

ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2014 SESSION

Open-book examination
Calculators : only authorized models
Duration : 3 hours

14-MI-B1 Mine valuation and mineral resource estimation

Total : 100 points

QUESTION 1 (30 points) Estimation of economic cut-off grade

You are a mining engineer working for an underground copper mine. The mining cost is 103\$ CDN/tonne of ore, the processing cost is de 37\$CND/tonne of concentrate, whereas the general and administrative costs are 20\$ CDN/tonne of ore. Smelting and refining costs are 18\$ CDN/tonne of ore. Estimate the cut-off grade (% Cu) before and after tax. Also, estimate the cut-off grade (% Cu) before and after recovery at the mill for the current copper price of 6630\$ US/tonne (April 2014), a concentration factor of 11 and a mill recovery of 90% (1\$ CND=0,91\$ US).

QUESTION 2 (16 points) Risk evaluation

The after tax cost of proving up new nickel ore reserves by drilling for an operating mine is 50¢/tonne. The after tax net revenue from each additional proved nickel ore is 3,5\$/tonne when mined at the end of the mine life. The cost of the additional drilling required to prove one tonne of nickel ore is 1,5\$/tonne (at the end of mine life). What is the maximum number of years in advance that the mining company could economically justify proving up reserves if the cost of capital is 15% ?

QUESTION 3 (14 points, 2 points par question) Mineral resource estimation

Circle True or False (except question e) for each of the following statements and justify your answers:

- The polygon method is recommended for small vein deposits. True or false? Justify your answer.
- Gold deposits have a coefficient of variation below 1. True or false? Justify your answer.
- Regular iron ore deposits have a high standard deviation. True or false? Justify your answer.
- Gold grades estimated with ordinary kriging reproduce well the parameters of the sample histogram. True or false? Justify your answer.
- What is the effect of composites on the mean and the variance? Justify your answer.
- The most important challenge in developing industrial minerals is capital availability. True or false? Justify your answer.

g) In order to study the variability of the grades that a mine sends to the processing plant we can use the variability (variance) of the estimated grades using kriging. True or false? Justify your answer.

QUESTION 2 (20 points) Capital cost estimation

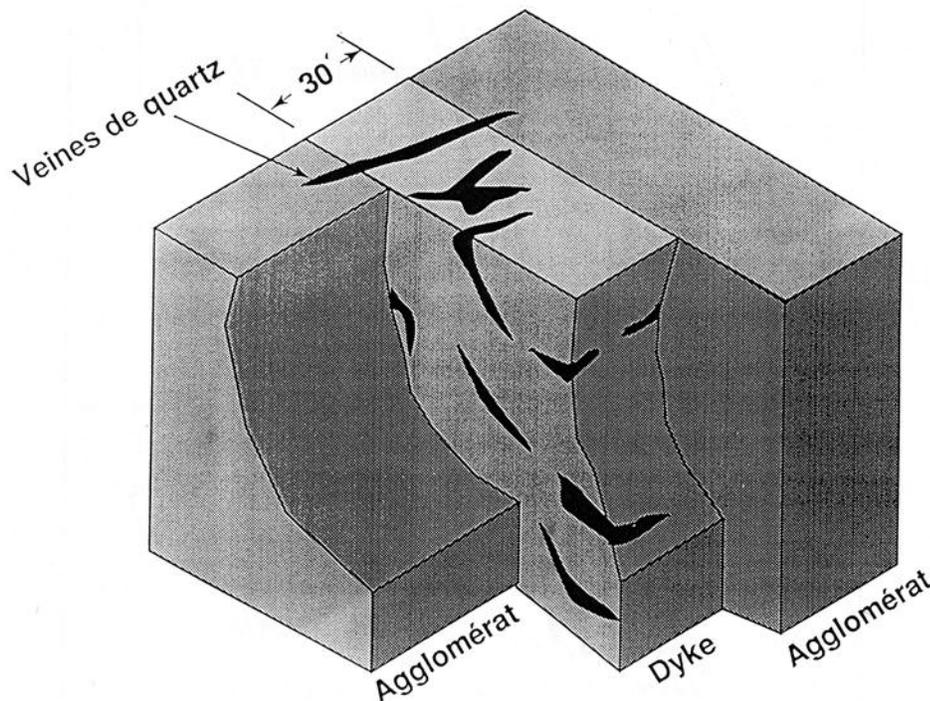
In a scoping study of a gold mine you are trying to estimate today (2014) the price of a crusher of 1000 tonnes/h. Five years ago (2009) you had paid 100 000\$ for a similar crusher of 500 tonnes/h. What would you do to estimate the price of this crusher?

QUESTION 2 (20 points) Operating cost estimation

You are in the process of completing a prefeasibility study of a gold deposit. The deposit has the form of a vertical diorite dyke that contains quartzite gold bearing veins (Figure 1) with an average gold grade of 4 g Au/tonne. The length of the dyke is 300m and its thickness 10m (30 feet), whereas the mineralisation continues to a depth of 100m. If the density of the mineralisation is 3 tonnes/m³ estimate the daily production rate (for 300 days/year) to mine the deposit using long-hole mining (10 points).

A colleague of your valuation team suggests that you use the mining cost (\$/tonne) of a neighbouring copper mine operating in a similar chalcopyrite (density of 4,2 tonnes/m³) deposit (15mx350mx110m) using long-hole mining. Moreover, the copper deposit has similar hanging wall and footwall characteristics. Would you be comfortable in using the same mining cost as in the copper mine? Justify your answer (10 points).

Figure 1 Diorite dyke



Veines de quartz = quartz veins
Agglomérat = agglomerate