01	0.0000E+00
1	2050	4	0.1806E+00	0.1103E+00	0.2719E-01	-0.3913E-01	0.6591E-02	0.7510E-02	0.9701E-02	0.1003E-01
2	2050	3	-0.5986E+00	-0.4783E+00	-0.1551E+00	0.0000E+00	-0.5866E-02	-0.7939E-02	-0.1438E-01	0.0000E+00
1	2099	4	0.1884E+00	0.1180E+00	0.3533E-01	-0.3094E-01	0.6764E-02	0.7173E-02	0.9197E-02	0.9908E-02
2	2099	3	-0.6130E+00	-0.4928E+00	-0.1696E+00	0.0000E+00	-0.7602E-02	-0.8968E-02	-0.1463E-01	0.0000E+00
1	2148	4	0.1943E+00	0.1243E+00	0.4110E-01	-0.2500E-01	0.7949E-02	0.8562E-02	0.1062E-01	0.1097E-01
2	2148	3	-0.6246E+00	-0.5043E+00	-0.1803E+00	0.0000E+00	-0.6809E-02	-0.8221E-02	-0.1527E-01	0.0000E+00
1	2198	4	0.1988E+00	0.1288E+00	0.4590E-01	-0.1974E-01	0.7178E-02	0.8464E-02	0.9850E-02	0.9481E-02
2	2198	3	-0.6333E+00	-0.5130E+00	-0.1899E+00	0.0000E+00	-0.6713E-02	-0.9081E-02	-0.1580E-01	0.0000E+00
1	2247	4	0.2030E+00	0.1329E+00	0.4994E-01	-0.1643E-01	0.9604E-02	0.1003E-01	0.1065E-01	0.1130E-01
2	2247	3	-0.6420E+00	-0.5232E+00	-0.1990E+00	0.0000E+00	-0.8411E-02	-0.9522E-02	-0.1592E-01	0.0000E+00
1	2296	4	0.2064E+00	0.1359E+00	0.5279E-01	-0.1363E-01	0.9844E-02	0.1076E-01	0.1204E-01	0.1226E-01
2	2296	3	-0.6522E+00	-0.5312E+00	-0.2072E+00	0.0000E+00	-0.8739E-02	-0.1030E-01	-0.1569E-01	0.0000E+00

File RS425-2.DAT

D(ft)	AZM	MAG	Vs01	SLOPE1	VAR1	Vs02	SLOPE2	VAR2
1460	250	0.0015	0.0005	-0.0258	0.000000	0.0014	-0.0454	0.000000
1509	243	0.0063	0.0029	-0.0121	0.000000	0.0056	-0.0932	0.000005
1558	109	0.0104	0.0033	-0.0085	0.000001	-0.0099	-0.0317	0.000000
1607	106	0.0110	0.0030	-0.0112	0.000000	-0.0106	-0.0355	0.000000
1656	108	0.0129	0.0041	-0.0223	0.000000	-0.0123	-0.0332	0.000001
1706	110	0.0135	0.0045	-0.0096	0.000000	-0.0127	-0.0262	0.000001
1755	110	0.0150	0.0050	-0.0113	0.000000	-0.0141	-0.0327	0.000001
1804	110	0.0163	0.0056	-0.0126	0.000000	-0.0153	-0.0308	0.000001
1853	109	0.0162	0.0054	0.0042	0.000001	-0.0153	-0.0282	0.000000
1902	115	0.0182	0.0078	-0.0160	0.000001	-0.0165	-0.0297	0.000001
1853	111	0.0153	0.0054	0.0042	0.000001	-0.0143	-0.0154	0.000000
1902	118	0.0166	0.0078	-0.0160	0.000001	-0.0147	-0.0170	0.000000
1952	302	0.0268	-0.0140	0.1591	0.000126	0.0229	0.1250	0.001074
2001	62	0.0187	-0.0088	0.1061	0.000026	-0.0165	-0.0185	0.000000
2050	119	0.0198	0.0096	-0.0170	0.000000	-0.0173	-0.0193	0.000000
2099	119	0.0197	0.0095	-0.0156	0.000000	-0.0173	-0.0162	0.000000
2148	120	0.0216	0.0108	-0.0152	0.000000	-0.0187	-0.0196	0.000000
2198	116	0.0220	0.0097	-0.0114	0.000000	-0.0197	-0.0205	0.000000
2247	120	0.0222	0.0111	-0.0077	0.000000	-0.0193	-0.0175	0.000001
2296	123	0.0226	0.0123	-0.0115	0.000000	-0.0189	-0.0158	0.000000