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# PLSR and XRD for process monitoring and exploration of ores

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Decreasing ore qualities and increasing prices for raw materials require a better control of processed ore and a more efficient use of energy. Traditionally quality control in mining industries has relied on time consuming wet chemistry or the analysis of the elemental composition. The mineralogy that defines the physical properties is often monitored infrequently, if at all.
The use of high speed detectors has turned X-ray diffraction (XRD) into an important tool for fast and accurate process control. XRD data and their interpretation do make the difference in the identification of minerals, in describing their distribution in ore bodies and in their beneficiation during processing.

The use of statistical techniques such as **P**artial **L**east **S**quare **R**egression (PLSR) or **P**rincipal **C**omponent **A**nalysis (PCA) on XRD raw data has been successfully trialled to determine raw materials and processed ores in addition to well established methods for mineral identification and quantification.
PLSR can be used to correlate process parameters directly from the XRD pattern without investigating the mineral content. Hidden information present in the XRD pattern but not determined with traditional methods can be used to improve the characterization of the analyzed materials.
The practical use for the direct determination of process relevant parameters during exploration and ore beneficiation will be illustrated on several case studies from mining and ore processing, figure 1.

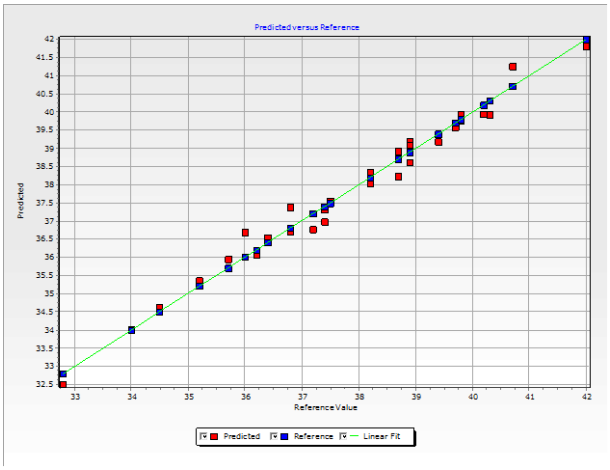


*Figure 1: Evaluation plot for the direct determination of the available alumina content in bauxites using PLSR on XRD raw data*

*Figure 2: PLSR is a method to predict 'hidden' information directly from XRD raw data (similar to the hidden part of an iceberg*