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(Bio)leaching of stockpiled iron-rich laterite in percolators

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Barro Alto mine, Brazil

- Iron rich limonitic material can not be processed in ferronickel smelter.
- The company is excavating limonitic material in order to reach Mg-rich saprolitic material.
- Limonitic ore containing a substantial amount of Ni and Co is deposited on a stockpile.

Open pit mine



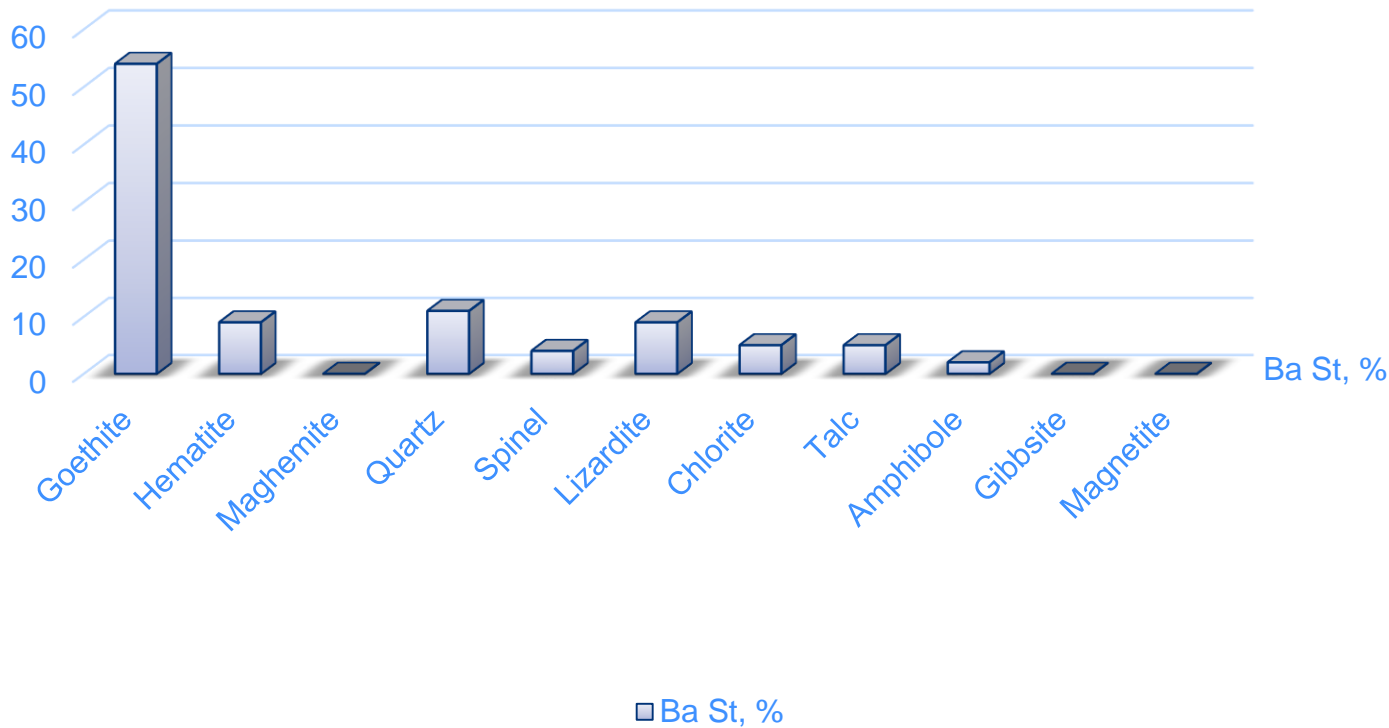
Stockpile



Chemical and mineralogical analysis

	SiO ₂ , %	Al ₂ O ₃ , %	MgO, %	Fe ₂ O ₃ , %	MnO, %	Cr, mg/kg	Co, mg/kg	Ni, mg/kg
Ba St	26	4.75	9.41	42.39	0.82	15760	1266	13610

XRD with Rietveld refinement



Chemical leaching in percolators

Lixiviants:

1. 1M sulfuric acid
2. 1M sulfuric acid + 7 g/L ferrous sulphate

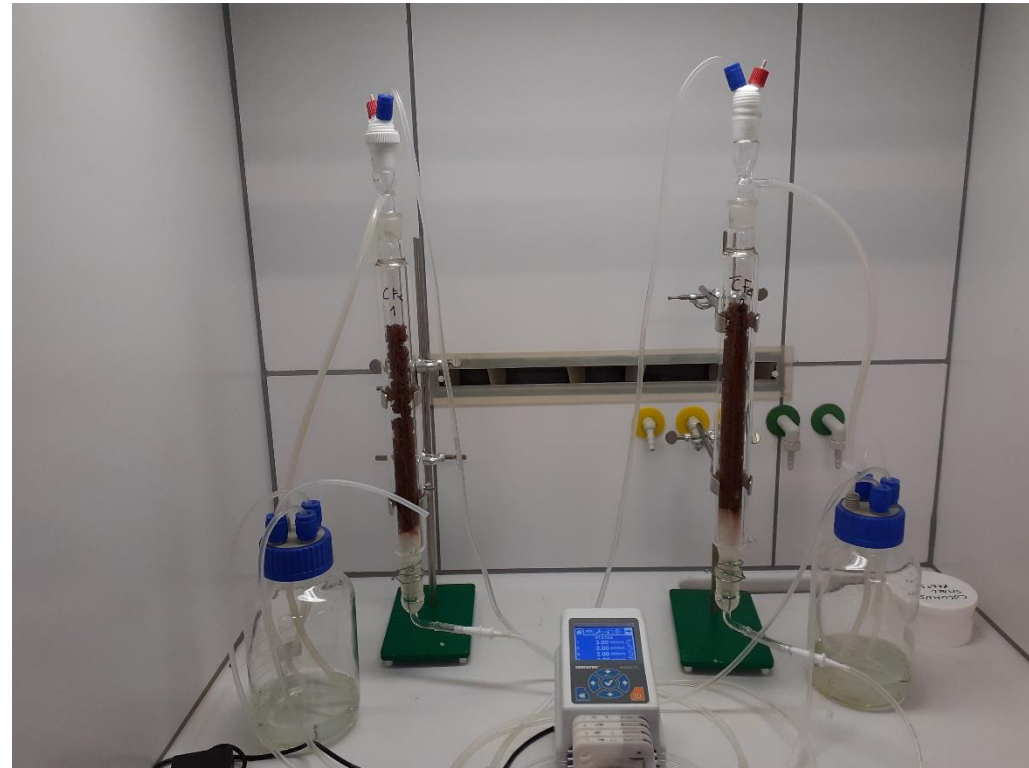
Experiment duration: 30 days

Liquid flow rate: 3 mL/min

Amount of lixiviant: 700 mL

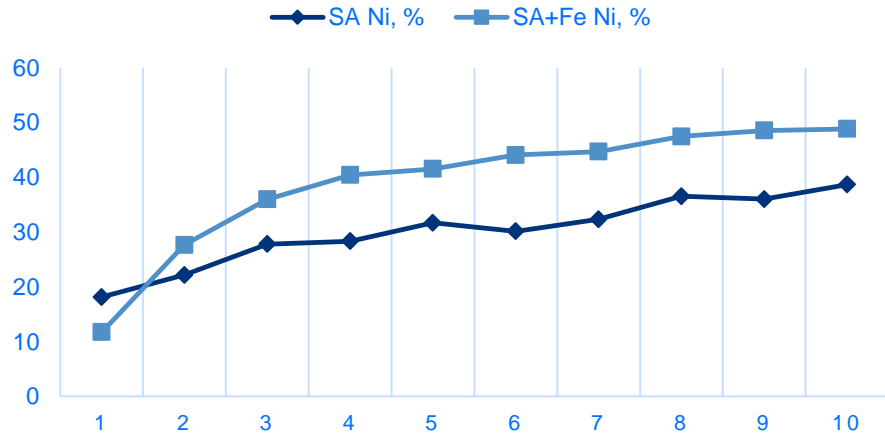
Recirculation mode

Every experiment in duplicates.

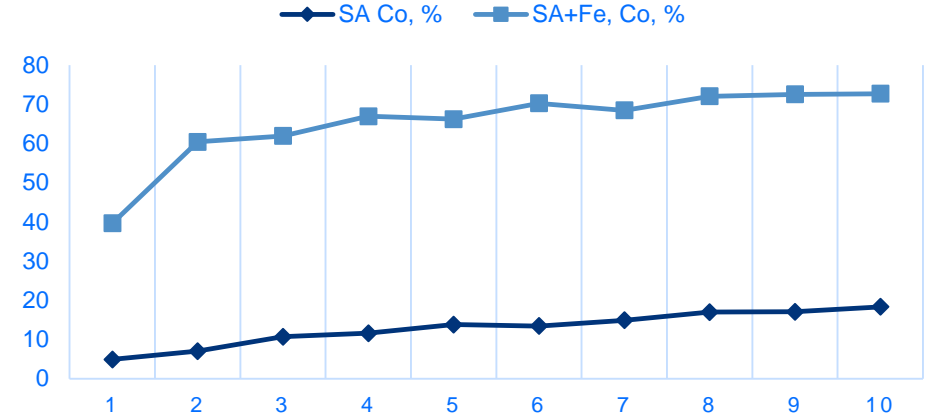


Chemical leaching in percolators - results

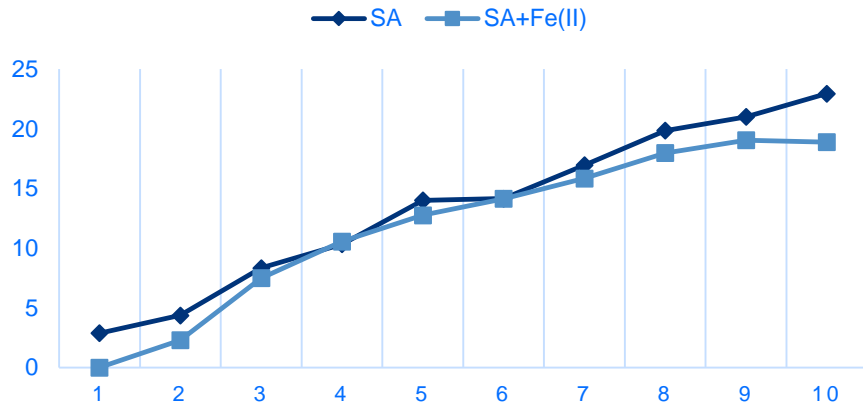
Ni extraction



Co extraction



Fe extraction



Legend: SA – leaching with 1M sulfuric acid
 SA+Fe – leaching with 1M sulfuric acid and 7 g/L ferrous sulfate

Ferrous iron crucial for efficient cobalt extraction; reductive dissolution of Mn-Co mineral phases (asbolane).
 Additional nickel extraction from asbolane.

Bioleaching of laterites in percolators

Leaching with culture of sulfur-oxidizing acidophilic bacteria

Acidithiobacillus thiooxidans.

Sulfur was mixed with limonitic material.

Bacteria oxidize sulfur producing sulfuric acid and reducing certain amount of Fe(III) to Fe(II).

Preliminary results:

- Good extraction of cobalt, due to presence of Fe(II).
- Kinetics of nickel extraction slower in comparison to chemical leaching, due to lower concentration of acid (pH approx. 1).



Conclusions

- Chemical leaching of the stockpiled limonitic laterites in percolators showed maximal Ni extraction of 50 % and Co extraction of 80 %.
- Bioleaching of laterites in percolators is a completely new approach.
- Results of bioleaching are similar to chemical leaching, but longer period of leaching is required.
- Heap bioleaching of laterites is a new promising approach for sustainable leaching of Ni and Co from lateritic ores.

Thank you for your attention!