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Mining District File Summary Sheet

DISTRICT	Rosebud
DIST_NO	4010
COUNTY If different from written on document	Pershing
TITLE If not obvious	Rosebud – Preliminary interpretation of basement structure contour map, October 5, 1997
AUTHOR	Vance R; Langstaff G.
DATE OF DOC(S)	1997
MULTI_DIST Y / (N?) Additional Dist_Nos:	
QUAD_NAME	Sulphur 7½'
P_M_C_NAME (mine, claim & company names)	Rosebud Mine; Newmont Exploration Ltd; Rosebud Joint Venture
COMMODITY If not obvious	gold; silver
NOTES	Correspondence; comments on basement structure map; handwritten notes; geology; Sand Ridge Fault data 10p.

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)

SS: DP 9/10/08
Initials Date

DB: _____
Initials Date

SCANNED: _____
Initials Date

Revised: 1/22/08

Structure Contour Map of ALS Surface

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29-17

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Structure Contour Map of ALS Surface

Newmont Exploration Ltd.
Rosebud Joint Venture

To: Randy Vance **Date:** October 5, 1997

Fr: George Langstaff

Subj: **Preliminary Interpretation of Basement Structure Contour Map**

As you know, a very limited number of holes have reached the Jurassic-Triassic Auld Lang Syne Group in the Rosebud Mine area. Basement-penetrating holes are concentrated around Dozer Hill and there are several more recent holes in the Dozer Northwest area. The following tentative conclusions are listed from most to least certain:

1. The basement surface (hereafter "bs") forms an irregular high under Dozer Hill.

2. The bs in the Dozer Northwest area is a relatively smooth, northwest-dipping surface.

3. There is no evidence for a change in the depth to basement of more than about 200 ft across the Rosebud Shear Zone. The change may be much less.

4. The bs is deeper to the northeast of Dozer Hill and may be offset by a northwest-trending fault.

5. Based on three holes, the bs dips to the west or northwest northeast of Dozer Hill.

6. The two easternmost holes (97-382, 96-362) suggest the bs dips west from the Kamma fault, i.e., the bs is not tilted to the east as one would expect if the bs is a stratigraphic contact.

7. Results in the Dozer Hill area are not entirely consistent and allow many interpretations. Most of the data can be explained by a west or northwest-dipping bs under the northwest flank of Dozer Hill, a southwest-dipping bs under the southeast flank of Dozer Hill, and a northeast-trending fault between them. Additional faults are probably present but more poorly constrained.

8. The subcrop of Auld Lang Syne in the saddle northeast of Dozer Hill still appears rootless.

9. Linear extrapolation suggests the bs is at an elevation of 2000 ft to 2500 ft under RS-406 (surface elevation of 5430 ft). Given the faults in the area, this is unlikely to be an accurate estimate.

The tentatively identified northwest- and northeast-striking faults are parallel to and close to the East Zone and South+North Zones, respectively, and could be feeder structures for gold mineralization.

Newmont Exploration Ltd.
Rosebud Joint Venture

To: Randy Vance **Date:** January 20, 1998

From: George Langstaff

Subj: **Update on Interpretations of the Structure Contour Maps of the Top of the Basement and the Top of the South Ridge Fault**

Drill holes used to construct the basement structure contour map and the South Ridge Fault(SRF) structure contour map are primarily in a northwest-trending swath about 1000 feet wide from Big Chocolate Hill to a few hundred feet northwest of the mine road (i.e., to 97-403). For the SRF map, a few holes south of Dozer Hill, between the South and East Zones, were also used (i.e., RL-267 and vicinity). Just as the basement contacts were taken from pre-Newmont logs and cross-sections so the SRF contacts were taken from Hecla cross-sections for the East and Far East Zones and from pre-Newmont drill logs (which did not always agree). The upper contact of the SRF was contoured rather than the fault plane (usually not identified) or somewhere in the fault zone, which is up to 100 feet thick on some logs. Map coverage has not yet been extended to the southwest to include holes in and around the South Zone.

Information not available in October includes basement intercepts for RS-410, RS-415, and RS-418, in the East Zone, and RS-420, on East Ridge. Basement intercepts in the recent Dreamland and vicinity holes provide additional new data for outlying areas but are beyond the area of the structure contour maps.

The SRF structure contour map confirms some of the features previously identified in the basement contour map and reveals additional structural information. Tentative conclusions are summarized below in anticipation of Craig generating the fact maps from the computer database.

1. The previously identified northwest-trending fault which passes north of Dozer Hill has been confirmed and is herein named the **Hidden Fault**. The Hidden Fault strikes about N125E, probably dips steeply to the north, and has normal and possibly right-lateral offset. The basement surface dips gently to the west north of the fault and moderately to the southwest south of the fault so offsets vary along the fault. The SRF is dropped down 50-100 feet north of the fault and its strike probably changes, too. There is no evidence of the Hidden Fault northwest of the Rosebud shear zone and southwest of holes 96-371, 97-382, and 97-386 but it may pass to the northeast of those holes, where there is no drill coverage.

The Hidden Fault is an important control on alteration. The SRF apparently loses its characteristic silicification north of the Hidden Fault. In many holes north of the Hidden Fault, the SRF was not even recognized (e.g., RL-147, RL-184, RL-279, RL-286c, and RL-288c). In RS-420 on East Ridge, a clay-altered zone at about 740 feet may be the continuation of the SRF although there is no prominent lithologic change across it.

"Basal Tertiary sediments" were intersected in a zone of holes parallel to and southwest of the Hidden Fault from RS-415 to RL-101. This suggests the Hidden Fault may have been active in the early(?) Tertiary and controlled sedimentation.

2. What has been called the South Ridge Fault is at least two and probably three separate faults. Hereafter, the term **South Ridge Fault** (SRF) will be restricted to the moderately northwest-dipping normal fault which passes above the East Zone. Surface outcrops on South Ridge which had been considered the South Ridge Fault are actually faults which cut the SRF. They are herein named the Sharkfin Fault and the Office Fault.

The **Sharkfin Fault** crops out on the north slope of Big Chocolate Hill as prominent, silicified "fins". The outcrop strikes N90-110E and dips 50-65°N. To the northwest, the fault may strike closer to N125E and dip more steeply where it cuts the SRF and basement near the East Zone. There are no basement intercepts southwest of the Sharkfin Fault to constrain the offset. The SRF is apparently dropped 100-200 feet lower north of the fault or, alternatively, the structure contours on the SRF are offset right laterally about 600 feet. The Sharkfin projects between the North and South Zones and it should be possible to verify displacement across the fault in that area using data from South Zone holes. The Sharkfin Fault also projects across the Rosebud shear zone to the vicinity of RS-421.

The **Office Fault** crops out as blocky, silicified outcrops on the north slope of Little Chocolate Hill and along the gully northeast of the exploration trailers. It projects under the mine office. Outcrop measurements suggest a strike of N90-100E and a northerly dip of 60-70°. This strike is approximately perpendicular to poorly constrained structure contours on the moderately northwest-dipping SRF in the subsurface north of the outcrops on Little Chocolate. A cross-section from South Ridge northeast to East Ridge (which I gave you before Christmas) indicates the apparent dip of the Office Fault is still significantly steeper than that of the subsurface SRF. There are no basement intercepts which constrain the location or offset of the Office Fault.

The relation between the Sharkfin and Office faults is poorly constrained. Strikes and dips are similar and both have northwest-plunging slickensides from the most recent(?) movement. However, the Sharkfin Fault projects to the south edge of Dozer Hill and the Office Fault follows the gully past the exploration trailers toward the mine office. The Sharkfin Fault could be dropped down on the north side of the Office Fault. This would shift the intersection of the Sharkfin Fault and SRF to the south and allow a better fit with constraints provided by SRF contours to the north, which would otherwise require an essentially vertical Sharkfin Fault.

3. What I previously postulated as a fault under Dozer Hill between a northwest-dipping basement surface to the northwest and a southwest-dipping basement surface to the southeast now appears to be the intersection of the SRF and the more gently dipping basement surface. Although it has been proposed that the orientation of the South Zone is controlled by the intersection of the SRF and bedding, it would be interesting to see if mineralization is actually following (above) the intersection of the SRF and the basement surface.

4. The basement appears to be offset between RS-415 and RS-418 by about 50 feet by a northeast-striking fault. A difference in elevation of the FG-LLT contact from a depth of 85 feet in RS-415 to 260 feet in RS-414 may support this hypothesis. A northeast-striking normal fault had previously been hypothesized to explain the change in elevation of the basement surface between the widely separated RL-95 and RBW-18. These faults may be the same structure, which has been offset by the Hidden Fault. This northeast-striking fault apparently does not cut the SRF.

5. A northwest-trending cross-section from northwest of Dozer Hill to the north flank of Big Chocolate Hill (I gave you a copy before Christmas) shows that the dip of the SRF steepens west of where it merges with the basement surface, which is also a fault. There are several possible explanations: 1) the SRF could be folded; 2) the SRF could be continuous and does not really merge with the basement surface, which may itself steepen or be offset; or 3) the SRF is offset by a steeper northeast-striking, northwest-dipping normal fault. This third, moderate angle normal fault could account for repetition of the Bud on the northeast side of Dozer Hill shown by some workers or could correspond to the upper branch of the SRF shown on Hecla cross-sections of the East Zone. These hypotheses have different consequences which could be verified by examining drill holes west of Dozer Hill.

6. Reinterpretation of the "South Ridge Fault" as three faults reveals a predictable pattern of silicification. Silicification is most intense between the Sharkfin (silicified) and Hidden (not silicified?) faults, where the East Zone is located. Silicification is more erratic between the Office (silicified) and Sharkfin faults, where the South Zone is located. This suggests the Sharkfin Fault may have been the primary conduit and the Hidden Fault a barrier to the fluids which caused silicification. If gold is related to silicification, then there could be mineralized zones in the hanging wall of the Sharkfin Fault deeper than the East Zone or possibly in steep structures rooted on the Sharkfin Fault.

7. If the SRF is different than the Sharkfin and Office faults, what happens to it south of those faults? Unless the SRF coincidentally stops at the Sharkfin and Office faults, it must continue at a higher elevation south of these faults. Like the SRF, the Saddle Fault on South Ridge also has east-dipping Bud in the hanging wall and Dozer in the footwall. The elevation difference from where the Saddle Fault crosses South Ridge to where the SRF underlies the South Zone is about 1000 feet. The lack of silicification (by your account) in the Saddle Fault is like the lack of silicification in the SRF north of the Hidden Fault. Both normal and right-lateral displacements are consistent with offset of the SRF to the Saddle Fault. In either case, the basement would be much shallower under South Ridge than under the East Zone.

8. The dips of the basement surface, which is a fault, and the SRF under and southeast of Dozer Hill are anomalously low compared to other normal faults in the Rosebud area. It is possible that there is something to the intrusion-ring fracture hypothesis of SFPG geologists. The lower dips southeast of and steeper dips northwest of Dozer Hill could be caused by doming over a pluton.

9. Recognition of northeast-trending normal faults in the East Zone area supports my hypothesis of northeast-trending faults offsetting the Kamma Fault, which was based on unreliable float-mapping. The finger of volcanic rocks which protrudes northeastward out into basement south of the Rosebud shear zone could be a graben.

10. A guess at the age relations of the faults considered in this study are summarized below with the oldest at the top.

Name	Strike	Dip	Type
Hidden Fault	NW	steep to NE	normal
basement surface	N or NE	low to NW to SW	normal
unnamed	NE	steep to SE?	normal
South Ridge Fault	N to NE	low-mod W to NW	normal
Sharkfin/Office faults	W to NW	N to NE	normal, right?
Kamma Fault	N to NW	mod-steep? to W	normal
unnamed	NE	steep	normal?
cuts SRF?	NE	mod to NW	normal
Hidden Fault	NW	steep to NE	right?

Wonder where the Rosebud shear zone would fit in this table?

Data for structure contour maps of top of basement and top of South Ridge Fault:							
		Depth to	Depth to	Unit Above	Unit Below		
Prefix	Hole No.	Basement	SRF	Basement	SRF		
KM	2		570		LBT		
RBW	16	1110					
RBW	18	1050	1020	Dozer	Dozer		
RL	69	1128	915		Dozer		
RL	75	1067	990		Dozer		
RL	89	1142	1082		Dozer		
RL	90		920				
RL	91	1143	1110		Dozer		
RL	92	1255	1240	Tos	Tos		
RL	93	1053	1035	SRF	JTr		
RL	94	1167	950	Tos	Dozer		
RL	95	1244	960	Dozer	Dozer		
RL	96	1156	1150	SRF	JTr		
RL	97	1152	980		Dozer		
RL	98	1035	944	Tos	Dozer		
RL	99	1205	980		Dozer		
RL	100	1120	990		Dozer		
RL	101	1044	1008	Tos	Tos		
RL	104	1055	1025		Dozer		
RL	106	1118	980		Dozer		
RL	107		974		Dozer		
RL	108	1060	1035				
RL	109	1108	980	Dozer	Dozer		
RL	110	1211	1178	Tos	Dozer		
RL	112	1085	1025	SRF	JTr		
RL	131	1050	680	Dozer	por.		
RL	140		none				
RL	141	1127	830	Dozer	Dozer		
RL	142		540		Dozer		
RL	145		630		Dozer		
RL	146		460		Dozer		
RL	147		none				
RL	149		360		LBT		
RL	165		950		Dozer		
RL	168		550		Dozer		
RL	169		635		Dozer		
RL	170		585		Dozer		
RL	179		655		Dozer		
RL	180		570		Dozer		
RL	181		555		LBT		
RL	182		600		Dozer		
RL	183		505		Dozer		
RL	184		850				
RL	185	920	725		Dozer		
RL	186		635		Dozer		
RL	187		580		Dozer		

RL	188		535		LBT		
RL	189		440		Dozer		
RL	190		505		Dozer		
RL	191		605		Dozer		
RL	193		715		Dozer		
RL	197	1070	1060	SRF	JTr		
RL	198		585		Dozer		
RL	199	1220	1190	Dozer	Tos		
RL	200		585		Dozer		
RL	201		660		Dozer		
RL	204		670		Dozer		
RL	205		525		Dozer		
RL	206		665		Dozer		
RL	207	1003	740		BMB		
RL	211		460		Dozer		
RL	211		425		LBT		
RL	212		595		Dozer		
RL	213		735		Dozer		
RL	214		460		LBT		
RL	215		405				
RL	216		525		Dozer		
RL	217		620		Dozer		
RL	218		620		Dozer		
RL	219		none				
RL	220		400		Bud		
RL	221		715		Dozer		
RL	222		450		Dozer		
RL	242		520		por		
RL	243		655		Dozer		
RL	245		590				
RL	248		220		Bud		
RL	249		715		Dozer		
RL	253		400				
RL	254		275				
RL	255		425				
RL	256		355		Dozer		
RL	257		430		Dozer		
RL	258		610		Dozer		
RL	259		560		Dozer		
RL	261		645		Dozer		
RL	264		943		Dozer		
RL	266		545		Dozer		
RL	267		195				
RL	268		230				
RL	270		430		Tos		
RL	271		735				
RL	273		475		por		
RL	275		315		LBT		
RL	278		310				
RL	279		515				

RL	282		300				
RL	283		175				
RL	285		600				
RL	286		none				
RL	288		none				
RL	289		944		Dozer		
94	306	1180	1133		Dozer		
94	308		680		Dozer		
94	309		625		Dozer		
94	310		590		Dozer		
94	311	1070					
94	314		710		Dozer		
94	315		620		Dozer		
94	316		510		Dozer		
94	317	1120	1095	Dozer	Tos		
94	319		800		por		
94	320		690		Dozer		
94	321		650		Dozer		
94	324		615				
94	325		570				
94	327	992	850	Tos	Dozer		
94	328		705		Dozer		
94	329		660				
94	330		530		por		
94	331		620		Dozer		
94	332		580		Dozer		
94	333		710		Dozer		
94	334	945	930	Tos	Tos		
94	335	951	805	Tos	Dozer		
94	336		655		Dozer		
94	337		610		Dozer		
94	338		598				
94	339	925	890	Tos	Dozer		
94	340		630		Dozer		
94	342		384		Dozer		
95	345		490		Tos		
95	346		465		por		
95	347		460		Tos		
95	350		435		Tos		
95	352		698				
95	353		585	Tos	Bud		
95	355a		755				
95	355c	950	800		Dozer		
96	356	1420					
96	357	1345					
96	358	1110					
96	360	1190					
96	362	810	740		Dozer		
96	366		420				
96	367		310				

96	369	1115	1065		Dozer		
96	370	1120					
96	371	1540					
96	373	1165	1025				
97	380	1205	1190	SRF	JTr		
97	381	1383	1348		Dozer		
97	382	1145		Chocolate?			
97	383	1395	1395	SRF	JTr		
97	384	1115		Dozer			
97	385	1461	1371	Dozer			
97	386	1285		Dozer			
97	397	1510					
97	398	1420	1400	SRF	JTr		
97	403	1470	1070				
RS	406	1668					
RS	407	1410					
RS	408	2257					
RS	410	1118		Dozer			
RS	415	963		Tos			
RS	418	1036		Dozer			
RS	420	995	665	Chocolate?	Chocolate?		
RS	421	1664					
RS	423	2214					
RS	424	2286					

Holes that hit ALS

Section		Approx Intercept	
1300	94-306C ✓	barely	
1350	RL 91C ✓	barely	
1400	RL 131C ✓	35'	
	" 207C ✓	20'	
1450	94-317C ✓	40'	
	RL-104C ✓	30'	
	RL 99C ✓	25'	
1500	RL 199C ✓ Tes?	60'	
	RL 93C ✓	30'	
	RL 97C ✓	80'	
1550	RL 97C ✓	"	
	69A ✓	50'	
1600	RL 112C ✓	150'	w/ gold
1650	RL 89C ✓	20'	
	" 100C ✓	40'	
	" 109C ✓	120'	
	" 94C ✓	80'	
1700	" 106C ✓	120'	
	RL 185 ✓	50	
	197C ✓	40'	
1750	101C ✓	80'	
	197C ✓	40'	
	94-335C ✓	100'	
	RL 92C ✓	40'	
1800	D-91-94	50'	
underground? → where on drill hole map?	94-339C ✓	20'	
1850	RL 98C ✓	30'	
	RL 95C ✓	20'	
2000	RL 141 ✓	30'	

Others

96-362
97-384
RBW-18* (2150N)
RL-110* (2550N)
97-382
97-386
97-381
97-385
95-355
94-334* (1750N)
RL-108* (1600N)
97-403
97-397
97-383
96-371
97-398
94-311* (1350N)
96-369
96-373
RL-75* (1300N)
97-380
96-358
96-356
96-357
96-360
96-370
RBW-16
94-327

* should be on sections

D-91-94
50'
Section 1800