Gold Exploration
with portable X-ray diffraction (pXRD)

In the field or at the core shed, geologists are often constrained to what minerals they can see with their hand lens. Due to the fine-grained nature of alteration that often accompanies gold mineralization, visual assessments made by the geologist are often subjective and, frequently, wrong. Samples are often sent off site to a laboratory for petrographic analysis. This procedure is time-intensive and expensive and sometimes fails to distinguish between minerals that have vastly different origins (e.g. formed by ground water or mineralizing fluids). Further, differentiating similar minerals, such as clays, carbonates, and fine-grained sulfides, is extremely difficult under the microscope.

Olympus pXRD provides geologists with reliable, qualitative, and quantitative mineralogical data in near real time in the field, at the drill-rig, or in the core-shed. The information that pXRD provides is objective, rather than subjective, and would take weeks or months to obtain using traditional methods.

Using an Olympus pXRD instrument, geologists can quickly make important decisions, such as:

- Whether to abandon or extend the drill hole
- Where to place the next drill hole
- Whether to continue mapping in the area

Aside from alteration vectoring, quantitative mineralogy provides important geo-metallurgical and mineral processing information for future mine design.

Olympus pXRD instruments use patented technology developed for the Mars Science Laboratories (MSL) mission. They are fitted with a charge-coupled device (CCD) to simultaneously collect X-ray diffraction and qualitative X-ray fluorescence data.

The benefits of Olympus' innovative pXRD analyzers include:

- Small sample: requires only 15 mg of material
- Easy sample preparation: does not require a skilled technician
- Fast acquisition time: obtain results in a few minutes
- Portability: battery-operated, rugged design with no moving parts
- Stand-alone instrument: no need for water cooling or a large, external power source
- No ongoing servicing requirements: enables XRD to be performed regularly with minimal downtime

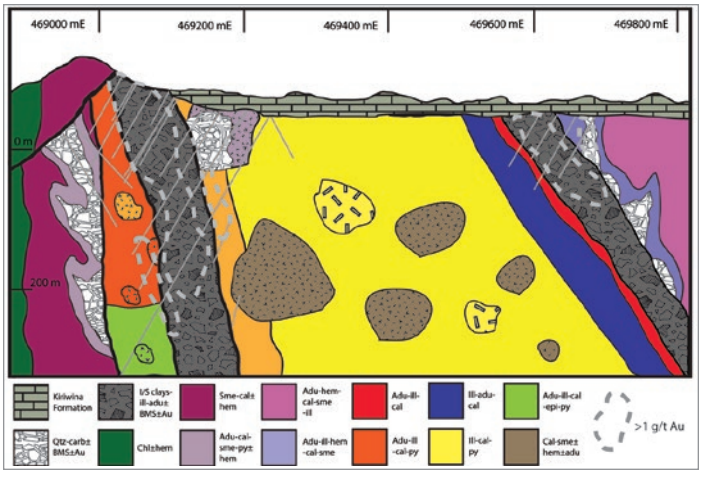

Figure 1. Alteration model through an epithermal gold deposit. Alteration facies were developed and mapped using quantitative mineralogy data derived from an Olympus pXRD instrument. *Burkett et al. (2015).**

Olympus XRD — Data quality and data collection time

Olympus pXRD analyzers provide the convenience of onsite quantitative mineralogy without the need for complicated sample preparation procedures. To illustrate the quantitative capabilities of Olympus pXRD products, comparisons have been made with a large, 4 kW, conventional lab-based XRD instrument (Figure 2). The results show strong agreement between the lab-based XRD unit and the Olympus pXRD system.

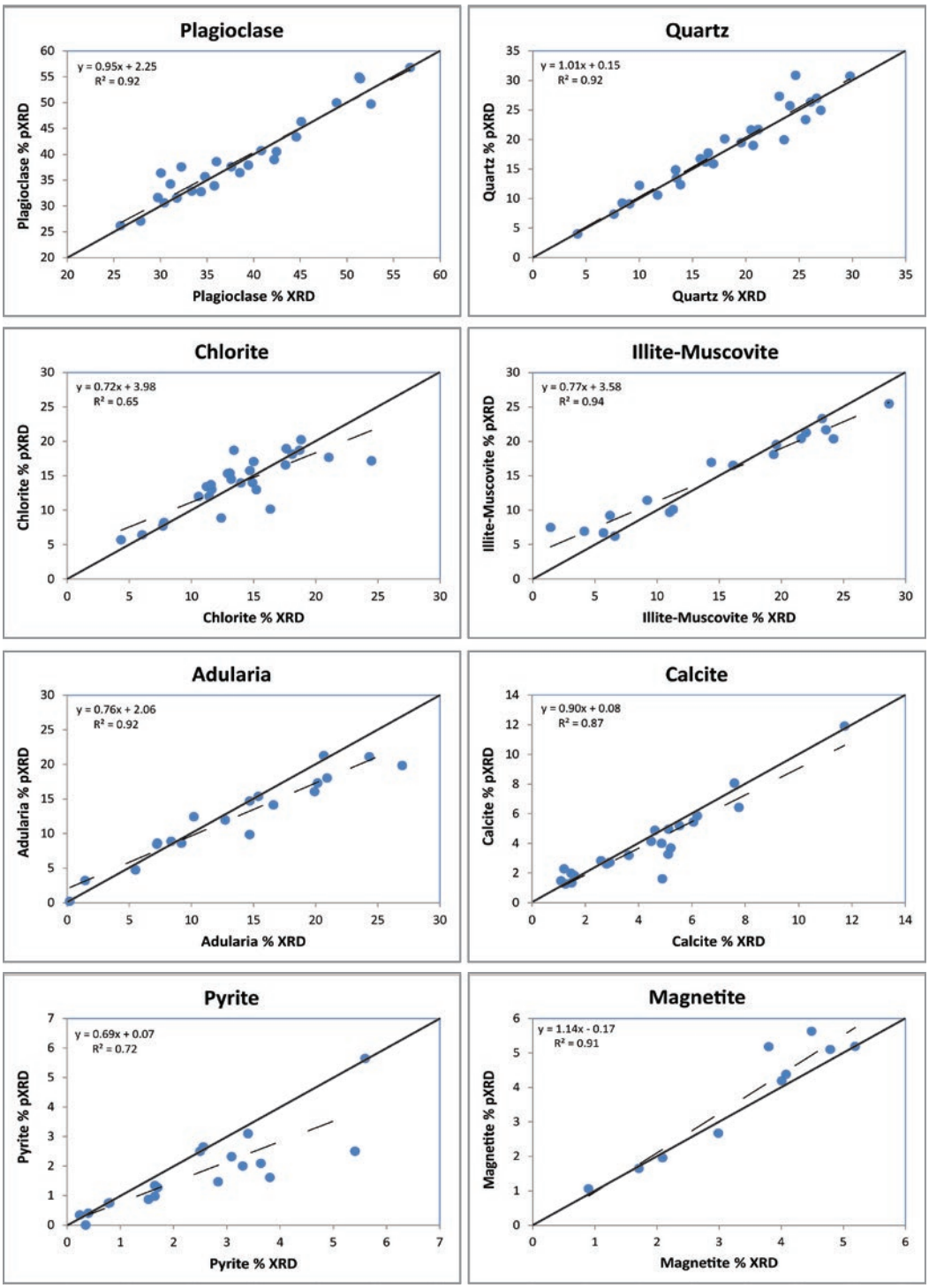

Figure 2. Excellent correlation between mineral percentages deduced from XRD traces from a lab-based, 4 kW XRD instrument (x-axis) and the Olympus pXRD (y-axis) with 20 minute runtimes. *Burkett et al. 2015.**

Results of quantitative XRD for a 4 kW, lab-based instrument and the Olympus pXRD at varying collection times

Mineral	Lab-based XRD	pXRD – 40 mins	pXRD – 20 mins	pXRD – 10 mins	pXRD – 5 mins
Pyrite	0.8	0.8	0.1	0.0	0.0
Calcite	6.1	5.4	7.1	8.1	8.4
Adularia	12.7	12.0	13.7	13.1	13.0
Albite	44.6	43.4	46.6	45.6	44.4
Muscovite	4.2	6.9	6.3	6.0	7.3
Chlorite	18.1	18.1	14.2	15.5	15.5
Quartz	13.5	13.5	12.1	11.6	11.4

Data collection time was also studied to assess the performance of the Olympus pXRD analyzers at varying testing times as well as comparison with lab-based XRD. Diffractograms of one sample using different testing times are shown in Figure 3. Figure 4 and Table 1 summarize the quantitative results at different data collection times and clearly shows consistent results between the two instruments (even at a runtime of 5 minutes).

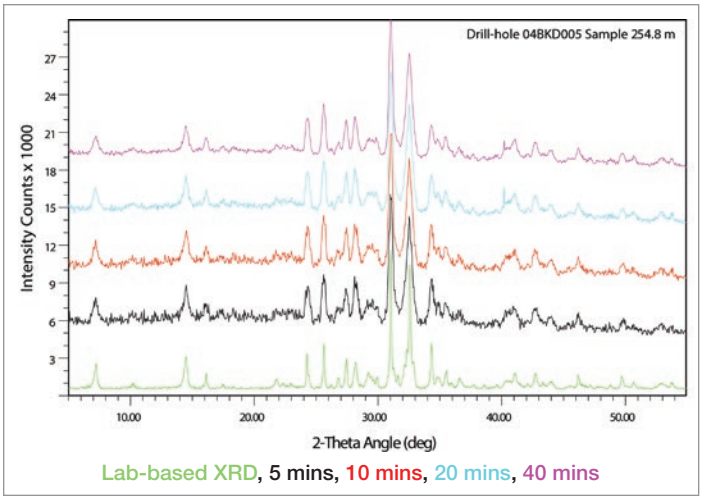

Figure 3. XRD traces obtained from a lab-based, 4 kW XRD instrument and the Olympus pXRD at varying collection times. *Burkett et al. 2015.**

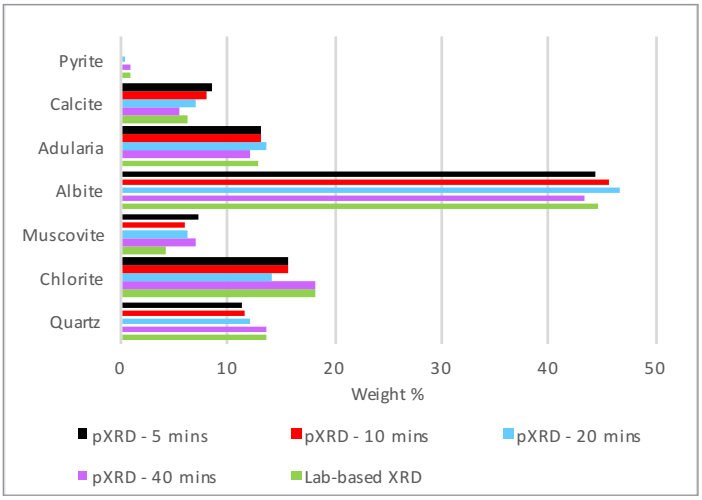

Figure 4. Comparisons between mineral percentages deduced from the XRD traces in Figure 3. Note the excellent relationship between the Olympus pXRD and lab-based instrument, even at short runtimes.

* D Burkett, I Graham, L Spencer, P Lennox, D Cohen, H Zwingmann, F Lau, B Kelly and D Cendon. (2015). "The Kulumadau Epithermal Breccia-hosted Gold Deposit, Woodlark Island, Papua New Guinea." Pacific Rim Congress 2015, Hong Kong, China. The Australian Institute of Mining and Metallurgy, pages 1–8.

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