A comparative study of quantitative methods in ore microscopy: digital image analysis *vs.* point counter device

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Quantitative mineralogical analyses of metallic concentrates from an ore-processing plant with reflected light microscopy have been carried out independently, on the same samples, by an expert mineralogist using a point counter device (**PCD**), and by digital image analysis (**DIA**) operated by a post-graduate student in order to compare the performance and results obtained with both methods [1].

Te results obtained by both methods (e.g. Table 1) are broadly similar [2] and differences do not exceed the expected margin of error inherent to the statistical significance of the samples studied [3]. But there are major differences when comparing the performance of both methods: while at best some 3 000 particles per hour can be registered with PCD, it is possible with DIA to process 100 000 particles per hour, extracting data not only about volumetric fractions, but also about morphological parameters of every mineral grain. This difference is enhanced if the work conditions are considered. While a human operator may work with PCD some 6 h day, if risk factors as fatigue are to be avoided, DIA systems can work 24 h day. Moreover, PCD should be handled by an expert ore microscopist, but there is at present a trend to reduce this training at universities, thus leading to a gradual disappearance of this type of experts. DIA does not need such a high grade of expertise, even if some sort of supervision is needed [4].

Table 1: Modal analysis PCD vs. DIA

	Mo	SFsCu	Py	Ccp
PCD (%)	69	13	8	10
DIA (%)	62	14	11	13

Pay-back for both methods has been calculated based on data shown on Table 2 and considering the number of samples that it is possible to analyze by means of each method. Although initial investment for DIA is more than twice the investment for PCD, pay-back is just one year for DIA, while the return of investment increases to three years for PCD.

Table 2: Pay-Back comparison PCD vs. DIA

	Equipment Cost	Labour (annual)	Income/ sample	Pay-back
PCD	30 000 $	50 000 $	150 $	**3 years**
DIA	70 000 $	30 000 $	150 $	**1 year**

To conclude, DIA coupled to reflected light microscopy is a powerful and cost-efficient tool to support ore-processing with varied quantitative mineralogical data, as modal analysis, morphological characterization of mineral particles, and mineral liberation analysis. DIA can provide more complete, reliable and efficient mineral characterizations than the traditional methods as PCD, which are less performing and do not preclude human error, e.g. by fatigue. It is also by far more economic than the methods based on SEM images, while providing comparable results. DIA can satisfy the demands of Geometallurgy with low investment and maintenance costs.

[1] Project *Ore characterization by computer vision (CAMEVA* CGL2006-13688-C02, MEC, Spain). [2] Pérez-Barnuevo, L. et al. (2008). Proc. Symp. Mineralogía Apl. Geometalurgia, abs. R5. XIII Congr. Latinoamericano de Geología, Lima. [3] Castroviejo, R. et al. (1999) (a). Geovision. Int. Symp. Imaging Appl. Geology. Liège, Belgium. 37-40. [4] Castroviejo, R. et al. (2009). Queensland. Proc. 10th Biennial SGA Meet, Townsville, Australia, 692-684 (ISBN 9780980558685).