

APPLICATION OF PORTABLE XRF (pXRF) TO MINERAL EXPLORATION

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TELE  GEO

STATEMENT OF PROBLEM

➤ There are two fundamental approaches to the use of portable XRF in mineral exploration:

➤ Quantitative analysis (i.e. for public reporting of results).

➤ Requires instrument calibration

➤ “Fit for Purpose” QA/QC program

➤ Thoughtful sampling program to obtain representative analyses

➤ Verification using laboratory analyses

➤ Qualitative analysis (i.e. for internal use only).

➤ Control samples to monitor instrument drift

➤ No calibration of instrument

➤ Minimal sample preparation (samples must be dry though)

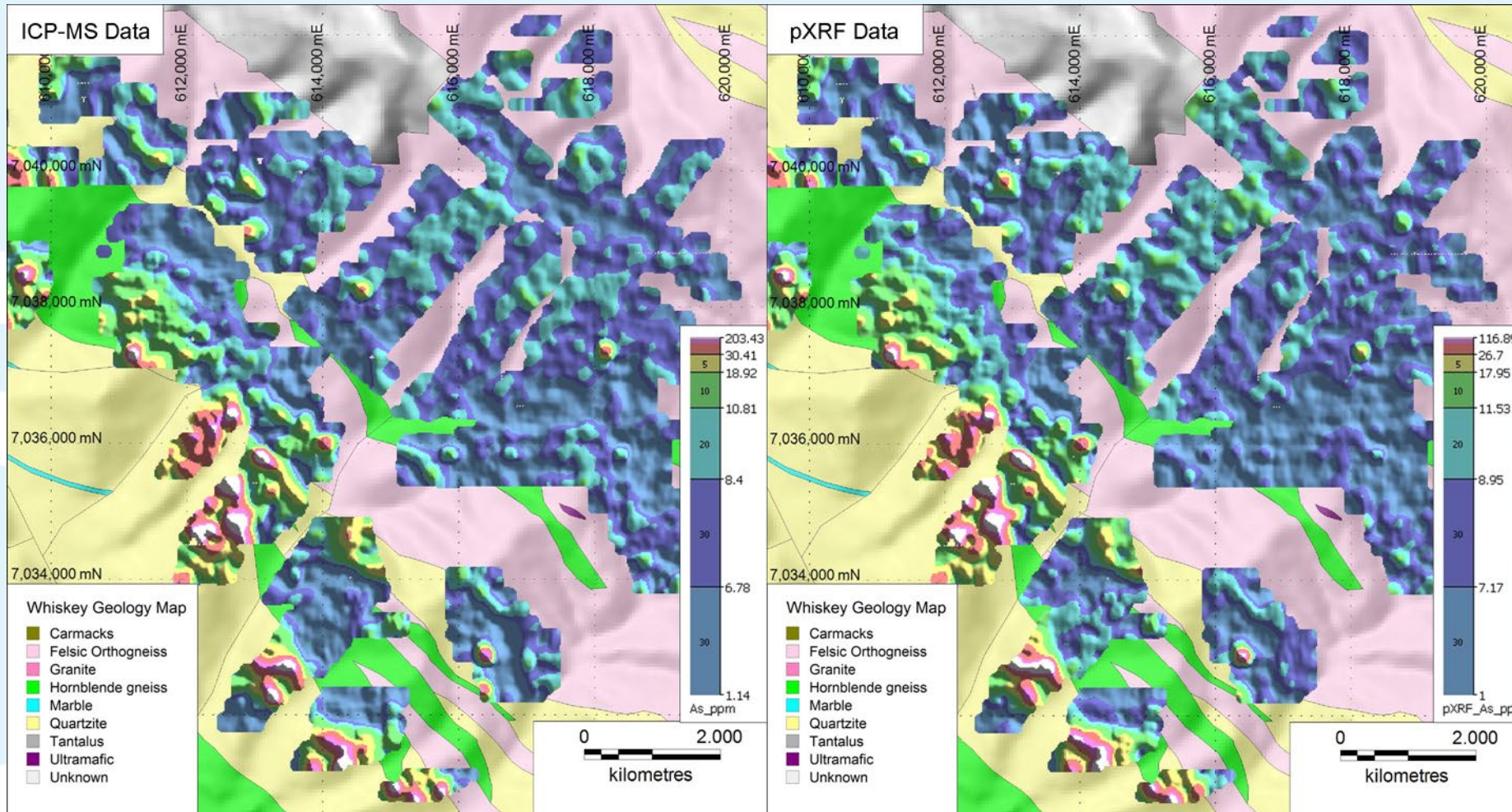
➤ Analyses can be done through sample bags



WHISKEY GOLD PROJECT, YUKON, CANADA

- Early stage Au exploration project for Smash Minerals in 2011.
- Intensive grid sampling program in residual soils (unglaciated part of Yukon).
- C-horizon soils used to identify anomalous Au and associated pathfinder elements, as well as to characterise and map bedrock geology.
- 14,651 un-sieved, dry soil samples analysed by benchtop and handheld (in test stand mode) pXRF through Hubco polyester sample bags.
- 1 kg samples also analysed using an aqua regia digestion/ICP-MS analysis of a 30 g, -150 mesh sub-sample.
- Results:
 - Good agreement for As & Cu from both machines for relative trends in ICP data.
 - Pb, Mo & Ni data needed leveling by instrument to give acceptable results.
 - Data for low level pathfinder elements (W, Sb, Ag, Bi, Te) erratic.

COMPARISON OF pXRF AND ICP-MS ARSENIC IN SOILS



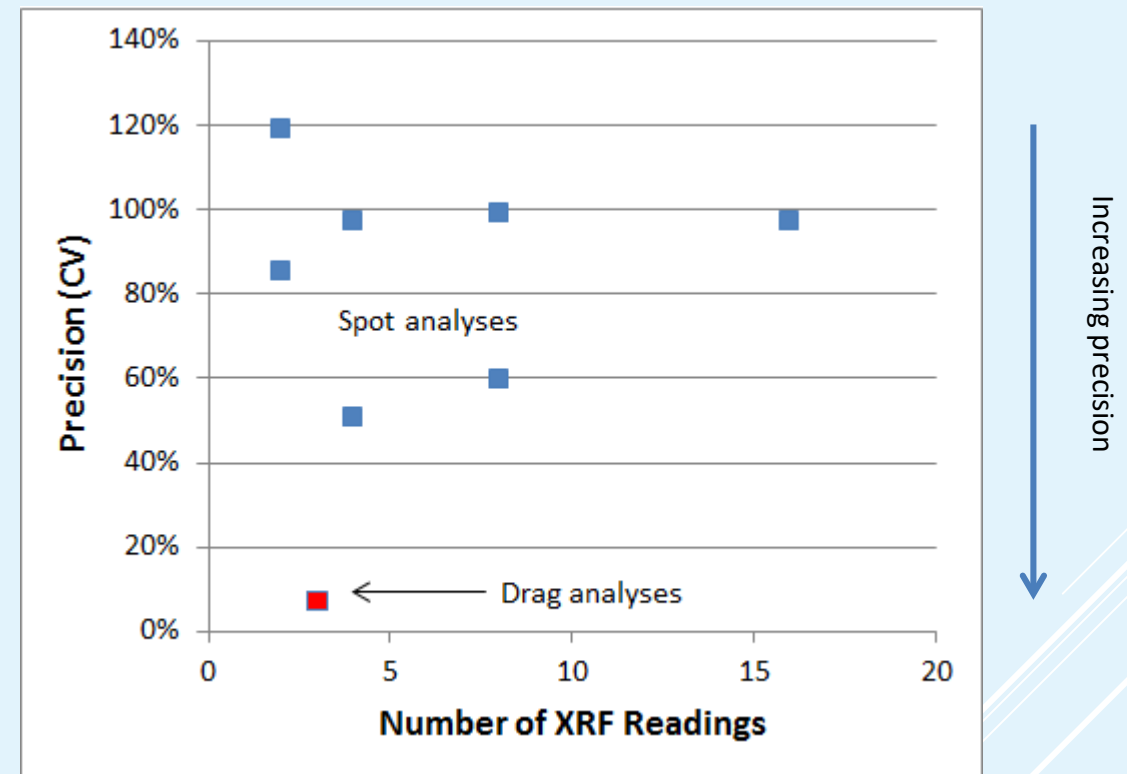
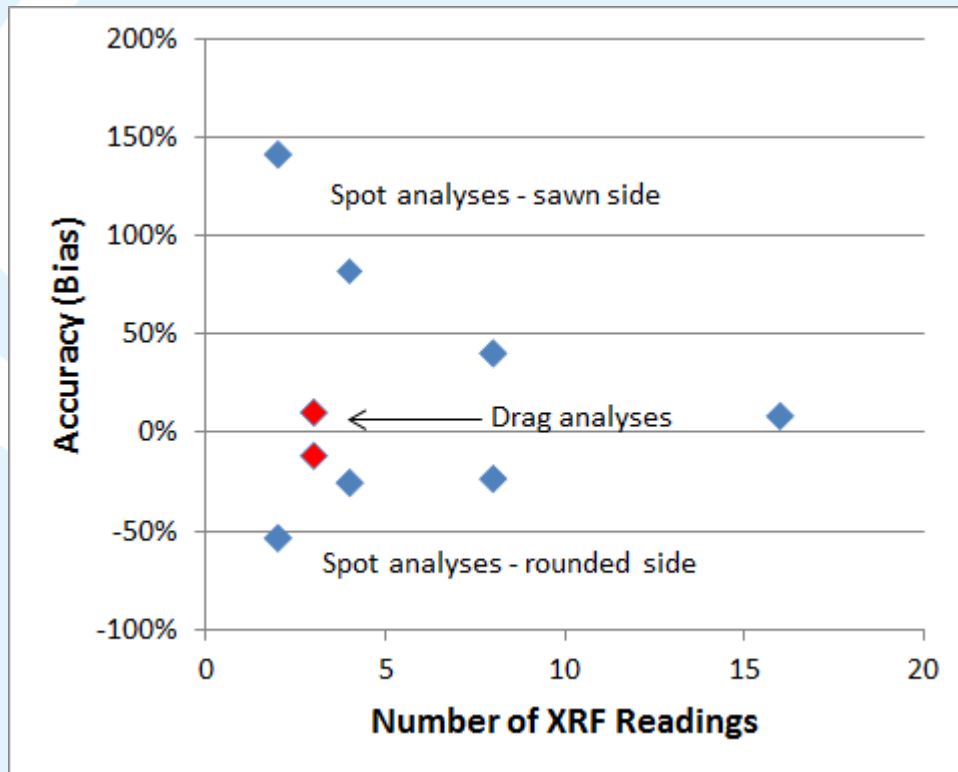
(From Arne et al., 2014)

- Data are plotted as percentile grids to compare relative trends.

SCANNING DIAMOND DRILL CORE

- Direct scanning by dragging the pXRF detector over the core may produce acceptable results.
- Ensure that only one beam set to the element (s) of interest is active during the analysis.
- Need a constant rate of scanning; lay out intervals in angle iron for analysis – can now be done robotically.
- Need close contact with the surface of the core.
- Results:
 - Spot sampling struggles to give good data if there are large particles in the core (i.e. nugget effect); the time required becomes impractical.
 - Multiple scans along different surfaces give more repeatable results (better precision) compared to a single scan.
 - Some orientations of mineralisation in drill core cannot be adequately sampled using pXRF of the surface of drill core (i.e. high-angle veins)

FINELY DISSEMINATED CHALCOPYRITE IN DRILL CORE



(Modified from Arne 2018)

- Performance of pXRF spot versus 3x drag analyses has been evaluated by comparing pXRF grade estimates following calibration to laboratory assays; precision has been estimated using the coefficient of variation (CV).

CONCLUSIONS

- Decide whether you want quantitative or qualitative data from your pXRF and devise your program accordingly.
- Qualitative pXRF data are sufficient for obtaining data quickly in the field and modifying exploration programs “on the fly”.
- Quantitative pXRF data must be obtained for public reporting purposes – this is no trivial matter.
- In some circumstances it may not be possible to obtain representative compositional data from outcrop or drill core using pXRF due to an unfavourable distribution of commodity minerals and/or a nugget effect.

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