

# **AFP APPLICATION MODELS FOR MINERAL CERTIFICATION SYSTEMS**

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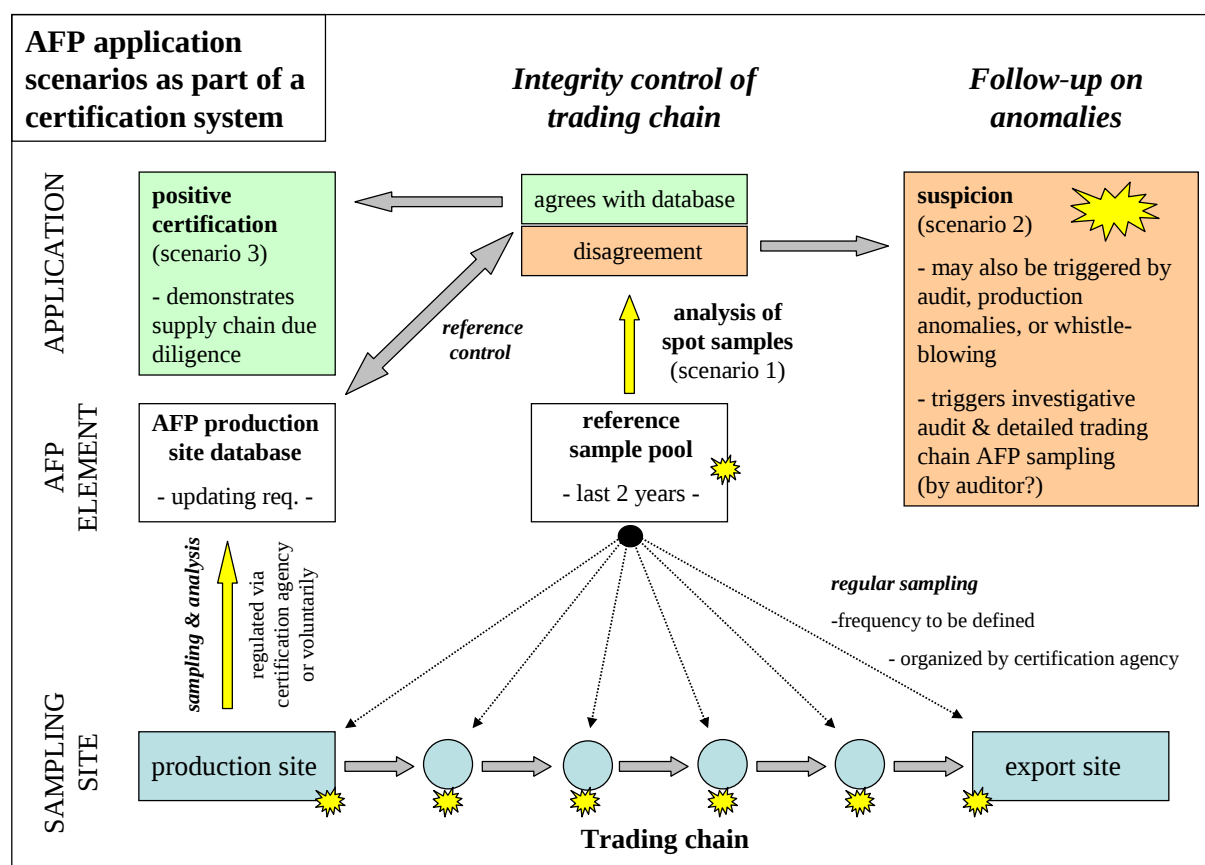
# 1 General Considerations

## 1.1 AFP Application Framework

The Analytical Fingerprint (AFP) method, executed via an AFP laboratory, may become integrated into a mineral certification system as an obligatory traceability tool. Since AFP represents an independent method to verify the integrity of mineral shipments, it also serves as a means to increase the credibility of a mineral certification system. AFP may alternatively be applied on a voluntary base by mineral producers wishing to demonstrate supply chain due diligence measures to their clients.

If applied in the frame of a certification system governed by a certification office, the certification office will coordinate the activities of an AFP laboratory. Certification-seeking mineral producers will be obliged to allow for AFP sampling at their production sites as well as along the associated mineral trading chains. Funding for AFP sampling and analysis could be provided by the mineral producers via the certification office, similarly to what is envisaged for the funding of certification audits.

Three AFP application scenarios are outlined below which focus on applying AFP in the frame of a certification system (Fig. 1). The underlying assumption for all scenarios is that general considerations for the coltan “proof of origin” are also applicable to cassiterite and wolframite/scheelite. Consequently, no distinction is being made below with respect to AFP target minerals. The reader is assumed to be familiar with general AFP methodology (Melcher et al., 2008, 2009; BGR, 2010).



**Fig. 1:** AFP application scenarios as part of a certification system (yellow = AFP analysis).

## **1.2 AFP Reporting and Oversight**

If applied in the frame of a certification scheme, an AFP laboratory should report to the certification office. The role of the certification office with respect to AFP will be (1) to coordinate and regulate AFP sampling, and (2) to use AFP as an independent tool to control the integrity of mineral trading chains.

The central element of the AFP scheme is the mineral source-specific AFP reference database against which actual mineral flows are compared in order to trace the origin of mineral shipments (Melcher et al., 2008, 2009). This database contains the sum of characteristic geochemical and mineralogical features of mineral concentrates of individual mineral production sites; it is hosted and used by the AFP laboratory who will submit regular (e.g., six months cycle) reports on the state of the database to the certification office. A regularly updated list of mining areas integrated into the AFP reference database should be made available to the general public for transparency control.

## **2 AFP Sampling**

### **2.1 General Sampling Constraints**

AFP sampling comprises (1) source sampling at mineral production areas<sup>1</sup> and (2) sampling along the trading chain. The former serves to feed the AFP reference database whereas the latter constitutes the actual integrity control instrument for mineral trading chains. In the frame of a certification scheme, the certification office should coordinate and regulate AFP sampling activities and, to this end, is required to liaise frequently with the AFP laboratory.

### **2.2 Production Site Sampling**

#### **2.2.1 Framework**

The purpose of production site sampling is to obtain and analyze mineral concentrate samples which will serve as a reference for the characteristic geochemical and mineralogical features of a given mineral production site; the data are to be stored in the AFP reference database. As source-specific features may vary on a small scale, in situ sampling of individual production sites should be given preference over sampling of aggregated material. Origin and integrity of AFP reference samples of individual production sites must be guaranteed, and a number of sampling constraints apply additionally (Melcher et al., 2009; BGR, 2010).

At the moment, all AFP scenarios as outlined below require prior source sampling at mineral production sites in order to integrate the geochemical and mineralogical features of a given production area into the AFP reference database.

#### **2.2.2 Sampling Procedures**

Production site sampling will partly be carried out by AFP laboratory staff. However, conducting a detailed AFP sampling campaign at individual production sites will be time- and labor-intensive as a function of size and accessibility of each production site. Therefore, AFP sampling cannot solely rely on AFP laboratory staff, but will necessitate involving experts of certification partner organizations.

Local geological surveys are the natural candidates for AFP support sampling, as they are usually well acquainted with project infrastructure, geology, and local production conditions. In order for a partner

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<sup>1</sup> corresponds to formal concessions related to an exploration/exploitation license in Rwanda

organization such as a geological survey to become officially affiliated with AFP support sampling, the organization needs to have a proven track record of working independently and accurately. Appropriate (standardized) sampling equipment should be made available to partner organizations, and the certification office/the AFP laboratory might choose to offer further support to a partner organization (e.g., capacity building, logistics) in order to allow for more efficient AFP sampling.

### **2.2.3 Reporting and Updating**

Once a given mineral production area has been integrated into the AFP reference database, further AFP sampling and analysis might become necessary in case of modified production parameters (e.g., changes in individual mining sites or modified concentrate upgrading procedures) potentially impacting on source-specific AFP data. Therefore, mineral producers will be required to submit a report to the certification office in case one or more production parameters have been modified. The certification office, in cooperation with the AFP laboratory, should then decide whether additional AFP sampling at the production site will be necessary.

Reporting should be done by mineral producers such as mining companies or artisanal mining cooperatives. In case the artisanal miners are not organized and/or lack capacity to fulfill their reporting requirements, reports might instead be submitted by relevant government authorities such as geological surveys (e.g., in the frame of mine inspections).

## **2.3 Trading Chain Sampling**

### **2.3.1 Framework**

The aim of trading chain sampling is to track and verify mineral flows within the certification system. By using AFP as an independent checking instrument (scenario -1-), the certification office may apply AFP as a tool to either detect anomalies which will trigger a more detailed investigation (scenario -2-) or to confirm (“positively certify”) the integrity of a given trading chain (scenario -3-; Fig. 1).

Trading chain sampling should be carried out by AFP laboratory staff and should additionally make use of credible partner organizations as well as personnel involved in existing procedures (e.g., auditors, independent chemical laboratories for grade control) wherever possible in order to minimize the impact of AFP sampling on mineral flow and trade.

### **2.3.2 The AFP Reference Sample Pool**

In order to streamline AFP sampling along the trading chain, it will be beneficial to form a continuously updated pool of reference samples to be provided, on a regular base, by all mineral producers and traders participating in the certification system. From this sample pool, individual samples may be selected for AFP spot analysis according to a pattern to be decided by the certification office in cooperation with the AFP laboratory and trading chain stakeholders (scenario -1-). Reference pool samples would also be available for AFP analysis in order to follow up on anomalies justifying a more in-depth investigation (scenario -2-; Fig. 1).

Constructing an AFP reference sample pool aims at:

- a) Installing a buffer for the AFP laboratory in order to balance the inflow of sample material and the analytical workload of the laboratory. This is particularly relevant for the initial stages of integrating the AFP laboratory into the certification system where analytical tasks should be prioritized according to their respective certification impacts without leaving material flow along the trading chains “uncontrolled”.

- b) As further outlined below (scenario -2-), detecting anomalies along a given trading chain might trigger an investigation including detailed AFP sampling. This should comprise high-resolution AFP sampling along the trading chain, but might also include analyzing older reference samples related to the same trading chain, allowing to trace anomalies (e.g., due to a change in sources) through space and time, the latter making for a stronger case in terms of evidence.
- c) Providing logistic benefits by constituting a central, easily accessible sample pool where the physical integrity of samples may be guaranteed.

The reference sample pool should be available at a central location (under the control of the certification office) for a yet to be defined time period (e.g., two years corresponding to the envisaged CTC audit frequency). During this time period, the certification office must document which samples were selected for AFP analysis and sent to the AFP laboratory; samples not analyzed should be returned to the original owner once the blocking time has elapsed.

### **2.3.3 Sampling Procedures**

Trading chain sampling and maintenance of the reference sample pool for AFP spot analysis must aim at minimizing interference with mineral flow in order not to delay the delivery of mineral shipments. This may be achieved by integrating AFP sampling into already existing procedures and by involving independent trading chain stakeholder personnel where possible. To this end, an effective consultation process with all trading chain stakeholder should be initiated.

The density and frequency of AFP sampling along the trading chain depends on how rigorously the certification office aims at controlling mineral flow. A regular sampling interval for the various steps of an individual trading chain might be four weeks<sup>2</sup>, but this frequency may vary along the trading chain and between different trading chain according to their complexity and risk potential.

Sites where samples for the AFP reference sample pool should be taken include:

- a) spot sampling by a qualified and authorized person (e.g., by a partner organization such as a geological survey in the frame of mine inspections) at individual production sites;
- b) spot sampling by a qualified and authorized person at the first processing site (e.g., processing plant feed and/or output) as well as at subsequent aggregation sites of mineral concentrates (e.g., loading for transport);
- c) spot sampling of concentrate at the producer/trader terminal where a trader purchases the material; in this context, samples (1 kg) are taken anyway for professional grade control, and a sample fraction is usually made available to both producer and client. Consequently, it would be straightforward to store a part of this sample (e.g., 10% = 100g) for optional AFP analysis in the reference sample pool. In case a trader maintains his own laboratory for grade control, AFP sampling should be conducted or supervised by an independent qualified and authorized person. In case an independent laboratory is charged with grade control, AFP sampling might be carried out by authorized and qualified lab staff who could subsequently forward sampled material to the certification office for central storage in the reference sample pool.

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<sup>2</sup> The sampling process should not be strictly predictable in order to make the system less susceptible to manipulation, but it should follow a roughly regular pattern set by the certification office, and confirmed by AFP laboratory and trading chain stakeholders.

## **2.4 Prioritizing AFP Sampling and Analysis**

AFP sampling should be prioritized according to production figures with priority given to large mineral producers in order to control a larger fraction of total mineral trade. Given its high impact relevance and low AFP coverage at present, material originating from the eastern provinces of the Democratic Republic of the Congo, if available, might also generally be prioritized for AFP analysis.

The AFP laboratory and the certification office might consider defining a minimum production threshold value in order for AFP sampling and analysis to become obligatory within a certification system. Otherwise, AFP sampling, analyzing, and reporting (and, if applicable, re-sampling/analyzing) might become logistically challenging to impossible, at least on short notice.

In case small individual mine sites may not be directly covered by AFP, samples might instead be taken where mineral concentrates are aggregated for the first time. Alternative systems to link individual production sites and first points of aggregation (e.g., sack tagging, cf. iTSCi) should then be considered and could be verified by occasional direct AFP spot sampling at individual, small production sites. The latter considerations are particularly relevant for the Democratic Republic of the Congo with a presently weakly developed control structure of the national mining sector.

## **3 AFP Application Scenarios**

### **3.1 Scenario 1: Integrity Control of Mineral Trading Chains**

AFP may serve as a regular checking instrument to verify trading chain integrity with respect to source regions or the occurrence of concentrate mixtures (Fig. 1). This scenario applies to all mineral producers participating in the certification system, with oversight falling to the certification office. Spot samples for AFP analysis are selected from a pool of reference samples following an analysis scheme to be defined by the certification office and consulted with the AFP laboratory and trading chain stakeholders.

Should AFP spot sampling reveal any irregularities with respect to the origin of minerals, suspicion would be raised triggering scenario -2- where a more detailed investigation (comprising an investigative audit as well as AFP sampling and analysis at a higher resolution) would be initiated (Fig. 1). Otherwise, AFP spot sampling would positively certify a given trading chain by confirming the integrity of mineral shipments and by verifiably linking them to a specific production site (scenario -3-).

### **3.2 Scenario 2: Verification of Mineral Trading Chain Anomalies**

#### **3.2.1 Framework**

This scenario may be triggered by a number of events raising suspicion that a mineral producer or trader (partly) source material from an illegal source related to a conflict-affected region/mine. These include:

- a) disagreement between the geochemical and mineralogical features of an AFP spot sample analyzed in scenario -1- with the characteristic features stored in the reference database of the production site (Fig. 1);
- b) detecting anomalies in the frame of a regular (certification) audit;
- c) receiving reports through whistle blowing;
- d) providing production figures inconsistent with actual production capacities.

Any of these events may justify a detailed investigation which should comprise an investigative audit of a mineral producer or trading chain, as well as high-resolution AFP sampling and analysis.

### **3.2.2 AFP Sampling, Analysis, and Reporting**

General trading chain sampling, analysis, and reporting procedures relevant for constructing the AFP reference database, the reference sample pool, and AFP spot analysis have been outlined above. However, in case a violation of trading chain integrity is suspected, the certification office will aim to follow up on anomalies in order to evaluate their significance and, ultimately, to take a qualified decision on potential sanctions. In this context, AFP may be employed as part of an investigative audit where the AFP laboratory would analyze a larger number of samples specifically related to the case in order to track the spatio-temporal distribution of anomalies (e.g., to demonstrate changing sources of material).

Samples may be sourced from the reference sample pool, and additional AFP sampling (and analysis) might be organized and/or overseen by the independent auditor charged with investigating a given mineral producer/trading chain. A qualified person (AFP laboratory staff or a person accredited via the laboratory) might accompany and assist the auditor in AFP sampling in case the auditor is not qualified to perform AFP sampling. The density of sampling along the trading chain would need to be adjustable to the individual scale of the investigation and to the complexity of the specific trading chain.

In case additional samples are taken along the trading chain, the auditor should submit AFP samples and a sampling report to the certification office providing relevant details (including sample number, location, description of sample context etc. as to be defined by the AFP laboratory and the certification office; BGR, 2010) as well as confirming (by signature) that individual sample integrity is guaranteed (e.g., by sealing). On behalf of the certification office, sealed AFP samples will then be sent to the AFP laboratory where analysis and result interpretation is to take place.

The AFP laboratory will subsequently submit an AFP investigation report specifically dedicated to the case to the certification office. In this report, the AFP laboratory should also document internal QA/QC procedures such as inserting and successfully identifying duplicate or standard samples in a given sample batch such that report accuracy and precision may be assessed by the certification office. The certification office will consider the AFP report, in combination with audit results, in order to evaluate trading chain integrity and, if applicable, decide on potential sanctions.

### **3.3 Scenario 3: Positive Certification of Mineral Trading Chains**

The aim of positive trading chain certification by means of AFP is to link a given mineral product along the trading chain to individual mineral production sites based on source-specific geochemical and mineralogical features stored in the AFP reference database. This scenario represents the positive outcome of the AFP checking process performed in scenario -1- and independently verifies mineral origin and associated trading chain integrity at a high confidence level. Positive certification by means of AFP may hence serve as a demonstration of due diligence in the upstream section of the trading chain.

## References

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