

DISTRICT	Rosebud
DIST_NO	4010
COUNTY If different from written on document	Pershing
TITLE If not obvious	Problems of stratigraphic nomenclature, October 20, 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 nomenclature; geology 4 p.

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

Stratigraphy - post-6/97

60001914

4010

39-25.

**Newmont Exploration Ltd.
Rosebud Joint Venture**

To: Randy Vance

Date: October 20, 1997

Fr: George Langstaff

Subj: **Problems of Stratigraphic Nomenclature**

The following findings are based on an examination of written material related to stratigraphic nomenclature of rocks in the Rosebud area (e.g., map legends, figures, reports). Eleven stratigraphic legends have been compiled into a single table for ease of comparison (attached). The table consists of direct quotations with punctuation changes, minor deletions (primarily for Brady), and the use of abbreviations. Text I have inserted is delineated by square brackets. No attempt has been made to reconcile the various stratigraphic legends with the various geologic maps or to verify the geologic maps.

There are few petrographic and no geochemical data to support written descriptions of the various rock units. Sample locations for the eight samples submitted to Paster by Kortemeier are not known. Paster's petrographic descriptions of Brady's 33 rock samples are not entirely consistent with Brady's descriptions of the respective rock units. For example, heterolithic tuff (according to Paster) was mapped as Chocolate vent facies, lithic tuff was mapped as lake sediments, vitric tuff was mapped as intrusive Dozer (Wildrose Canyon), and there is a high degree of variability between samples from the same rock unit. However, no attempt is made here to modify Brady's descriptions to match Paster's.

In spite of the limited scope of this study and the uncritical reliance on what has been written, a few observations which should help us understand what has been done and what can still be done in terms of stratigraphy are possible.

1. Much of the stratigraphic nomenclature is inconsistent with standards for formal stratigraphic nomenclature. However, most workers have used the same sequence of units (though not necessarily the same characteristics or contacts) so established rock unit names will probably be adequate for exploration purposes.

2. Composition terms, such as Dozer Rhyolite and Brady Andesite, have not been documented by whole-rock geochemical data. Use of the term "formation" would be more proper but is probably not necessary at this point.

Turner's proposal to use the term "sequence" for some units is inadvisable given the way the term is currently used by stratigraphers. "Formation" and "member" can be used informally to subdivide the Kamma Mountains Group in whatever detail is necessary or expedient.

The generally indiscriminate use of the terms "tuff" and "base surge" as rock unit names has been rightly criticized by Turner.

3. Some rock units are unique to specific authors and would not be useful without field checking. Examples include the Goblin Gulch Dacite and Knob Gulch Breccia of Mueller, the

Brown Rhyolite Flow of Brady, and the Black Knob and AAA members of the Chocolate Formation of Kortemeier and McLachlan (CPK/HSM).

4. Descriptions of the Gator formation differ substantially (compare Massingill and CPK/HSM). Either Gator or Badger overlies the Chocolate Formation on Massingill's map but CPK/HSM may not have recognized this. Field checking would be necessary to verify that the distinction between the Gator and Badger is a useful one.

5. Reported phenocryst contents of massive Chocolate units differ. Sanidine reported by LAC geologists may have been misidentified (without the benefit of thin sections?). Brady, CPK/HSM, and Allen reported plagioclase. LAC, Brady, and Allen reported biotite but CPK/HSM reported amphibole as the mafic phase. CPK/HSM emphasized the glomeroporphyritic textures of plagioclase in massive Chocolate units but other observers did not mention it.

6. There are contradictory interpretations of the Upper Bud. It is considered epiclastic breccia by Maynard, LAC, Mueller, Brady, Dirt Biker, and Allen but lithic tuff by Massingill, SFPG, CPK/HSM, and Muerhoff and Holmes.

7. The lower contact of the Chocolate Formation is one of the key contacts within the Kamma Mountains Group. Unfortunately, there are few guidelines for placing the contact. CPK/HSM even state that it is a gradational contact between Chocolate surge tuff and Bud surge tuff (no mention of the genetically related ash-flow tuff which should overlie a base surge) and Mueller also indicates that the lowermost Chocolate member is "Bud-like". Information examined so far does not indicate how one is to distinguish "Bud-like" Chocolate Formation from "genuine" Bud. Perhaps the contact has been placed at the top of the uppermost green rocks.

There are possibly three ways to pick the lower contact of the Chocolate Formation: ¹at the base of the first massive flow or sill (as suggested by Turner), ²at the top of the bedded breccia underlying lithic tuff (as implied by Maynard and Dirt Biker), or ³at the top of the uppermost breccia or lithic tuff. The first choice will not work if the flows or sills are laterally discontinuous or if sills are not parallel to bedding. The second will not work if lateral facies equivalents of the bedded breccia are not bedded or if the bedded unit is only locally developed (such as in paleotopographic lows) and this choice may in fact split genetically related deposits into different formations. The third choice is the least ambiguous lithologically and stratigraphically but would also be compromised by lateral facies changes and may also split genetically related components of the same pyroclastic eruption.

8. SFPG geologists and Turner have postulated equivalence of the "Mine Host Sequence", or LBT, and the Brady Andesite. The following evidence suggests the Brady Andesite is more likely equivalent to the Bud Marker Bed:

	Brady Andesite	LBT	Bud Marker Bed
Depth below Choc. Fm.	>150' (SFPG), 200' (Maynard)	>200' (M&H)	<100' (M&H)
Thickness	300' (SFPG)	320-440' (Allen)	30-130' (Allen)
Height above Dozer Fm.	>1000' (SFPG)	0-200' (M&H)	400-500' (Allen)
Upper contact	Upper Bud Tuff (SFPG)	Lower Bud (Allen)	Middle Bud (Allen), Upper Bud (M&H)
Lower contact	Lower Bud (SFPG)	Tos, Dozer (Allen)	Lower Bud (Allen)
Phenocrysts	amph. (SFPG), plag & bi (Brady)	none	plag (Allen)
Vesicles	none	yes (Allen)	none (Allen)
Laminations/ Flow banding	yes (SFPG), not mentioned (Maynard, Brady)	yes (Allen)	none (Allen)
Breccia/Tuff	crystal-lithic (SFPG)	heterolithic (M&H), monolithic (Allen), ash (Allen)	none (Allen)

Contact relations and textures suggest the Bud Marker Bed is a better match to the Brady Andesite than the LBT. Thicknesses are imprecise but indicate the Brady Andesite and Bud Marker Bed are closer to the Chocolate Fm. than to the Dozer Fm. whereas the LBT is in contact with the Dozer Fm. or, locally, Tos. The absence of crystal-lithic tuff and the lesser thickness of the Bud Marker Bed could be explained by thinning and merging of the two sills (as named by Maynard) or flows of the Brady Andesite toward the mine area. Termination of the tuff could thus be due to intrusion or to stratigraphic pinchout. Alternatively, one of the sills or flows of the Brady Andesite may pinch out toward the mine area.

If the Brady Andesite and Bud Marker Bed are equivalent, where is the LBT on the surface? It would be equivalent to Tbb1 of Massingill, Tcb2 of Maynard, LBT of LAC, Wildrose Rhyolite of Mueller and Dirt Biker(?), and Tbs1 of Brady and would be included in the Lower Bud of SFPG.

9. Sedimentary rocks which directly overlies the Auld Lang Syne Group have been referred to by several names but are distinctive in that they contain clasts of only pre-Tertiary rocks. These sandstones and conglomerates are interbedded locally with basalt (Mueller) or andesite (Dirt Biker, Brady). They lie stratigraphically below the Dozer Formation. This suite of sedimentary and volcanic rocks has been named the Oscar Formation.

However, the Oscar Formation of Muerhoff and Holmes and of Allen includes lithic tuff and breccia which has only a minor amount of Auld Lang Syne clasts and is stratigraphically above the Dozer Formation. If the two Oscar Formations are equivalent, the formation must contain an upper part which is dominantly volcanoclastic and the intervening Dozer Formation must be intrusive.

Turner's "Lower Bud Sequence" contains Auld Lang Syne clasts near the base and so may include what Allen considers Oscar Formation.

10. The Kamma Mountains Group contains an abundance of pale, massive, very fine grained to aphanitic volcanic and subvolcanic rocks. Phenocrysts are generally rare and fine grained. Although they may be of some help in identification in core, they are probably of little use at the surface. Identification of these fine grained rocks is problematic. Most workers have lumped most such rocks within the Dozer Formation.

To complicate matters further, the Dozer is described as a flow dome complex by Brady and Turner. Conceivably, both intrusive and extrusive rock bodies could be assigned to the unit. However, if the Dozer Formation on South Ridge is the extrusive flow dome and is overlain by the Lower Bud, then similar rocks higher in the section, such as those north of Wildrose Canyon(?) and at the east end of Rosebud Canyon, must be younger and should be named something else.

11. There are no distinctive marker beds in the Rosebud mine area so long-range correlations are difficult. In fact, massive aphyric or weakly porphyritic units, plagioclase-phyric flows or sills, monolithic breccias, lithic tuffs, and flow-banded rocks occur throughout the section.

Green rocks of the Bud Formation on South Ridge have caught the eye of many workers but there is no guarantee the green color persists laterally or is stratigraphically significant.

Bedding is apparently restricted to the Bud and Oscar formations and rocks younger than the Chocolate. Although the presence of bedding may be indicative of the Bud Formation (in the absence of Auld Lang Syne clasts) if between the Dozer and the Chocolate, not all the Bud is bedded.

Brady emphasized the characteristic red silty matrix of the Badger but Massingill saw red matrix in the lower Bud (equivalent to Red-Brown Ugly Unit of Lac and LBT) and single outcrops in the Kamma Mountains show gradations from red to grey matrices.

The Rosetta Stone for Kamma Mountains stratigraphy has not yet been found. If the various primary volcanic units are geochemically distinctive, whole-rock analyses of major, minor, and trace elements may help.