Case History: Mining Selectivity and Equivalent Block

Business Context
In the early 80’s, Cogema undertook on behalf of Somair, its subsidiary in Niger, a reconciliation study aimed at assessing the benefits that geostatistics could bring to the mine resource-estimation and strategic-planning practices. Several global geostatistical estimates of a mined-out area representing about 1½ year’s production were developed and compared to the pit production figures.

Background
This sedimentary, flat-lying uranium deposit (Fig 1) is mined on 3m-high benches. The grade-control crew uses 5m x 5m grade maps and a hand-held radiometric scaler to assist the dozer in producing heaps of ore as homogeneous in grade as possible (Fig 2). These heaps are then loaded into 25t-trucks while new ones are formed. Each truck is scanned. The grade derived from the radiometric reading serves to dispatch the truck either to the mill or heap-leach pad and establish the mine production figures.

Methodology
The study did not involve the grade-control data. H Sans implemented the following methodology:
1. Variography of the 25m drill-hole data.
2. Modelling the composite-grade histogram using the gaussian anamorphosis technique.
3. Computing dispersion variances for a suite of SMU’s (SMU= Selective Mining Unit).
4. Implementation of the discrete gaussian change-of-support model to produce the various global grade-tonnage estimates.

Findings
Table 1 shows that grade-tonnage predictions made using the 7.5m x 7.5m x 1.5m SMU were close to the production figures (Actual). The high and low cut-off grades refer to the ore sent respectively to the mill and the heap-leach pad.

Interpretation - Benefits
- This SMU or equivalent block encapsulates the concept of effective selectivity. It conveniently measures the combined effect of the mining and grade control practices, on the resource. All aspects of the “information effect” are incorporated into this SMU.
- It is fascinating to see that applying a cut-off grade to a modelled histogram of real SMU grades - a straightforward approach indeed - did provide a good estimate of what the mine delivered over 1½ year.
- This SMU is the SMU to use in strategic mine planning based on the 25m data. Global estimates can be readily prepared using the methodology outlined in this paper. The equivalent block is also easy to incorporate into a 25m x 25m block-model.

The equivalent block as a tool can serve many purposes e.g. to understand an actual - predicted gap, measure mining performance and develop sound mine planning strategies.

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Table 1: Actual / Predicted Ratios

<table>
<thead>
<tr>
<th>Cut-off grade</th>
<th>Grade</th>
<th>U metal</th>
<th>Ore</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1.02</td>
<td>0.96</td>
<td>0.94</td>
</tr>
<tr>
<td>Low</td>
<td>0.99</td>
<td>0.93</td>
<td>0.94</td>
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