ESR1: Resource potential and speciation of Cu-Zn tailings for future mining and remediation (Neves Corvo, Portugal)

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MSCA-ETN SULTAN

European Training Network for the Remediation and Reprocessing of Sulfidic Mining Waste Sites

Ciências ULisboa

INSTITUTO DOM LUIZ

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OBJECTIVES AND MILESTONES

- To characterize the physical, mineralogical & geochemical properties of Cu-Zn tailings of the Neves Corvo VMS deposit
- To determine the solid-phase speciation, metal distribution maps in sulphide minerals and variability of metal allocation

MILESTONE:
PHYSICAL, MINERALOGICAL AND GEOCHEMICAL CHARACTERIZATION AND VARIABILITY CU-ZN TAILINGS ESTABLISHED (CF. POTENTIAL OF CU & ZN AND POSSIBLE BY-PRODUCTS (AG, AU, IN, SE) (M24)

- To evaluate the exploitation potential for base, precious and critical metals (incl. Cu, Zn, Ag, Au, In, Se);
- To perform geometallurgical evaluation of metals for mineral reprocessing
- To develop a "from mine to processing plant" model to optimise reprocessing of Cu-Zn tailings;
- To perform an economic resource potential and remediation assessment

MILESTONE:
RESOURCE POTENTIAL AND SPECIATION OF CU-ZN TAILINGS FOR FUTURE MINING AND REMEDIATION ESTABLISHED AND COMPARATIVE STUDY BETWEEN DIFFERENT TYPES OF BASE METAL TAILINGS FINALISED. (M40)

WHAT HAPPENED THE LAST 6 MONTHS

- ☑ Sampling processing plant July - December 2019 + Jan 2020 (feed, concentrates and tailings)
- ☑ Sampling overall tailings samples (30 cm) waste rock ~10 years old and ~ 20-30years old
- ☑ Compilation of historical information processing plant and tailings dam 2011-2019
- ☑ Physical characterization of waste rock and tailings + some chemical analysis (XRF) ONGOING

RESEARCH AND RESULTS

SUL_NC_01 (Fresh waste rock)

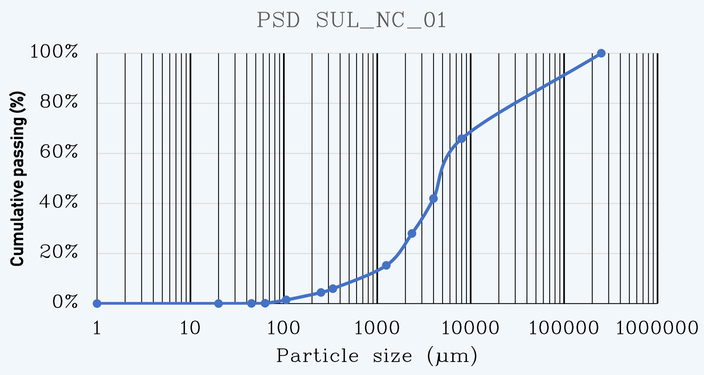


Figure 1. Particle size distribution curve sample SUL_NC_01 before grinding with a D80 of 30 mm

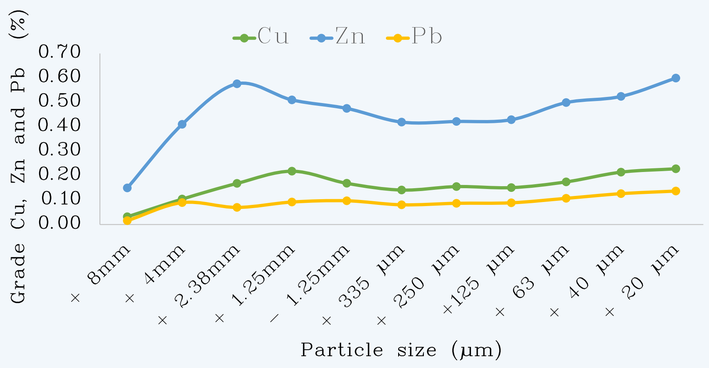


Figure 2. Cu, Zn and Pb grades' distribution by size fraction in sample SUL_NC_01

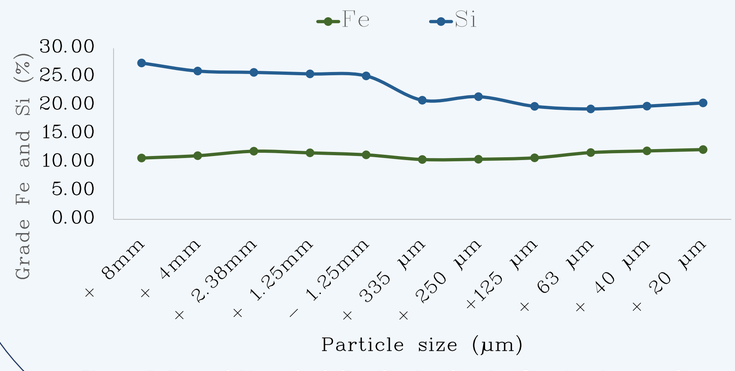


Figure 3. Fe and Si grades' distribution by size fraction in sample SUL_NC_01

SUL_NC_02 (Tailings)

Assay	SUL_NC_02 General
Bal	34.051
Fe	25.522
S	17.142
Si	15.402
Al	3.795
Mg	1.858
Zn	0.869
Ca	0.771
K	0.613
As	0.500
Cu	0.332
Pb	0.306
Ti	0.103
Mn	0.103
Sn	0.097
Cl	0.053
Ba	0.029
Sb	0.027
Cr	0.018
V	0.015
Ni	0.011
Bi	0.003
Cd	0.003
Sr	0.003

Assay	SUL_AGE_01T	Assay	SUL_AGE_02T
Bal	35.278	Bal	37.901
Fe	26.152	Fe	24.561
S	15.017	S	14.893
Si	13.191	Si	14.480
Al	4.479	Al	3.946
Ca	0.859	Zn	0.932
K	0.791	Ca	0.916
Zn	0.762	K	0.685
Cu	0.528	As	0.445
As	0.515	Pb	0.342
Pb	0.395	Cu	0.325
Ti	0.123	Cl	0.129
Mn	0.119	Ti	0.113
Sn	0.105	Mn	0.101
Sb	0.044	Sn	0.069
Ba	0.030	Sb	0.049
Cl	0.020	Ba	0.027
V	0.018	Cr	0.021
Cr	0.018	V	0.019
Ni	0.012	Ni	0.012
Bi	0.004	Sr	0.004
Sr	0.003	Rb	0.003
Rb	0.003	Mo	0.001
Mo	0.001	Nb	0.001

Assay	SUL_AGE_03T	Assay	SUL_AGE_04T
Bal	44.708	Bal	39.766
Fe	24.337	Fe	25.332
S	13.686	S	15.259
Si	10.403	Si	11.667
Al	2.664	Al	3.157
Zn	0.983	Zn	1.035
Ca	0.875	Ca	0.810
Pb	0.573	Pb	0.611
K	0.500	K	0.524
As	0.399	As	0.419
Cu	0.371	Cu	0.406
Cl	0.131	Mn	0.097
Mn	0.088	Sn	0.087
Sn	0.081	Ti	0.072
Ti	0.066	Cl	0.066
Sb	0.041	Co	0.050
Ba	0.030	Sb	0.044
Cr	0.023	Ba	0.028
V	0.011	Cr	0.022
Ni	0.010	Ni	0.015
Sr	0.004	V	0.014
Rb	0.002	Sr	0.003
Cd	0.002	Cd	0.003
Mo	0.001	Rb	0.002
Nb	0.001	Mo	0.001

Bal* stands for balance. It represents X-ray energy levels that the analyzer does not attribute to a particular element

Figure 7. XRF results for sample *SUL_NC_02 General*, SUL_AGE_01T(10-2019), SUL_AGE_02T (03-2019), SUL_AGE_03T and 04T (2014).

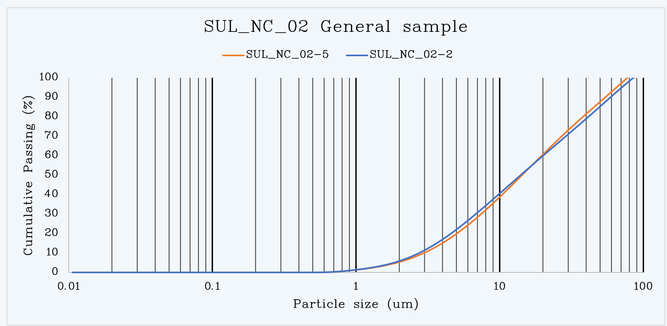


Figure 8. Particle size distribution sample SUL_NC_02 (2 samples) by laser diffraction with a D80 of 40µm

SUL_NC_03 (Old waste rock)

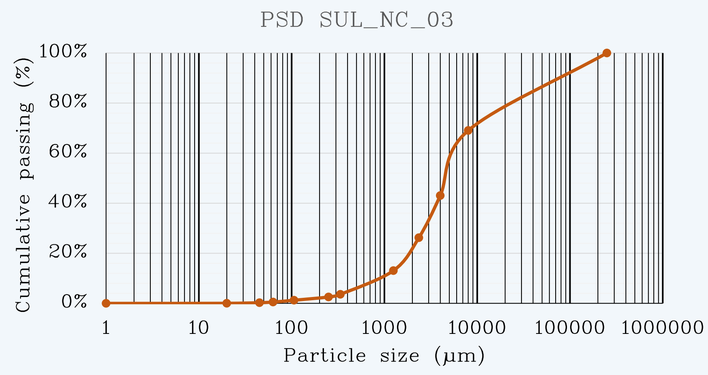


Figure 4. Particle size distribution curve sample SUL_NC_03 before grinding with a D80 of 20 mm

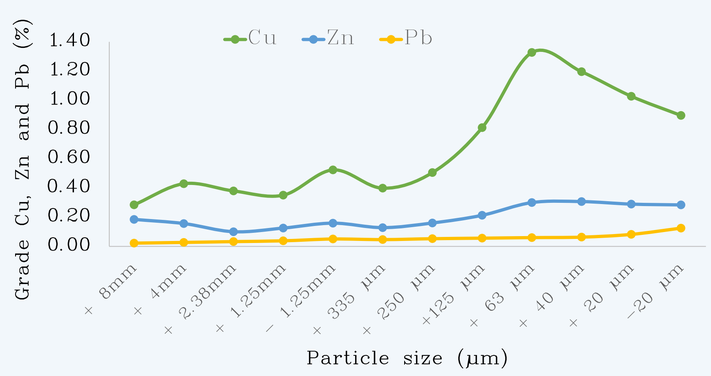


Figure 5. Cu, Zn and Pb grades' distribution by size fraction in sample SUL_NC_03

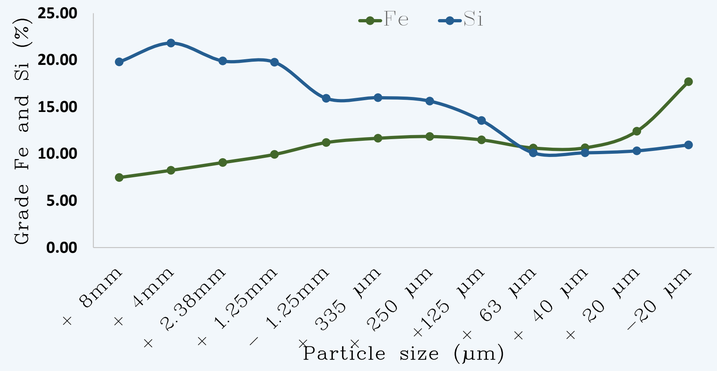
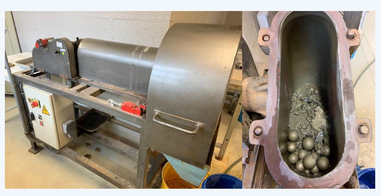
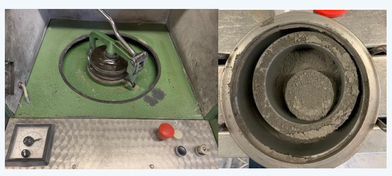


Figure 6. Fe and Si grades' distribution by size fraction in sample SUL_NC_03

METHODS AND TECHNIQUES



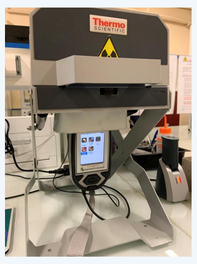
Grindability
Optimum size



Powdering
Sample prep

Coarse sieving granulometric

Fine sieving granulometric



XRF Portable Niton XL3t Gold++

PROGRESS REPORT

1. **SUL_NC_01** and **SUL_NC_03** D80 values vary between 30 and 20 mm, respectively, with little difference between the two samples concerning to their PSD.
2. **SUL_NC_01** shows the highest concentrations of **Zn** in its coarser and finer fractions (lower values in-between); Cu and Pb grades are reasonably independent from size fractions (before grinding).
3. **SUL_NC_03** shows its highest **Cu** concentrations in the finer fractions; Zn and Pb have homogeneous grades throughout the size fractions (before grinding).
4. Main elements found in **SUL_NC_02** (XRF results) correspond to **Fe** and **S**, consistent with pyrite being the main mineral in the NC tailings.

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