Your Task: One of the important jobs that economic geologists do when employed with mining companies or government geological surveys like the USGS is to assess the economic potential of new ore deposits. Once the limits of the ore body have been delineated, it is up to the project geologists to determine if a profit can be made in establishing a mine at the site. Numerous factors need to be considered. How much ore is there? What is its grade? What rate of extraction/processing can be done? How long can the mine operate? What is the cost of processing? There are also startup costs. Last year, you could have easily borrowed money from a bank to get started. In today’s economy, even profitable mine sites are difficult to develop because of lack of funds (i.e., banks will not loan money).

This exercise will introduce you the economic realities of mineralogy. Consider the diagram on the next page. It shows the extent of a copper ore deposit located in an isolated area of Papua New Guinea. You have been contacted by a local investment firm that is considering helping to fund the development of a small pit mine at the deposit. The junior mining company that found the deposit is a small Australian exploration firm (AusCo). They don’t normally produce the deposits they find (i.e., they are not a mining firm), but would like to work this one if it is profitable. If the deposit is not worth them mining it, they would be willing to sell their interests in the property to mining giants Rio Tinto or BHP. AusCo is looking to cut a deal with an investment bank.

Assaying data has shown that the deposit consists of 2 zones. Both zones are essentially rectangular in extent. Zone 1, the rich interval, contains on average, 3 wt% digenite, 2 wt% chalcocite and 5 wt% chalcopyrite. Zone 2 contains 1.5 wt% chalcocite and 2 wt% chalcopyrite. The average specific gravity of the ore in zone 1 is 3.45 g/cm³ (3450 kg/m³). The average specific gravity of the ore in zone 2 is 3.12 g/cm³ (3120 kg/m³). The plan is to extract the rich ore zone first and then, if economically feasible, expand the open pit into zone 2.

In Papua New Guinea, average extraction/smelting costs are relatively low ($US 45.00/tonne), but the infrastructure is poor. Consequently, start up costs for even a relatively small extraction operation (4,000 tonnes/month) will be in the order of $US 10 million dollars. There are also no final processing facilities available. That will have to be done in Australia, so budget $30.00/tonne for shipping/offsite processing. The deal that AusCo would like to make with investment bank is to get an interest free loan payable in full within 3 years. In return for the loan, the investment firm gets 25% of the profits from year 3 onwards until the mine is closed.

At current copper prices¹, and considering the processing/extraction and shipping costs as well as reasonable operational expenses², how much money can AusCo expect to make from the high grade deposit per year? How long will they be able to mine it before the high grade deposit runs out? Can they pay off the loan within 3 years?

Is zone 2 currently economical? If so, how much money will AusCo make per year and how long will this deposit last? If it isn’t currently economical, what price of copper will be needed to make

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¹ That means today: check a commodities site on the internet for the most recent copper prices.
² AusCo is a 3 person operation; 2 geologists and a secretary. Salary expenses are estimated to be $125K per year. Also budget an additional $10K per year for assaying and personal travel expenses.
it so? Assume extraction/processing costs remain the same for the foreseeable future. Ultimately, would you recommend that the investment firm write AusCo a check for US$10,000,000.00?

Please submit your assessment in the form of a professional letter written to the following investment firm:

Ponzi Investing Pty.
1313 Slim Road
Hobart, 7000 Tasmania
Australia

Be sure to answer all of the questions posed in this week’s assignment.

Due Date: See calendar or website for due dates.
Table 1: Worksheet for estimating copper production/gross revenue for the Zone 1 mine site.

$US ____________ current price per pound of Copper

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Mol. Wt.</th>
<th>Wt% Cu in mineral</th>
<th>Wt% Cu in ore</th>
<th>Total wt Cu per m³ ore</th>
<th>$US gross per m³ ore</th>
<th>$US gross per tonne ore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digenite Cu₉S₅</td>
<td>732.24</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chalcocite Cu₂S</td>
<td>159.16</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chalcopyrite CuFeS₂</td>
<td>183.53</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Gross per tonne of Ore

Less processing/smelting costs in PNG of $ _______/month

Less transport/processing costs in Australia of $ _______/month

Total Net per tonne of Ore

Total Gross per month based upon _______ tonnes mined

Less salary costs of $ _______/month

Net profit/(loss) per month ($US)

Net profit/(loss) per year ($US)

Zone 1 Longevity Calculation Space
Table 2: Worksheet for estimating copper production/gross revenue for the Zone 2 mine site.

$US \text{ ____________ current price per pound of Copper}$

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Mol. Wt.</th>
<th>Wt% Cu in mineral</th>
<th>Wt% Cu in ore</th>
<th>Total wt Cu per m$^3$ ore</th>
<th>$US$ gross per m$^3$ ore</th>
<th>$US$ gross per tonne ore</th>
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</thead>
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<tr>
<td>Chalcopyrite CuFeS$_2$</td>
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<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Gross per tonne of Ore

Less processing/smelting costs in PNG of $\text{ ________/month}$ -
Less transport/processing costs in Australia of $\text{ _______/month}$ -

Total Net per tonne of Ore

Total Gross per month based upon ________ tonnes mined

Less salary costs of $\text{ ________/month}$ -

Net profit/(loss) per month ($US$) -

Net profit/(loss) per year ($US$) -

Zone 2 Longevity Calculation Space