Examination of Dr Palmer's GRM Interpretations on Line 00 (or 1000N) at Mt Bulga

Class tutorial Prof. Bob Whiteley, Feb. 2012 References & bibliography

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- Palmer (2009, p87 & p89) has stated that the GRM, a ray-based refraction interpretation method introduced 40 years ago, is a subjective and empirical method. It relies on supposed improved performance based on simplified seismic models.
- The GRM contains all the model assumptions of the Reciprocal (Plus-Minus) Method (~ 50 years old) with the additional assumption that an "optimum XY" can be reliably extracted from processed first arrival data. In application, the GRM requires a simplified overburden velocity model.
- The theoretical basis that an "optimum XY" actually exists in variable earth models and meets Palmer's definition has not been established.
- Using other more complex seismic models representing laterally variable earths Leung (2003) has shown that extraction of an "optimum XY" using Palmer's criteria is unreliable.
- Interpreted seismic sections produced with the GRM in variable conditions do not produce synthetic TX data whose times agree with measured TX data from inner and near end shots where overburden velocities are represented. This is in contrast with tomography i.e. how do you check GRM interpretations?

Location of the Mt. Bulga Massive Sulphide Deposit



Modified from Agnew et. al. (2005). Lewis Ponds, a hybrid carbonate and volcanic-hosted polymetallic massive sulphide deposit, New South Wales, Australia. *Mineralium Deposita*, 39, 822-844.





2:Old collapsed workings, with the highly porous Mt Bulga gossan extending to the ground surface, note the sharp contact with the volcanics. Top of arch is at ~8m depth.

3: Close up of Mt Bulga gossan showing extensive voids and wallrock collapse breccia (dime gives approx. scale)



Palmer's (2006a, Figure 2) TX data. Data from the offset shots SP1 and SP 97 were used for the GRM interpretations but not for the various tomographic models unless Palmer created artifical data to connect the offset shots with their respective shot points (unlikely).













Are any of these interpretation correct ? How do we check and which one do we use?







Initial VIRT (Whiteley, 2004) interpretation of Palmer's data with raypaths from SP 1 and SP 97 by Tak-Ming Leung (completed in 2009)

Note close fit with inner and near offset source data, deepest refractor represents approx. base of weathering and top of the fresh sulphides. The fit to the offset data could be improved a little with some more VIRT modelling but this would not change things much.





Whiteley's Geological Interpretation of VIRT Model obtained from Palmer's data











Forward ray groups, note rapidly decreasing amplitudes over low velocity gossan (Zone C)





Comments:

- Dr Palmer's GRM interpretations on Line 00 at Mt. Bulga are inconsistent with the assumptions contained within the GRM
- Comparison between tomographic images from various GRM starting models in Palmer (2012) is technically questionable as the inversion process has not used the offset TX data used for the GRM models. So what is being compared?
- First arrival amplitude behaviour is inconsistent with Palmer's GRM interpretations