# UNFC resources reporting and national mineral resources accounting

## Case-studies: Kylylahti and Ikkari

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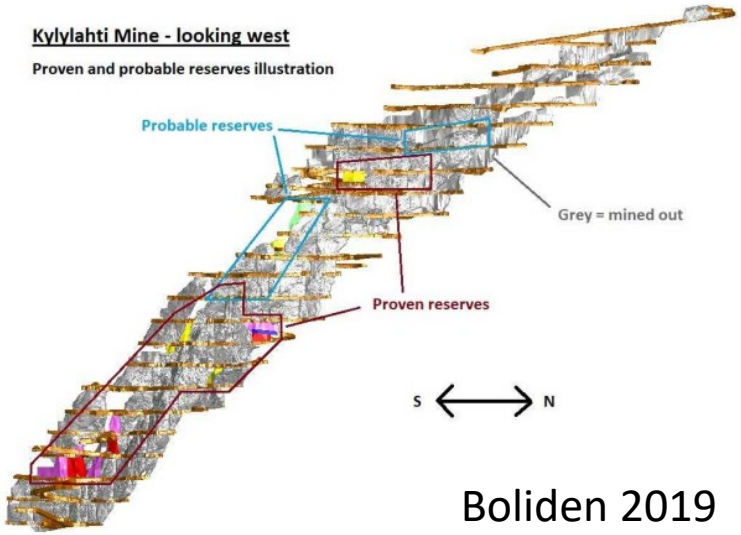
# Kylylahti Mine case-study

## Operation to closure

| | |
|---|---|
| **Deposit Type** | Polymetallic Cu-Au-Zn-Ni-Co (-Ag) |
| **Current Owner/operator** | Boliden (OMX Stockholm) |
| **Discovery year** | 1984 (Outokumpu Mining) |
| **Assessment of Resources/Feasibility Study** | 2005-2008 (Altona Mining Ltd)<br>Boliden acquisition in 2014 |
| **Type** | Underground (150-810 m levels) |
| **Mining** | 10 years (2011-2020) |
| **Mine Status** | Care and maintance (closed) |
| **Total ore mined (kt)** | 6,076 |
| **Total ore milled (kt)** | 6,164 |

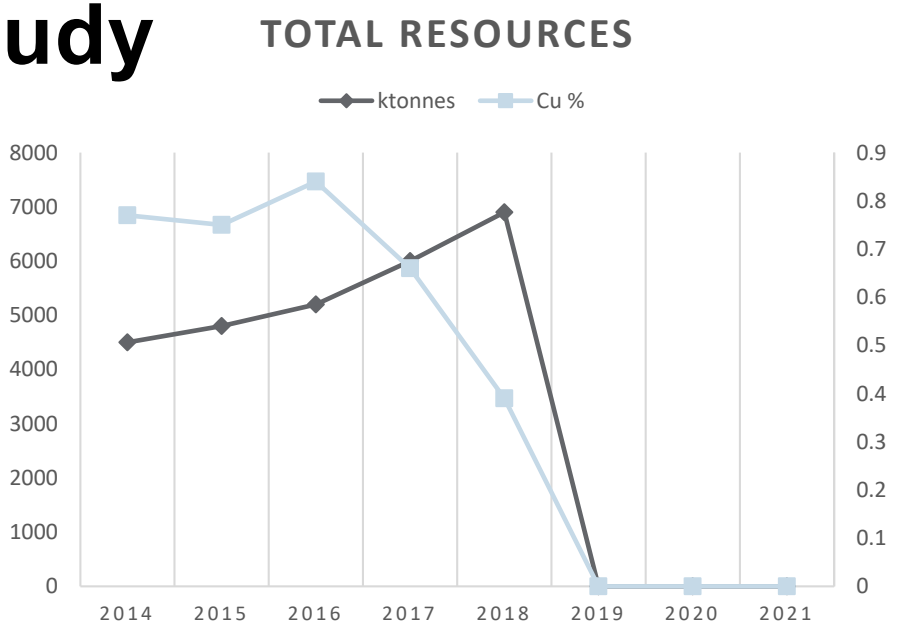



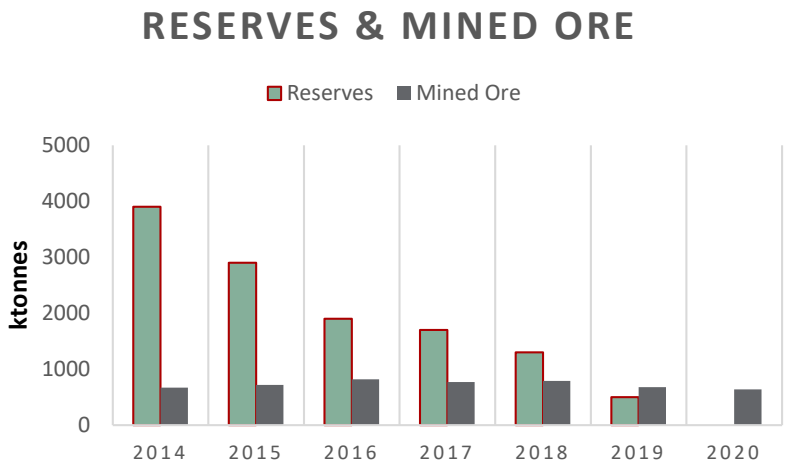

Boliden 2019

# Kylylahti Mine case-study

## Operation to closure

- In 2018, Boliden reported that there are no plans to convert any Mineral Resources into Mineral Reserves due to lack of RPEEE and plans for mine closure in 2020
- The known ore potential is between +700 – +900 m levels



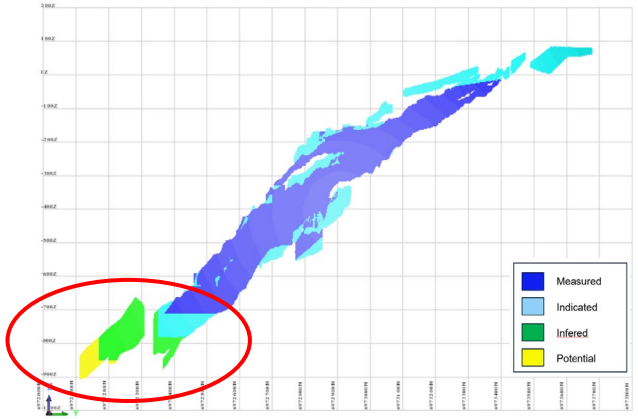
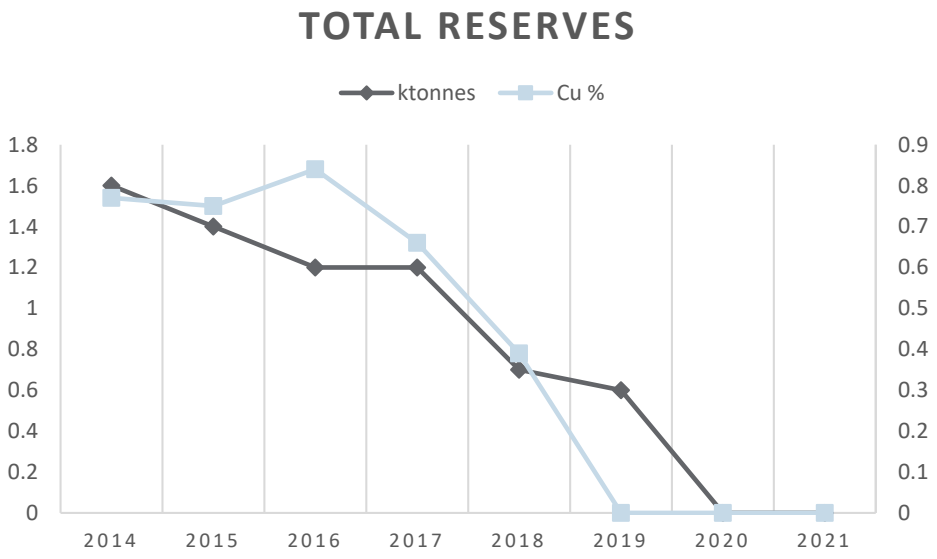




Figure 16. Schematic long section of mineral resource classes at Kylylahti



# Kylylahti Mine case-study

## Operation to closure

- The Mineral Resources are not included into those volumes of the block model used to estimate the Mineral Reserves for the Kylylahti stopes and development
- Mineral resources remaining in 2018 were presumably not used during 2019 and 2020 before closure of mine in autumn 2020 and, therefore, they are assumed to still exist
- The total Mineral Resources of 6.9 Mt at 0.39 % Cu, 0.22 % Zn, 0.28 % Ni, 0.11 % Co, and 0.28 g/t Au

| Kylylahti | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| **Mineral Resources (Measured)** | | | | | |
| ktonnes | *1200* | *1700* | *1900* | *1900* | ***2500*** |
| Cu, % | *0.77* | *0.75* | *0.84* | *0.66* | *0.56* |
| Zn, % | *0.4* | *0.4* | *0.4* | *0.3* | *0.3* |
| Ni, % | | *0.2* | *0.2* | *0.23* | *0.25* |
| Co, % | | *0.2* | *0.2* | *0.14* | *0.14* |
| Au, g/tonne | *0.3* | *0.3* | *0.4* | *0.3* | *0.24* |
| **Mineral Resources (Indicated)** | | | | | |
| ktonnes | *2800* | *3000* | *3200* | *3900* | ***3700*** |
| Cu, % | *0.53* | *0.47* | *0.43* | *0.34* | *0.34* |
| Zn, % | *0.3* | *0.3* | *0.2* | *0.2* | *0.21* |
| Ni, % | | *0.3* | *0.3* | *0.27* | *0.27* |
| Co, % | | *0.2* | *0.1* | *0.12* | *0.11* |
| Au, g/tonne | *0.6* | *0.6* | *0.6* | *0.4* | *0.36* |
| **Mineral Resources (Inferred)** | | | | | |
| ktonnes | *500* | *100* | *100* | *150* | ***700*** |
| Cu, % | *1.48* | *0.71* | *1.4* | *0.28* | *0.08* |
| Zn, % | *0.4* | *0.2* | *0.5* | *0.1* | *0.05* |
| Ni, % | | *0.3* | *0.1* | *0.27* | *0.42* |
| Co, % | | *0* | *0.3* | *0.08* | *0.04* |
| Au, g/tonne | *1.3* | *1.6* | *0.5* | *N/A* | *0.02* |
| **Mineral Resources (Total)** | | | | | |
| ktonnes | *4500* | *4800* | *5200* | *6000* | ***6900*** |
| Cu, % | *0.77* | *0.75* | *0.84* | *0.66* | *0.39* |
| Zn, % | *0.4* | *0.4* | *0.4* | *0.3* | *0.22* |
| Ni, % | | *0.2* | *0.2* | *0.23* | *0.28* |
| Co, % | | *0.2* | *0.2* | *0.14* | *0.11* |
| Au, g/tonne | *0.3* | *0.3* | *0.4* | *0.3* | *0.28* |

# Kylylahti Mine case-study

## Operation to closure

- During the active-project phase, all Kylylahti's Mineral Resources are mapped into **E2F2G1,2,3** according to the CRIRSCO–UNFC Bridging Document (UNECE, 2015)
  - Measured Resources → **E2F2G1** or **E2F2.1G1**
  - Indicated Resources → **E2F2G2** or **E2F2.1G2**
  - Inferred Resources → **E2F2G3** or **E2F2.1G3**
- In 2020, the shutdown period started and Kylylahti's Mineral Reources are mapped into **E2F2.2G1,2,3** (INSPIRE Code List: "Care and maintanance, retention")
- After full closure, the quanities are mapped into **E3.3F2.3G1,2,3** (INSPIRE Code List: "Closed, Abandoned, Historic") **Development Not Viable**

# Kylylahti Mine case-study

## Operation to closure

- If the current owner (Boliden) decides to (1) re-open the mine or (2) sells off its asset to a new company, the quantities are re-mapped as follows:
  - (1) Quantities are re-mapped into **E3.2F2.2G1,2,3 Development Unclarified** till the owner (Boliden) reports the new updated estimate on its Mineral Resources which are then mapped into **E2F2.1G1,2,3** following the CRIRSCO-UNFC Bridging Document
  - (2) Quantities are re-mapped into **E3.2F2.2G1,2,3 Development Unclarified** till the new owner reports the new updated estimate on its Mineral Resources which are then mapped into **E2F2.1G1,2,3** following the CRIRSCO-UNFC Bridging Document
- The new listed company must refer to its quantities as ”historic estimate” till the updated estimation is disclosed. The company can either report the quantities according to Exploration Target results (UNFC: **E3F3G4** or **E3.2F3.1G4**) or re-evaluate the previous resource estimate (”new CP sign-off”) and disclose the quantities accordingly (UNFC: **E2F2.1G1,2,3**)

# Kylylahti Mine case-study

## Operation to closure

| UNFC Classes defined by Categories and Sub-categories | | | | | | | INSPIRE Code list | TRL (Relevant to F axis) |
|---|---|---|---|---|---|---|---|---|
| | Produced | Sold or used production | | | | | | |
| | | Production which is unused or consumed in operations<br>*Future production that is either unused or consumed in the project operations is categorized as E3.1. These can exist for all classes of recoverable quantities* [d] | | | | | | |
| | | Class | Sub-class | Categories E | Categories F | Categories G [a] | | |
| Total Products | Known Sources | Viable Projects<br>*Estimates associated with Viable Projects are defined in many classification systems as Reserves, but there are some material differences between the specific definitions that are applied within different industries and hence the term is not used here.* [d] | On Production | 1 | 1.1 | 1, 2, (3) [b] | Operating Continuously<br>Operating intermittently | 9 |
| | | | Approved for Development | 1 | 1.2 | 1, 2, 3 | Under development | 8 |
| | | | Justified for Development | 1 | 1.3 | 1, 2, 3 | Pending approval | 5,6,7 |
| | | Potentially Viable Projects<br>*Not all Potentially Viable Projects will be developed.* [d] | Development Pending | 2 [c] | 2.1 | 1, 2, 3 | Evaluation of Resources (Detailed Feasibility Study, Prefeasibility) | 3,4 |
| | | | Development OnHold | 2 | 2.2 | 1, 2, 3 | Care and maintenance<br>Retention | |
| | | Non-Viable Projects<br>*Non-Viable Projects include those that are at an early stage of evaluation in addition to those that are considered unlikely to become viable developments within the foreseeable future.* [d] | Development Unclarified | 3.2 | 2.2 | 1, 2, 3 | Assessment of Resources (Advanced exploration, Resources' definition, Prefeasibility, Scoping study (resources)) | 3,4 |
| | | | Development NotViable | 3.3 | 2.3 | 1, 2, 3 | Closed<br>Abandoned<br>Historic | |
| | | Remaining products not developed from identified projects<br>*Remaining products not developed from identified projects or prospective projects may become developable in the future as technological or environmental-socio-economic conditions change. Some or all of these estimates may never be developed due to physical and/or environmental-socio-economic constraints.* [d] | | 3.3 | 4 | 1, 2, 3 | | 1,2 |
| | Potential Sources | Prospective Projects | | 3,2 | 3,1 | 4 | Subsurface exploration (Exploration Target Outline) | 3,4 |
| | | | | 3,2 | 3,2 | 4 | Detailed surface exploration (Exploration) | 3,4 |
| | | | | 3,2 | 3,3 | 4 | Regional reconnaissance (Grassroots) | 3,4 |
| | | Remaining products not developed from prospective projects | | 3,3 | 4,1 | 4 | | 2 |
| | | | | 3,3 | 4,2 | 4 | | 1 |
| | | | | 3,3 | 4,3 | 4 | | |

Existing Resource (quantities) figures (tonnage&grade)

New Resource (quantities) figures (tonnage&grade)

**1.** Active Project (CRIRSCO-compliant Resources)

**2.1.** Active Project (New Resource update in re-opening the mine)

**1.1.** Non-active Project (re-mapping of Resources during shutdown period)

**2.1.** Active Project (re-mapping of Resources in period of evaluation of resources)

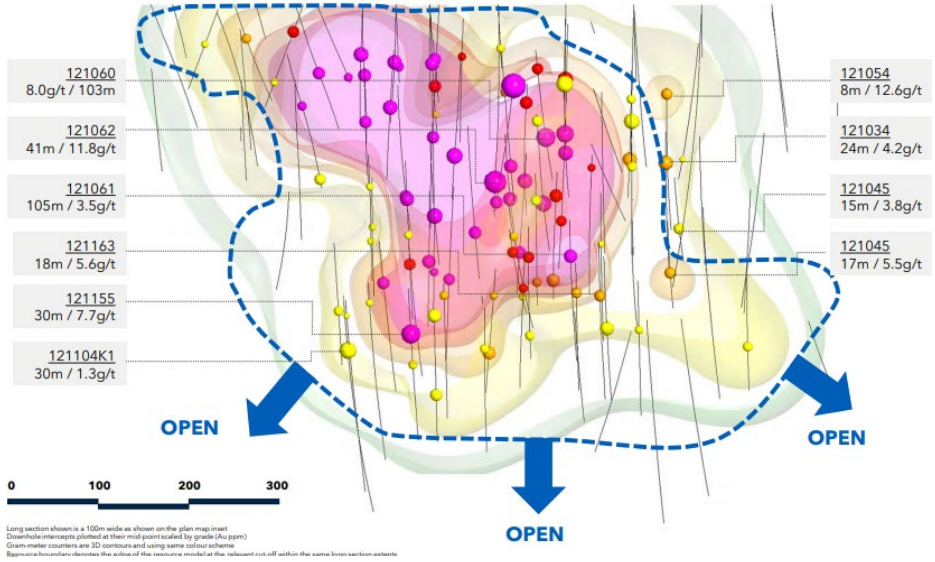
**1.2.**Non-active Project (re-mapping of Resources in closed mine)

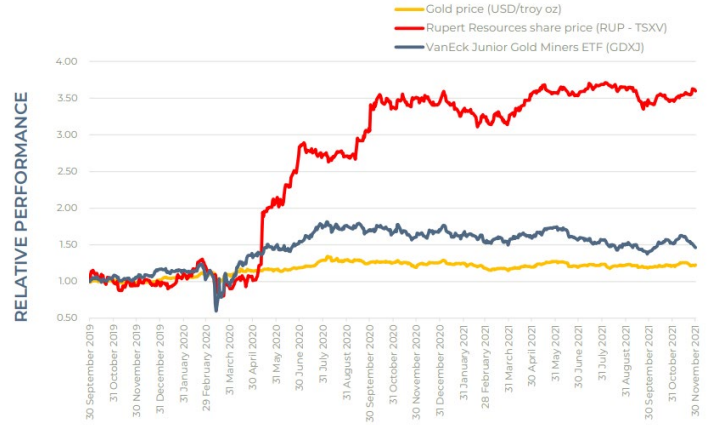
**2.2.** Active Project (Exploration Target update when assessing the potential of economic viability)

# Ikkari case-study

## Exploration to Maiden Resource

| | |
|---|---|
| **Current Owner/operator** | Rupert Resources (TSXV) |
| **Discovery year** | 2019 |
| **Assessment of Resources/Studies** | 2019-2021 (1.5 years) |
| **Type** | No current operation (open pit & underground, planned) |
| **Total Resources (kt)** | 49,300 |
| **Total ore mined (kt)** | - |




Rupert Resources 2021

# Ikkari case-study

## Exploration to Maiden Resource

| | Cutoff Grade (g/t Au) | Tonnes (Mt) | Average Grade (g/t Au) | Gold Metal (Mozs) | Gold Metal (Kg) |
|---|---|---|---|---|---|
| Open Pit | 0.4 | 34.44 | 2.3 | 2.58 | 80,200 |
| | **0.6** | **30.53** | **2.6** | **2.51** | **78,200** |
| | 0.8 | 27.14 | 2.8 | 2.44 | 75,900 |
| | 1.0 | 24.47 | 3.0 | 2.36 | 66,500 |
| Underground | 1.0 | 23.56 | 2.1 | 1.60 | 49,800 |
| | **1.2** | **18.80** | **2.4** | **1.44** | **44,600** |
| | 1.3 | 17.34 | 2.5 | 1.38 | 42,800 |
| | 1.5 | 13.65 | 2.8 | 1.21 | 37,700 |
| **Open Pit** | **0.6** | **30.53** | **2.6** | **2.51** | **78,200** |
| **Underground** | **1.2** | **18.80** | **2.4** | **1.44** | **44,600** |
| **Total** | | **49.33** | **2.5** | **3.95** | **122,800** |

- Prior to Maiden Resource estimate, Rupert Resources published Exploration Results (high-grade intercepts) of this target
- The total Mineral Resources of 49.33 Mt at 2.5 g/t Au (all inferred)

Rupert Resources 2021

# Ikkari case-study

## Exploration to Maiden Resource

- During the active-project phase all Ikkari's Mineral Resources are mapped into **E2F2G1,2,3** according to the CRIRSCO-UNFC Bridging Document (UNECE, 2015)
  - Inferred Resources → **E2F2G3** or **E2F2.1G3**
- This is mapped as Sub-class **Development Pending** (INSPIRE Code list *Evaluation of Resources (Detailed Feasibility Study, Prefeasibility)*)
- The results prior to reported quantities (tonnage & grade) cannot be reported in accordance with UNFC
- For example, the UNFC classes **E3.2F3.1G4** or **E3.2F3.2G4** or **E3.2F3.3G4** (INSPIRE Code list *Subsurface exploration, detailed surface exploration and regional reconnaissance*) cannot be used if the company has not reported any quantities (e.g., Exploration Target Results)

# Ikkari case-study

## Exploration to Maiden Resource

- When the Project goes forward with Technical Studies and moves towards production, the UNFC classification moves from **E2** to **E1** (use the E-axis sub-categories if applicable) and from **F2.1** to **F1.3**, and finally to F1.1
- Each Sub-class reflects the project technical maturity and ESG assumptions and as well as economical viability
- →Technical Feasibility and Environmental-Socio-Economic Viability

# Ikkari case-study

## Exploration to Maiden Resource

- ACTIVE PROJECT:
  - Hypothetically, if the Ikkari Project would not be technically feasible or would not meet the environmental-socio-economic viability, the quantities are classified as **E3.3F2.3G3 Development Not Viable** or **E3.2F2.2G3 Development Unclarified**
  - This would apply also in situations where company is still holding the asset or, for example, looking for selling off the asset
- NON-ACTIVE PROJECT:
  - Hypothetically, if the company would abandon the Ikkari Project and no company would take over the target (e.g. exploration licensing/permitting), the last estimation would prevail and quantities would be classified as **E3F3G3** (**E3F3G4**?) **Prospective Projects**

# Ikkari case-study

## Exploration to Maiden Resource

New Resource (quantities) figures (tonnage&grade)

**2.1. Active Project (re-mapping of Resources in period of evaluation of resources)**

**1. Active Project (CRIRSCO-compliant Resources)**

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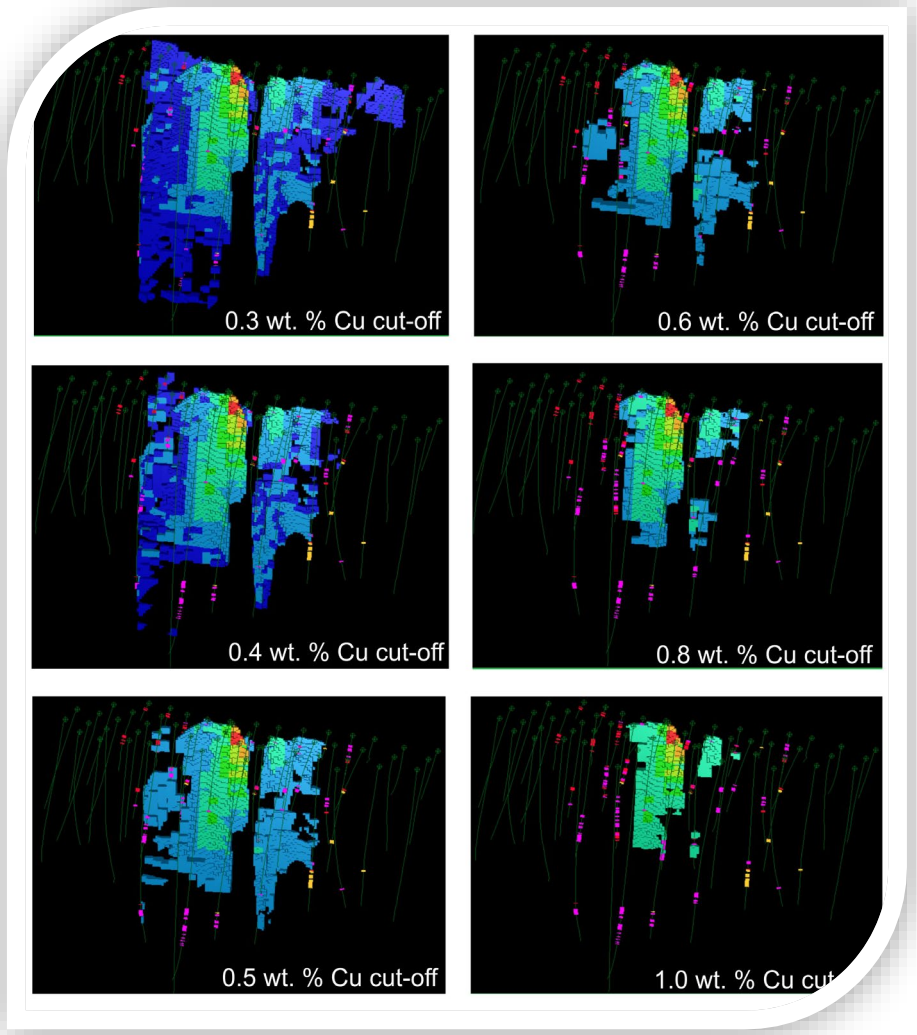
| | | | | 3,3 | 4,2 | 4 | | 1 |
| | | | | 3,3 | 4,3 | 4 | | |

# Case-Study Summary

## Wrap-up

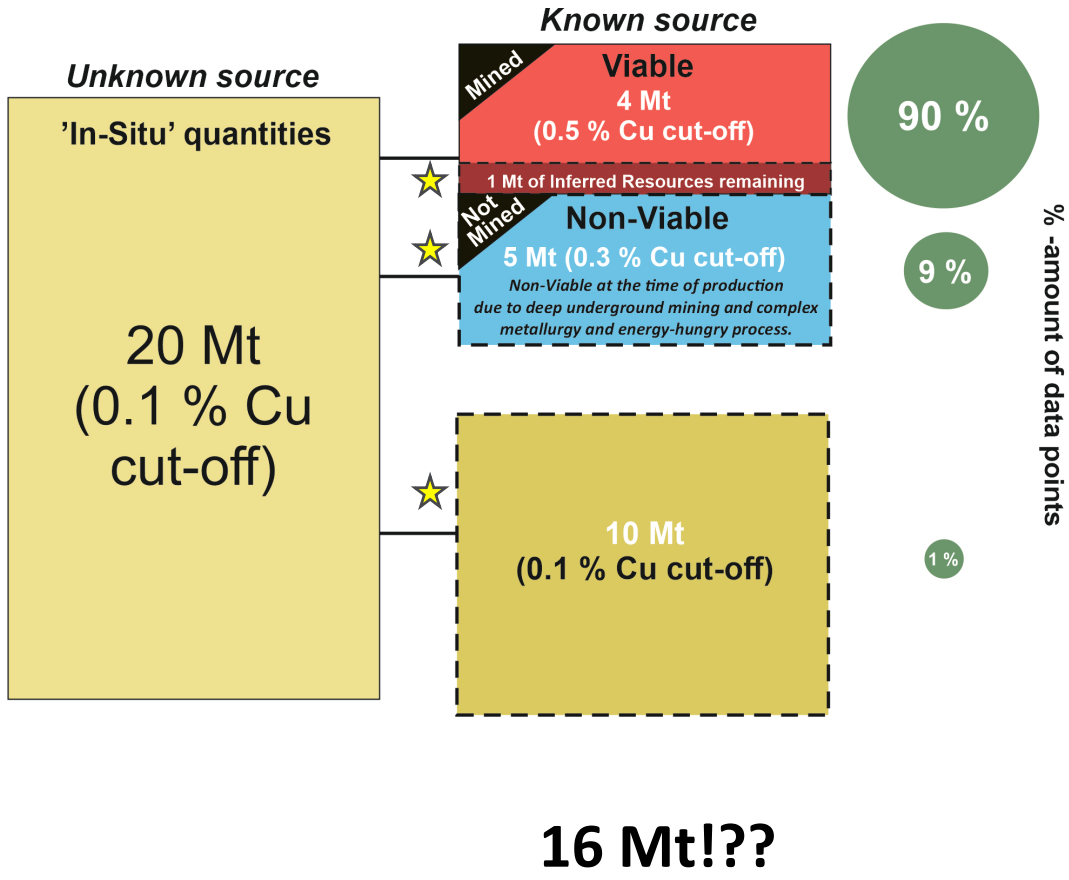
- Resource management needs continuous re-classification of resource quantities according to project status which includes all EFG-axes
- When mapping quantities in accordance with UNFC we need data (tonnage & grade information)
- Estimated quantities need to reflect the “true” current situation related to project maturity which, e.g., indicate realistic timeframes of saleable product inputs to the market or the total amount of potential viable quantities of critical raw materials in Europe.
- Resource estimates are always based on some cut-off grade which defines the lowest threshold of potential viability into the future (e.g. mineralized and non-mineralized rock)



# Case-Study Summary

## Inventory estimates

- How do we define the inventory estimates? The so called high-estimate of quantities (UNFC) with high uncertainty (low sample density and irregular grade continuities etc.)
- It is important that we understand what goes into the “Inventory estimates”.
- A large tonnage figure is not necessary the best indicator when communicating supply of European raw materials




**16 Mt!??**

# References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# Thank you!

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Date __ I __ I 2022, Geneva

GTK