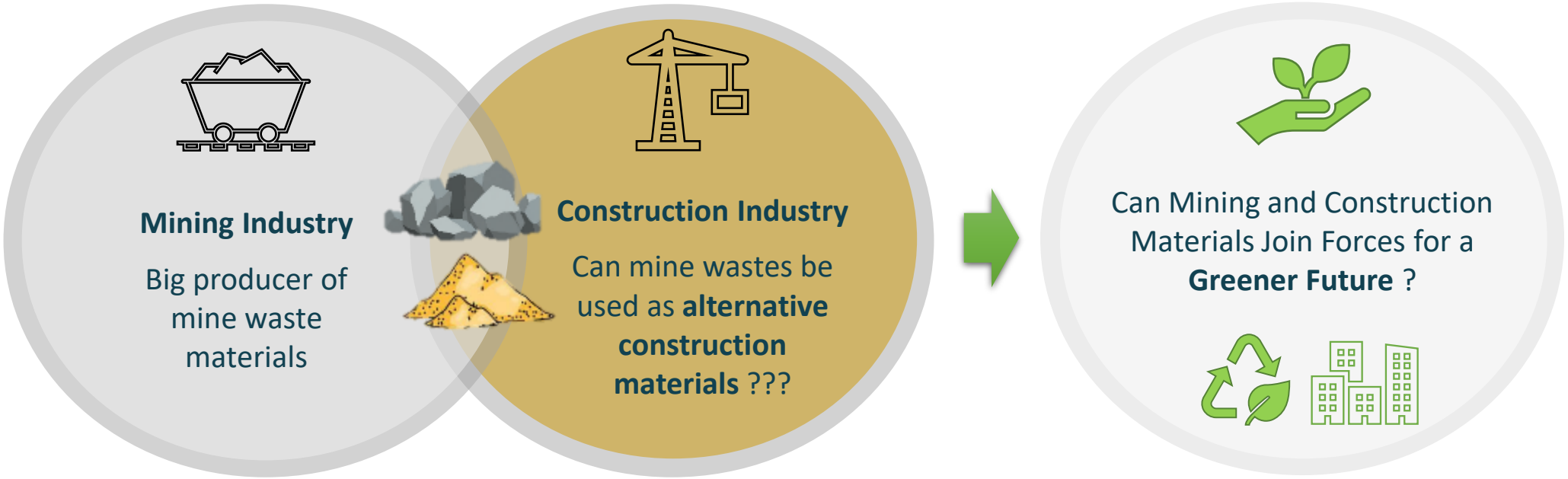
University Mohammed VI Polytechnic

Can Mining and Construction Materials Join Forces for a Greener Future ?



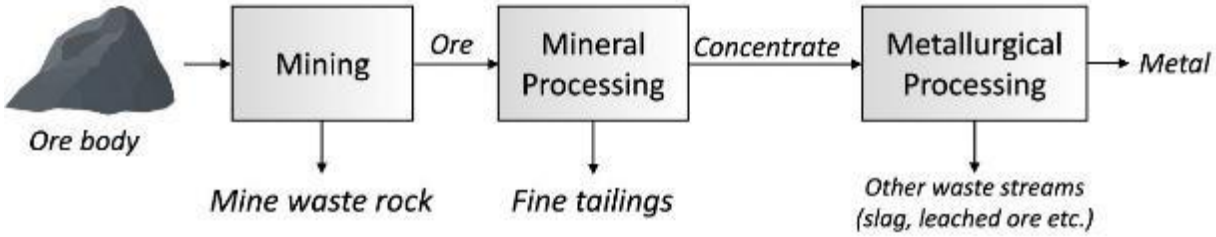
MIT Global Summit on Mine Tailings Innovation

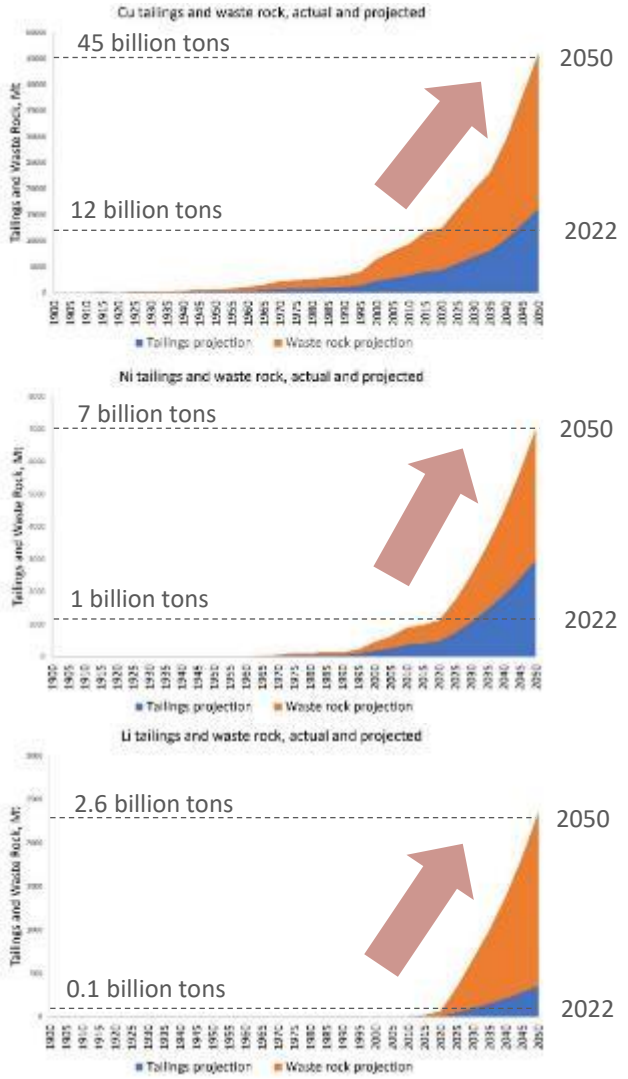
September 19-20, 2024

Presented by: **Yassine Taha**
Email : yassine.taha@um6p.ma

Mining industry challenges

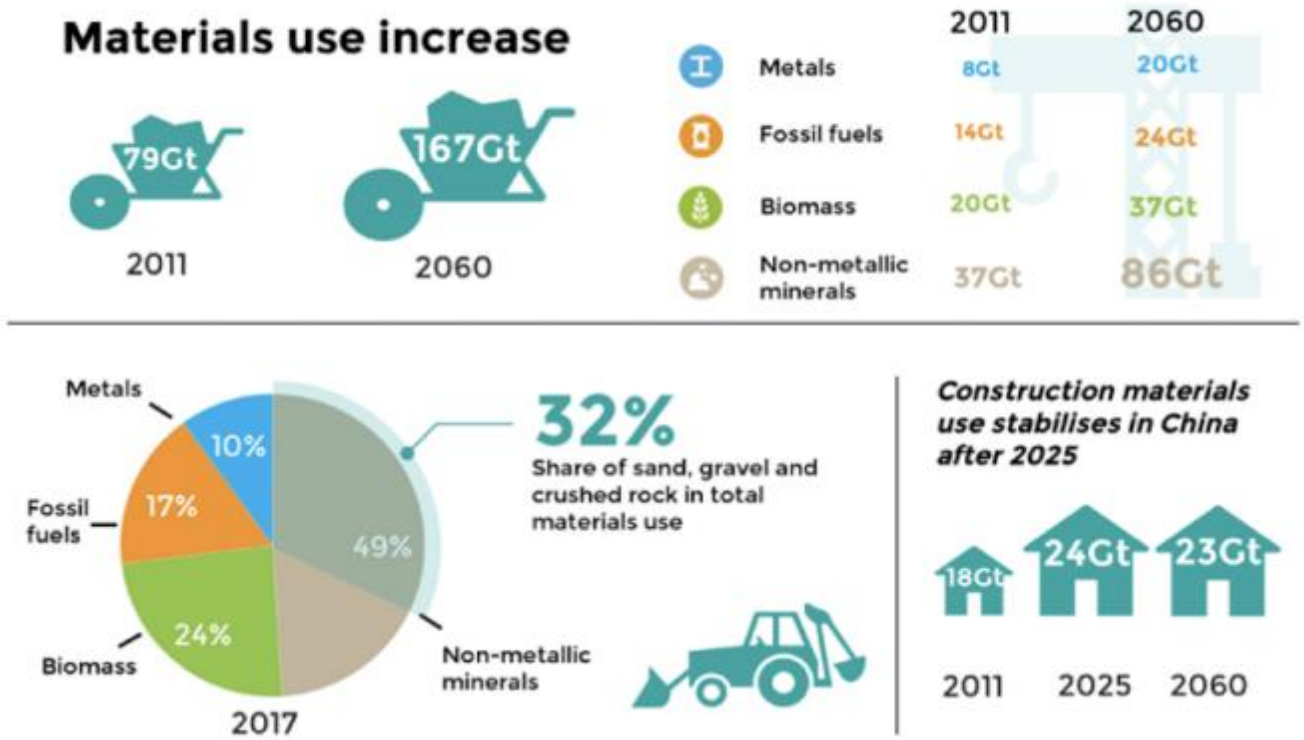
- Around 50 to 100 billion tons of mine waste are produced annually
- This amount will increase more in the future due to lower-grade ores
- At the end, mining is producing a LOT of waste rock and tailings



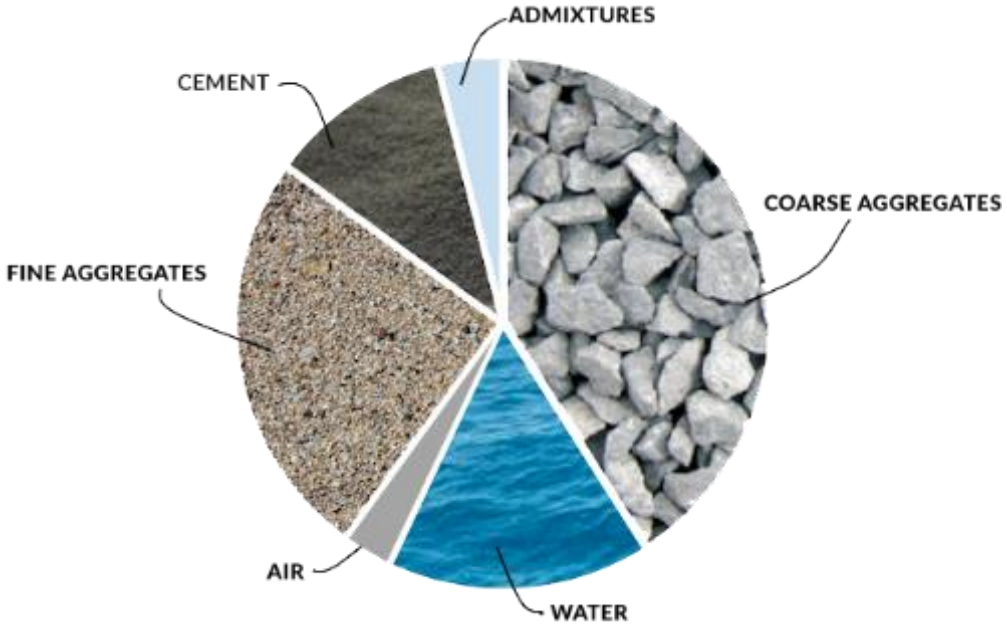


Source: Rick K.Valenta et al., 2023

Construction materials DOMINATE resource consumption



Source: OECD Global Material Resources Outlook to 2060

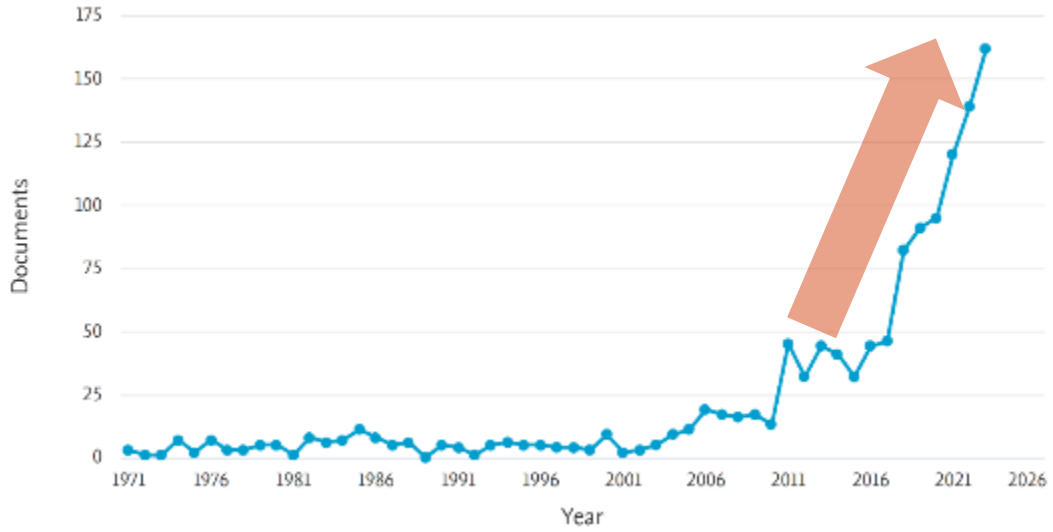


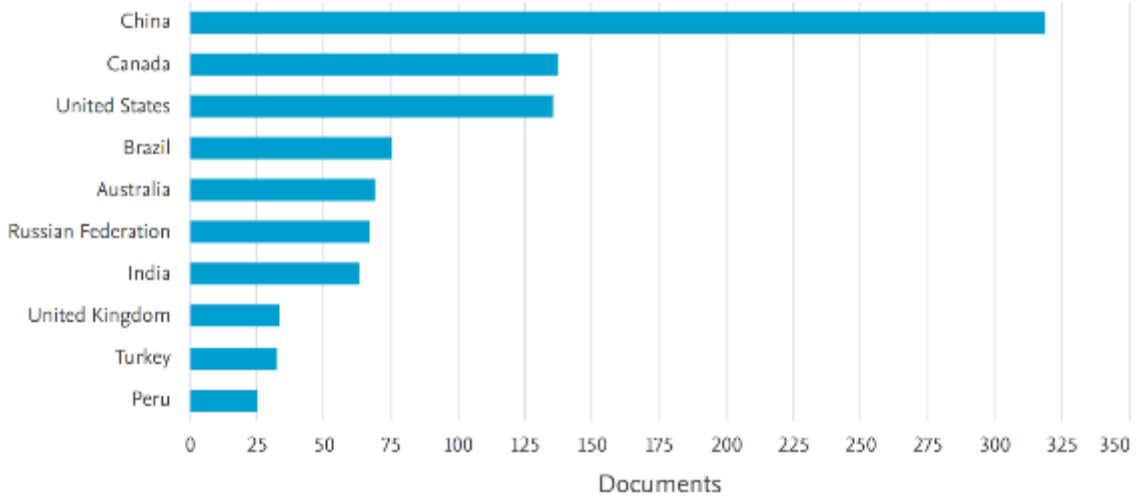
Mine waste could be used as construction and building materials to replace sand, gravel, clays, limestone, etc.

In the construction sector only:

- 22 billion tons of aggregates (gravel, sand, crushed rocks, additives)
- 3.6 billion tons of cement
- 2.5 billion tons of water

Reuse as construction materials





Source: Scopus

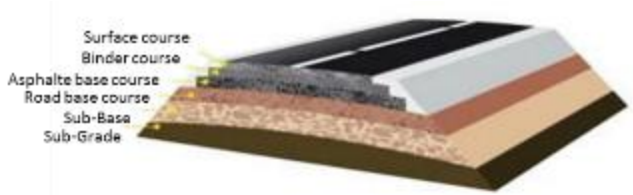
Clinker & Cementitious materials

Glass & Ceramics

Concrete aggregates

Geopolymers

Roads construction



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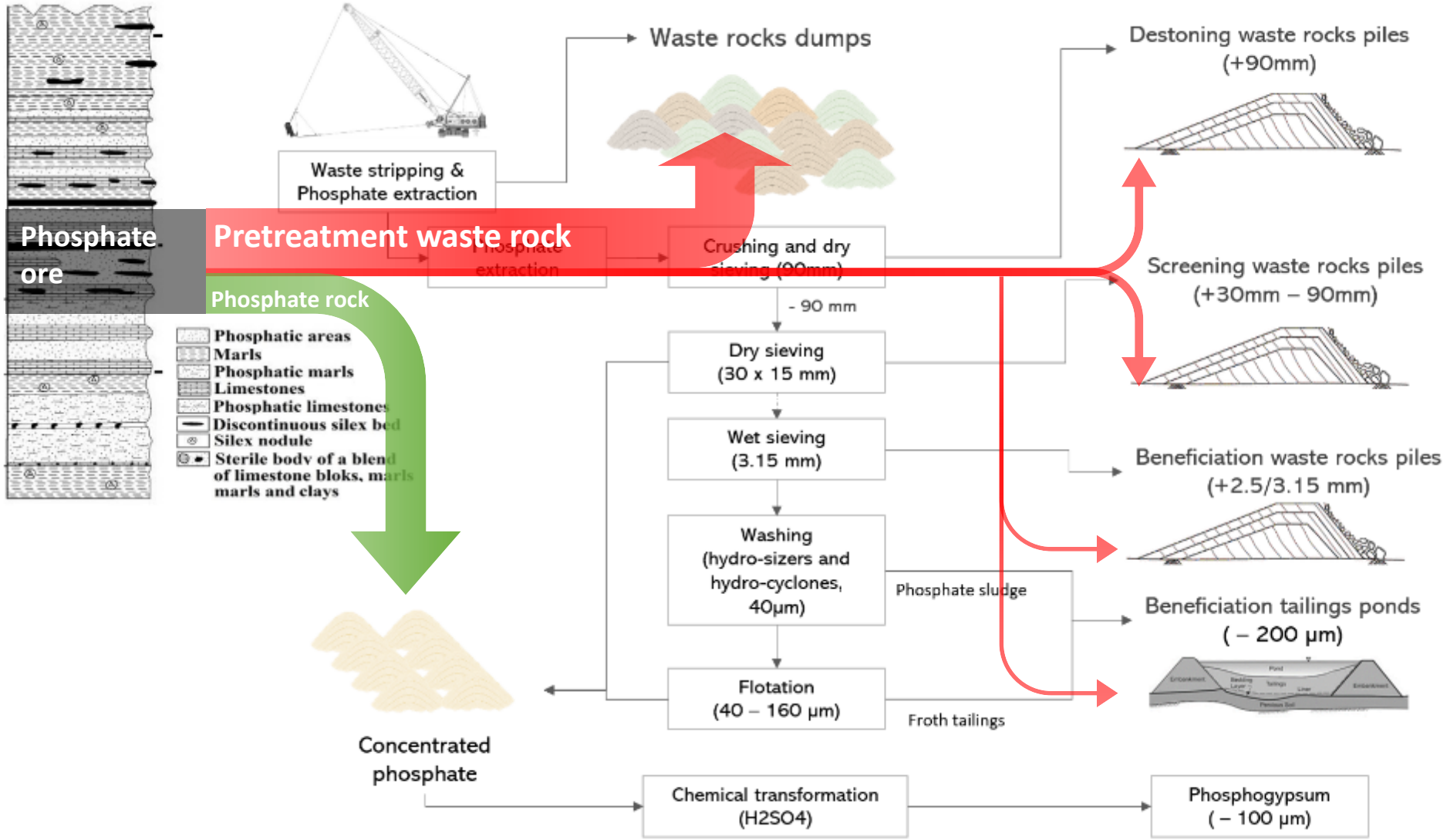
GSMI

Case study : Phosphate waste streams



How to change things for a sustaianble resources management ?

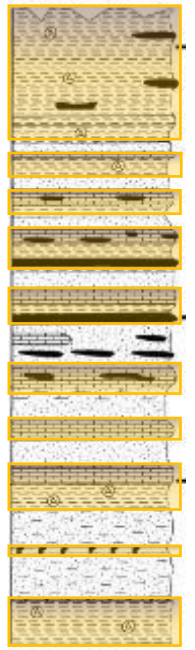
Actions to **MANAGE ALREADY DISPOSED** mine waste ?

FUTURE ACTIONS to change **CURRENT EXTRACTION & PROCESSING** methods ?

16km

13km

Phosphate tailings
Morocco



Phosphatic areas, Marls, Phosphatic marls, Limestones,
Phosphatic limestones, Discontinuous silex bed, Silex nodule,
Sterile body of a blend of limestone bloks, marls and clays

Phosphate Mine WASTE ROCK - Future Actions

Actions to **MANAGE ALREADY DISPOSED** mine waste ?

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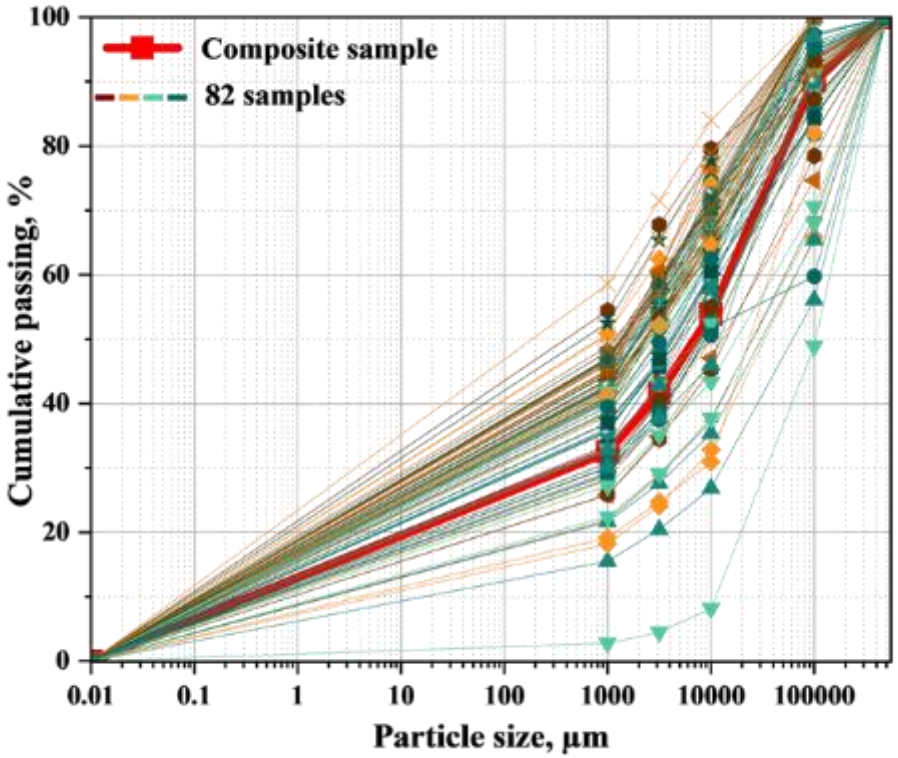
13km



Phosphate Mine WASTE ROCK - Future Actions

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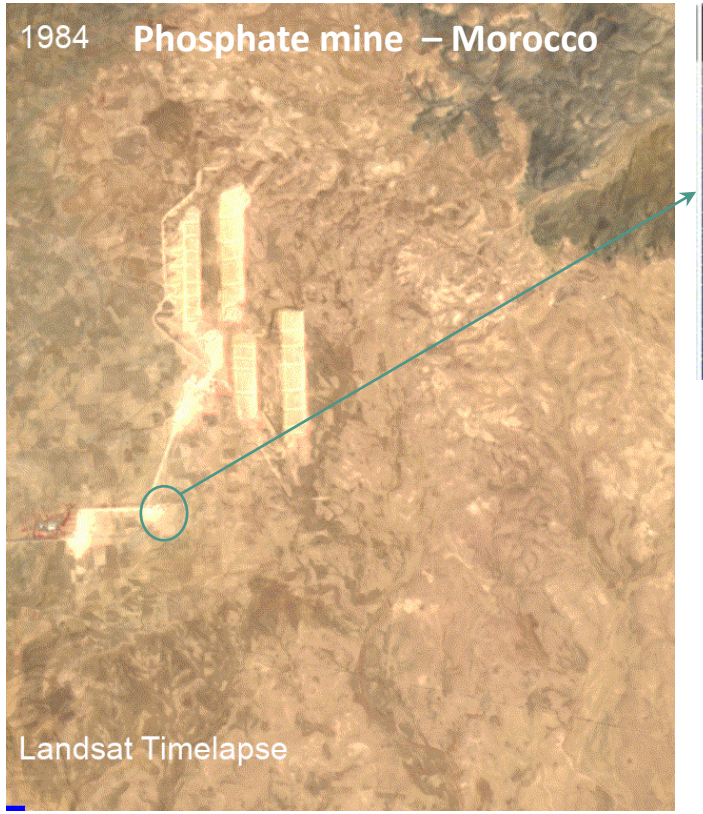
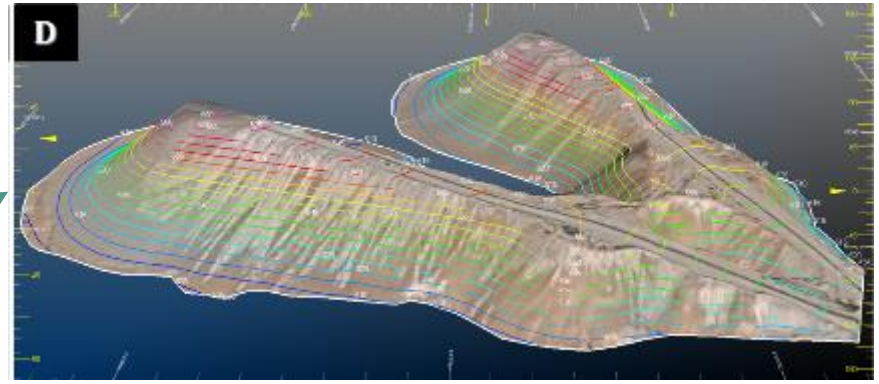
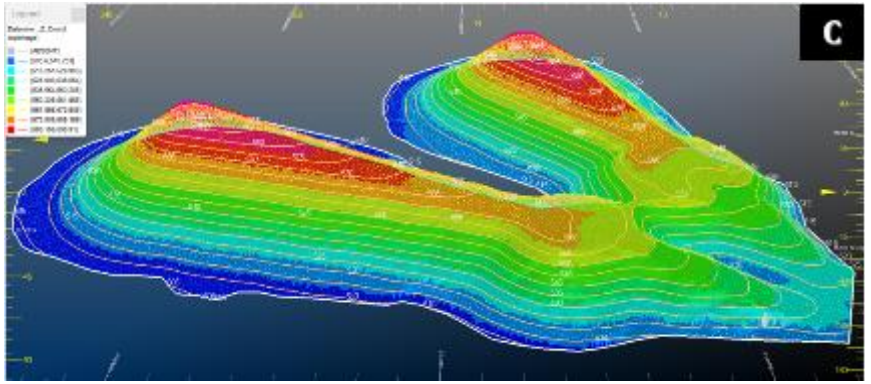
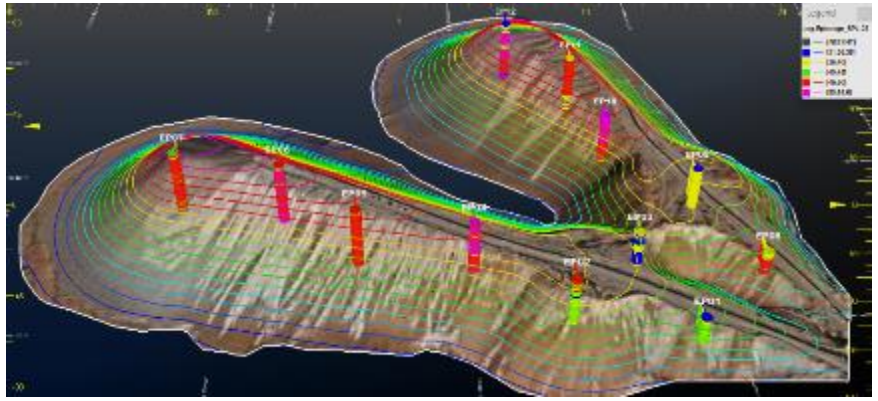


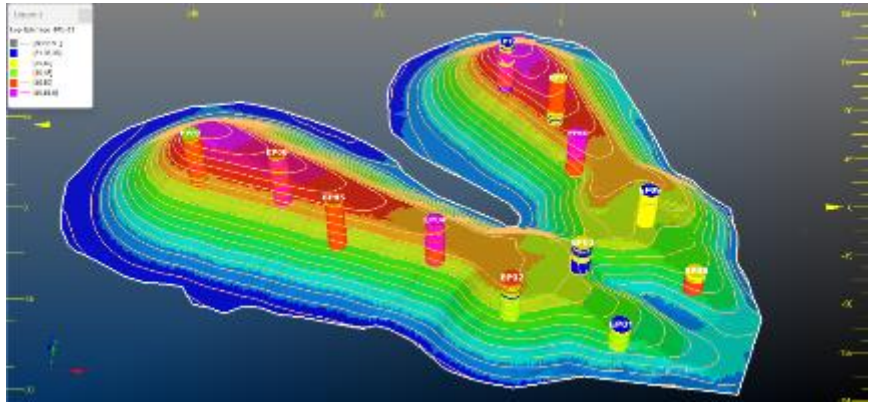
16km

13km



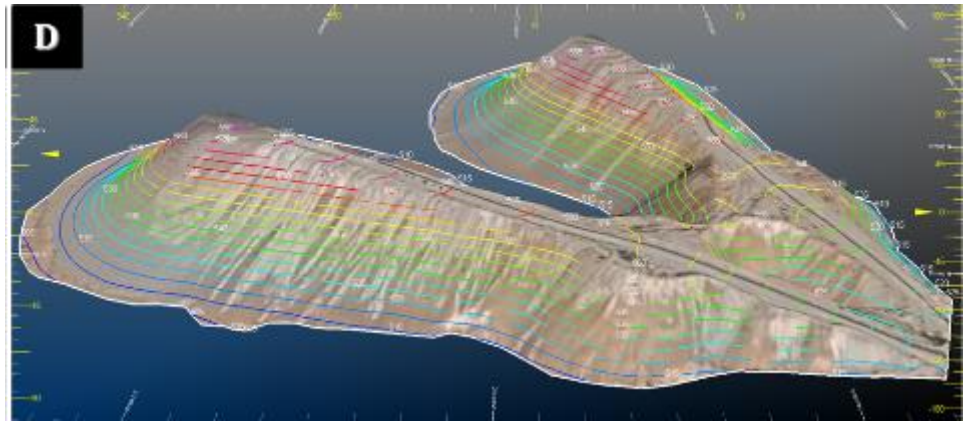


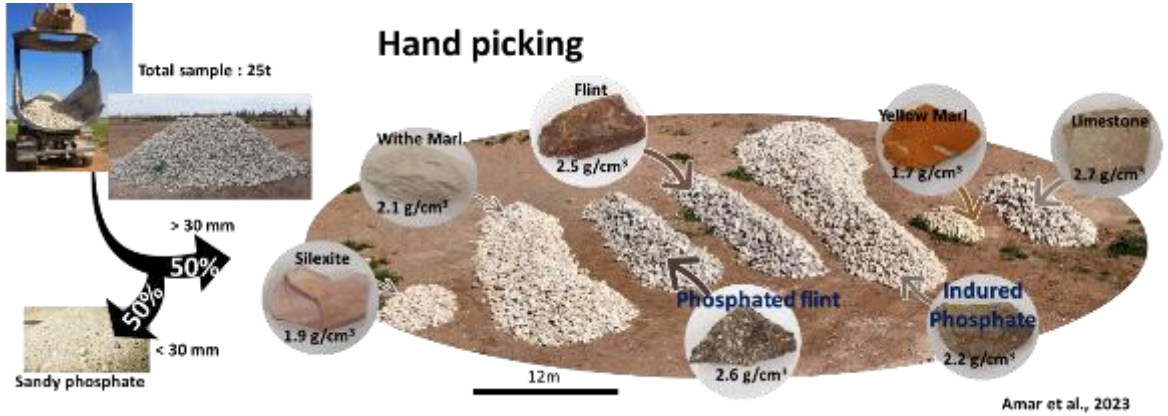


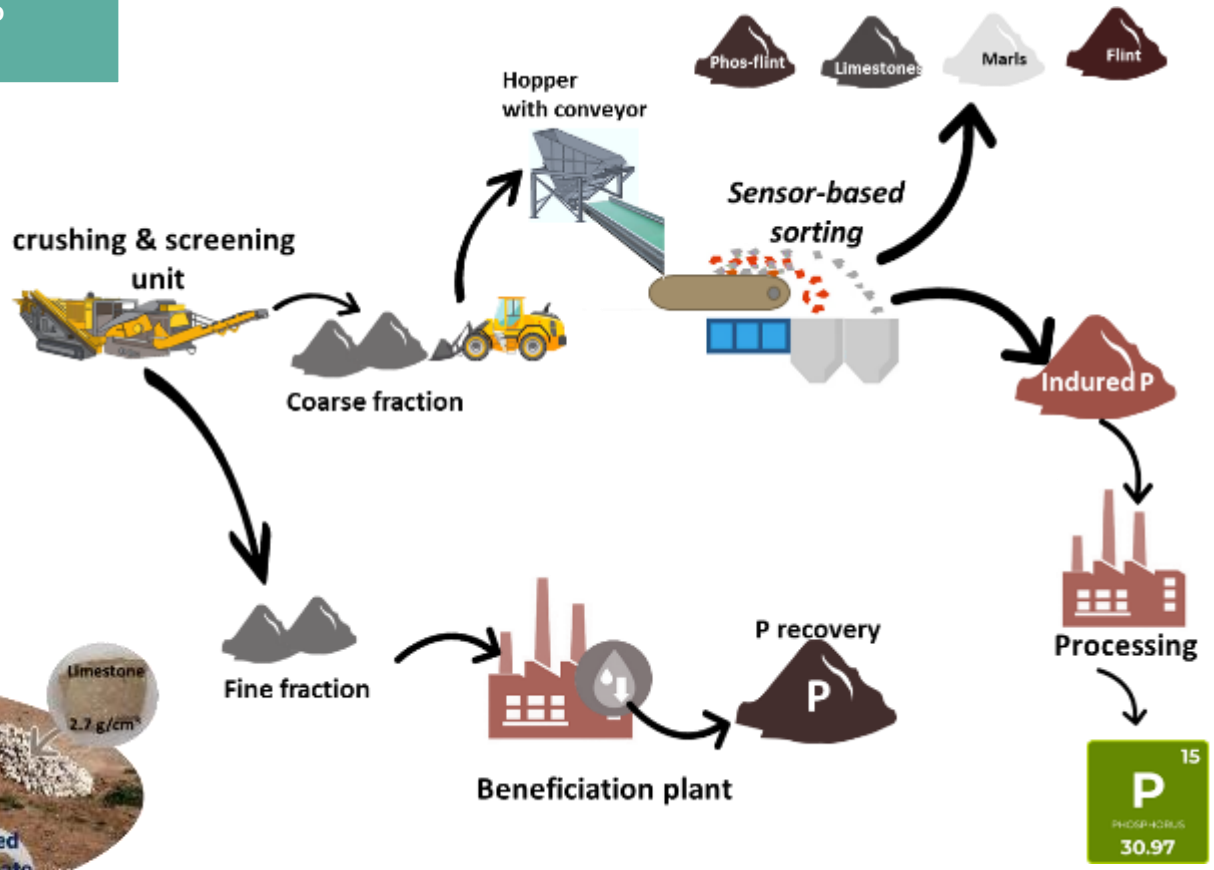


Phosphate Mine WASTE ROCK - Future Actions

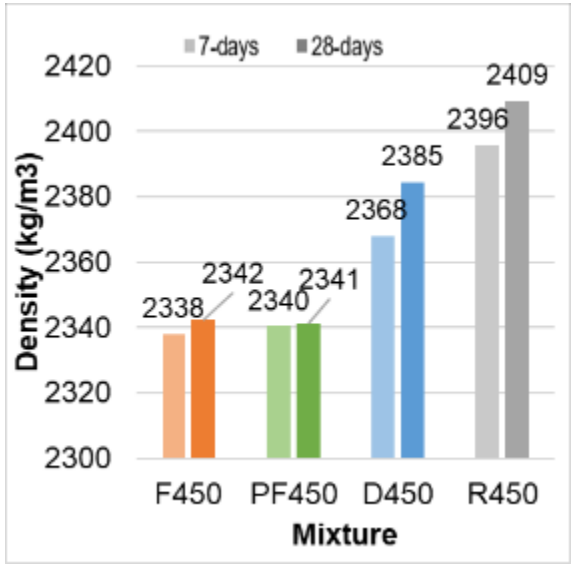
Actions to **MANAGE ALREADY DISPOSED** mine waste ?

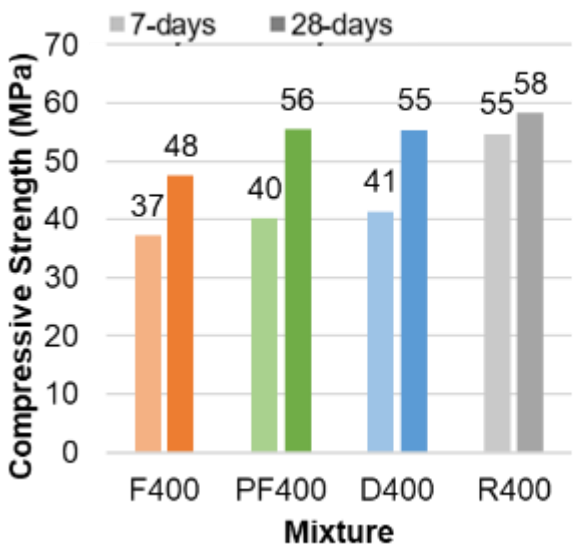


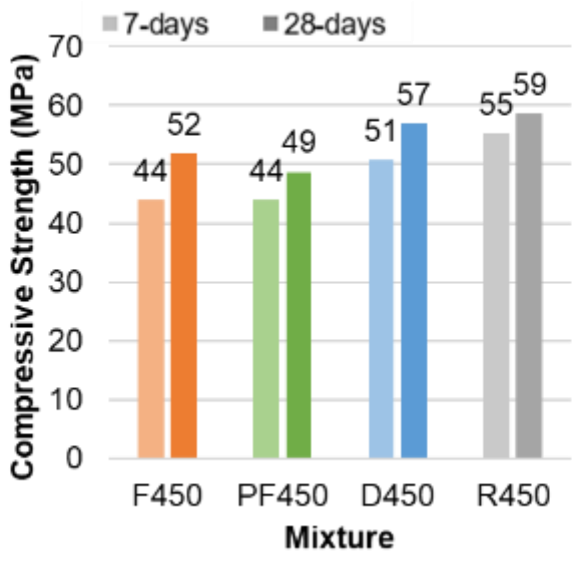


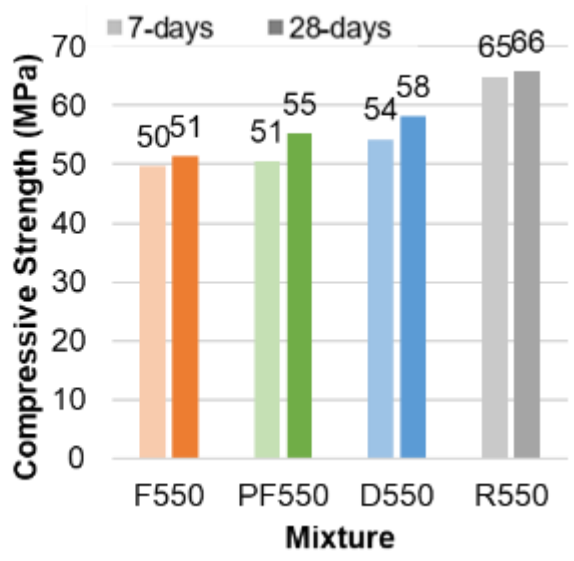


High Performance Concrete





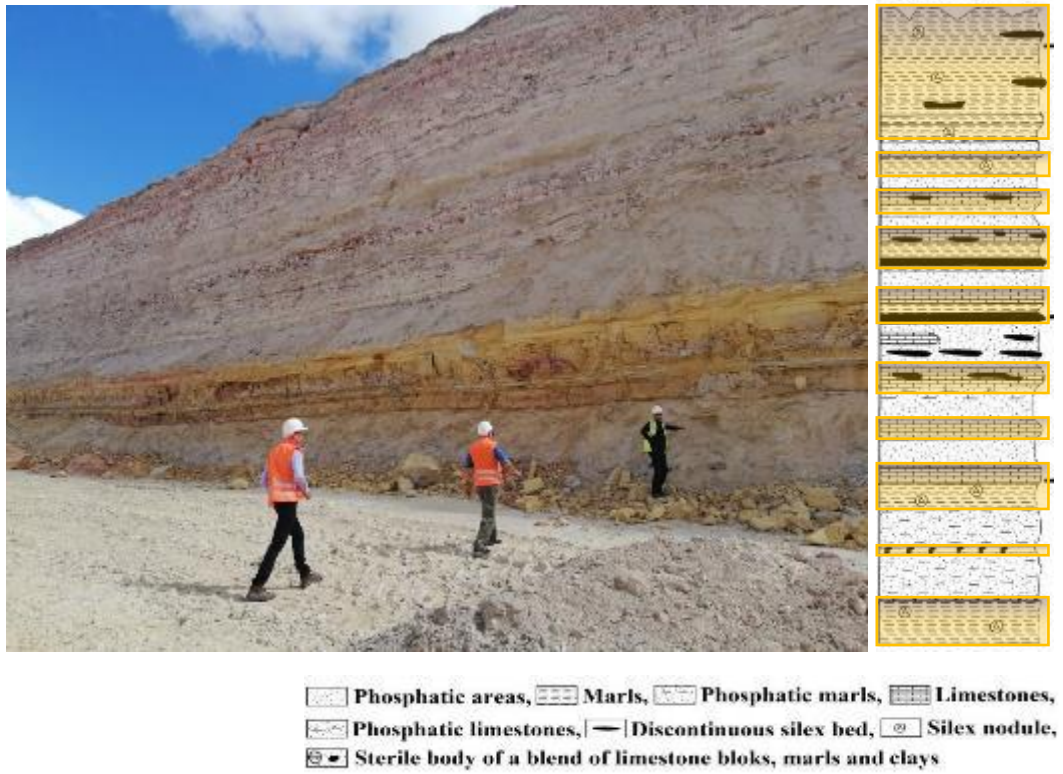




Source : Projet AS66 – 2020 – 2024 I Thèse Yahya Elberdai

FUTURE ACTIONS : Cement from phosphate over and interburden

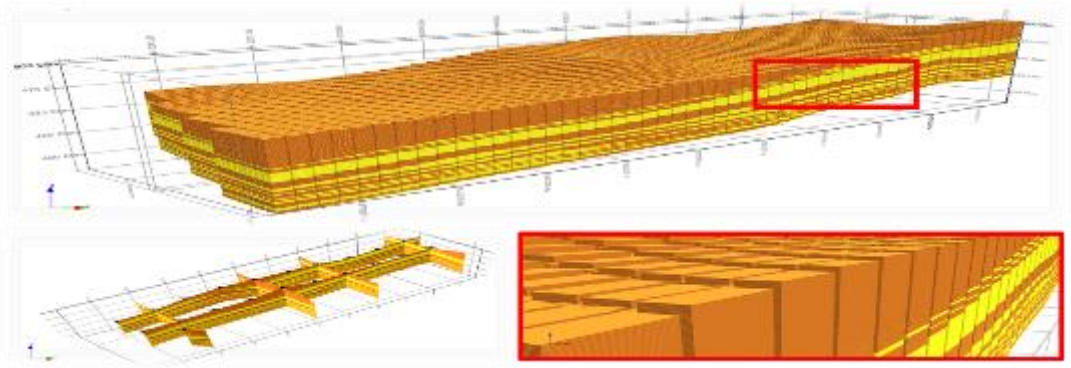
FUTURE ACTIONS to change **CURRENT EXTRACTION & PROCESSING** methods ?



Phosphatic areas, Marls, Phosphatic marls, Limestones,
Phosphatic limestones, Discontinuous silex bed, Silex nodule,
Sterile body of a blend of limestone bloks, marls and clays

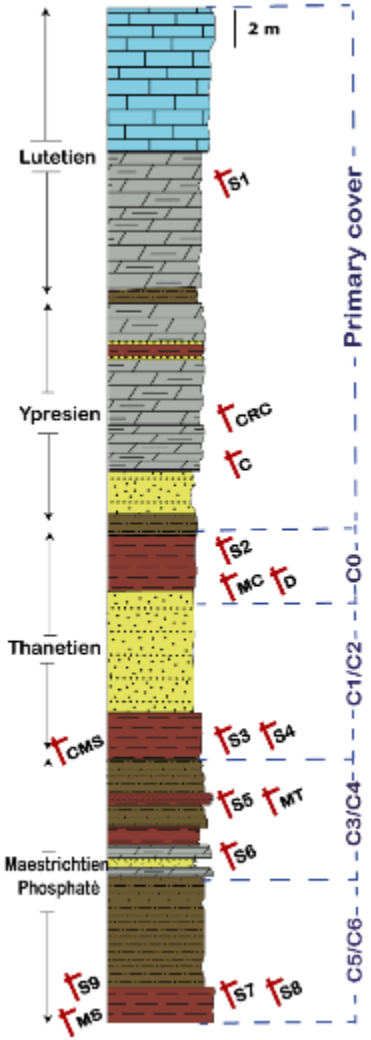
Marls,
Limestone blocks
Flint, Clays, Silicates

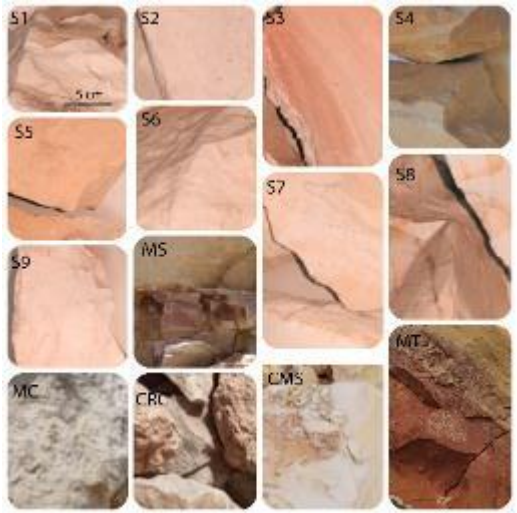
Rocks contained in the overburden may have a significant potential reuse as construction products or aggregates in road networks

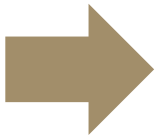


3D geological model of a phosphate deposit

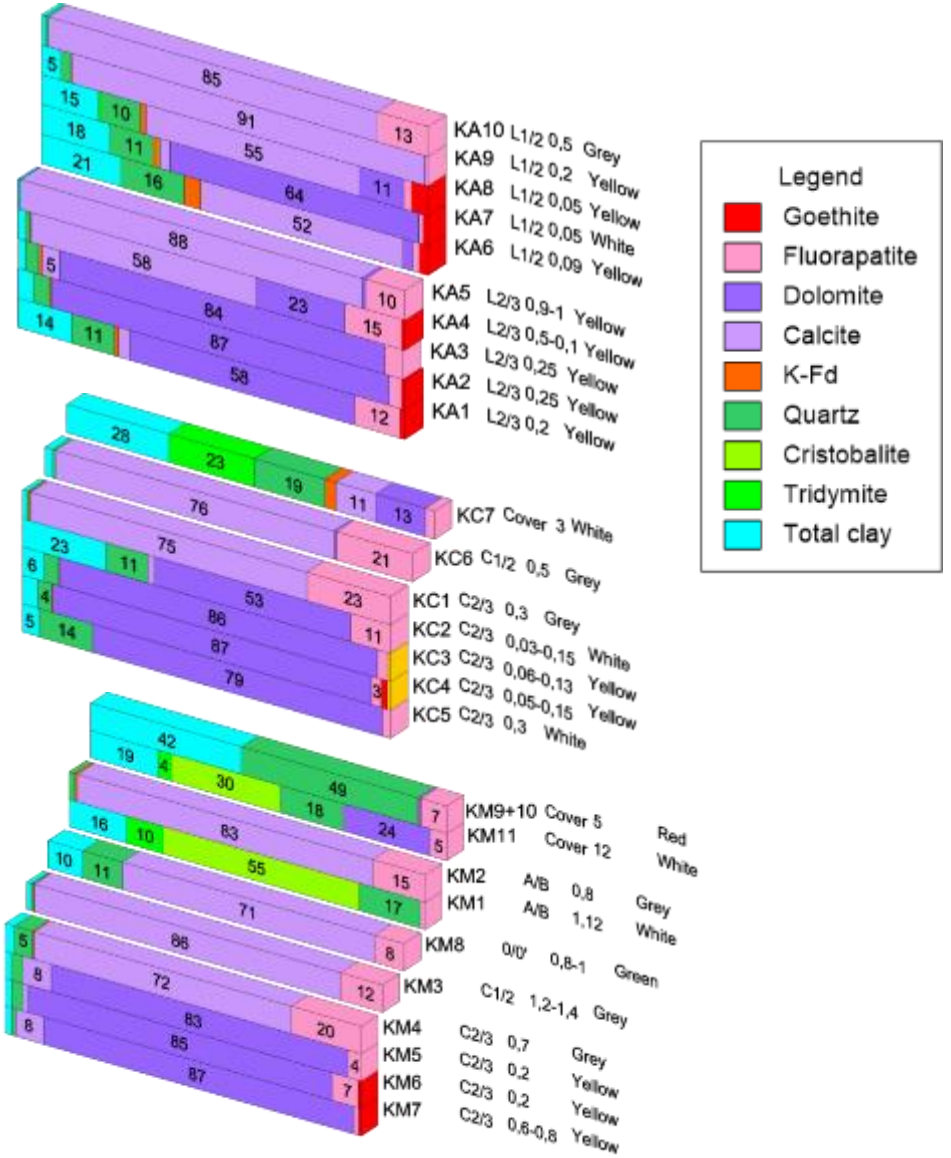
Interburden properties



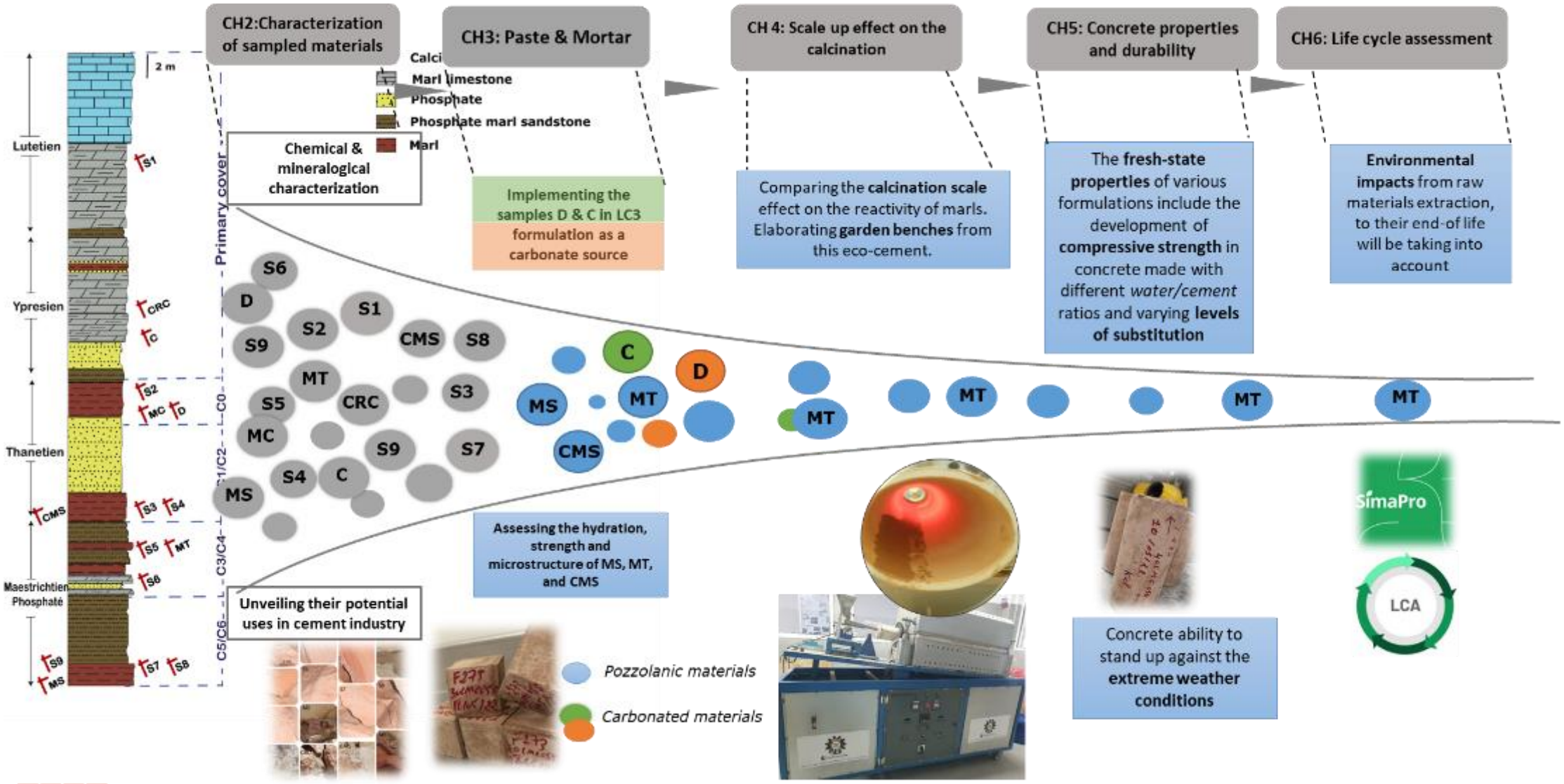




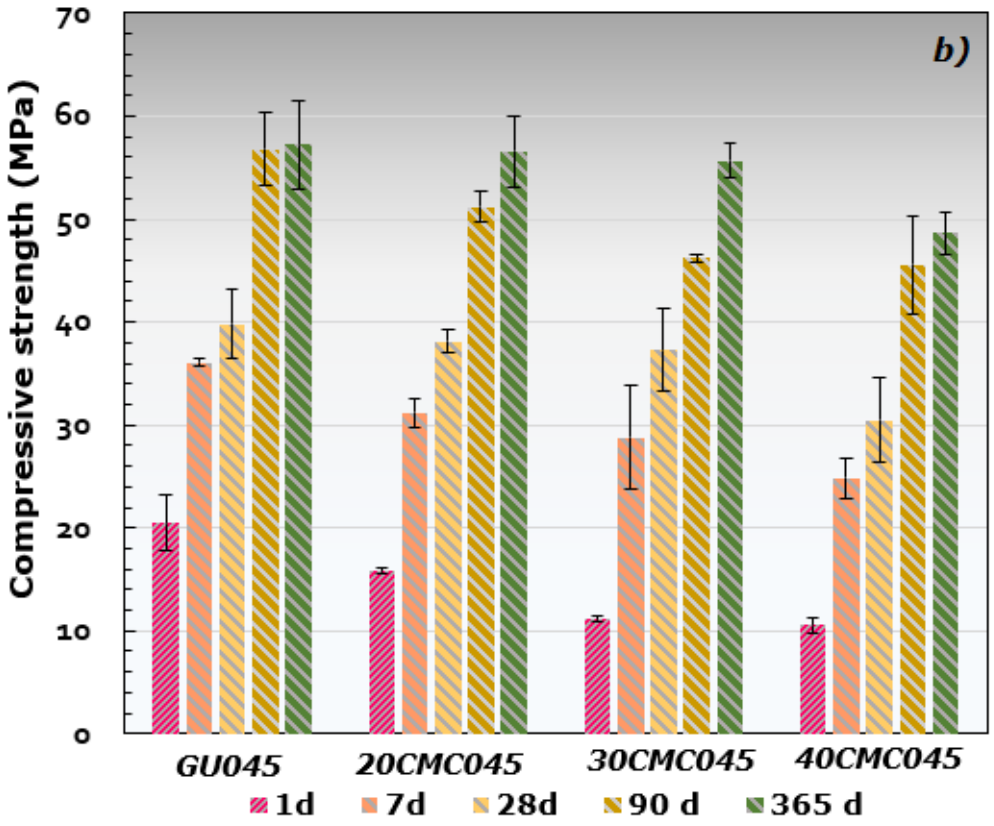
Calcite rich limestone
Marl limestone
Phosphate
Phosphate marl sandstone
Marl

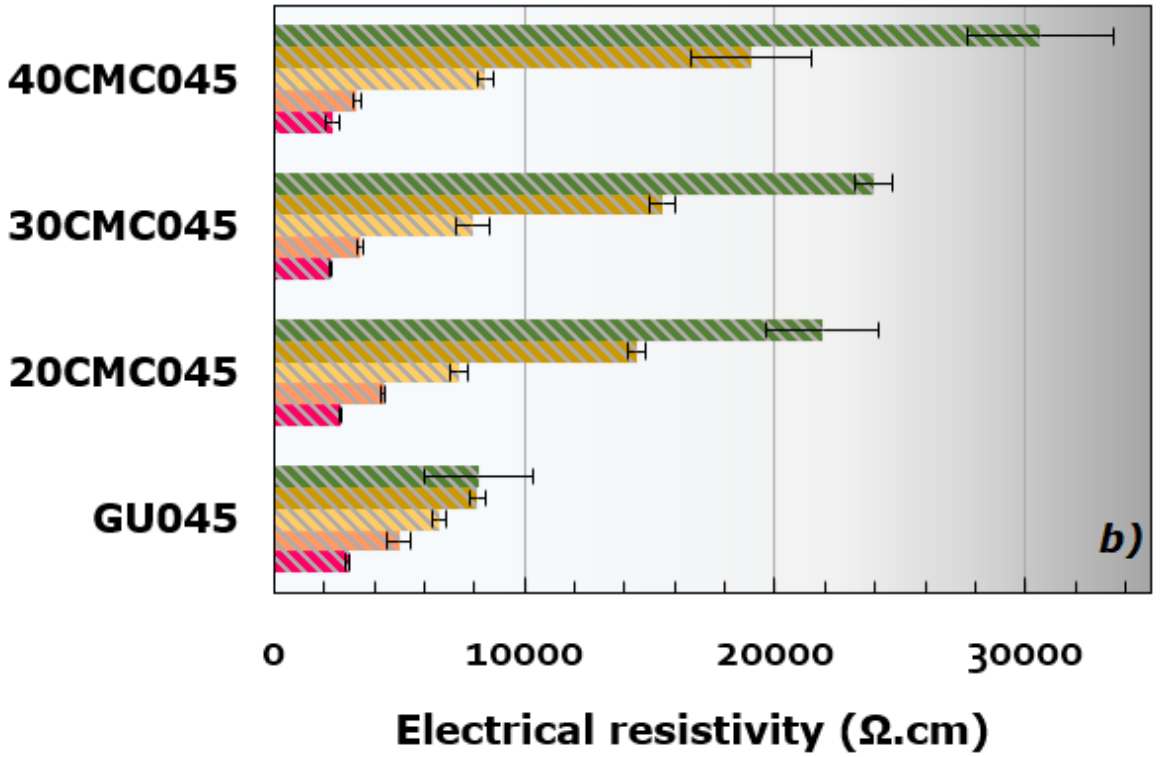


Methodology

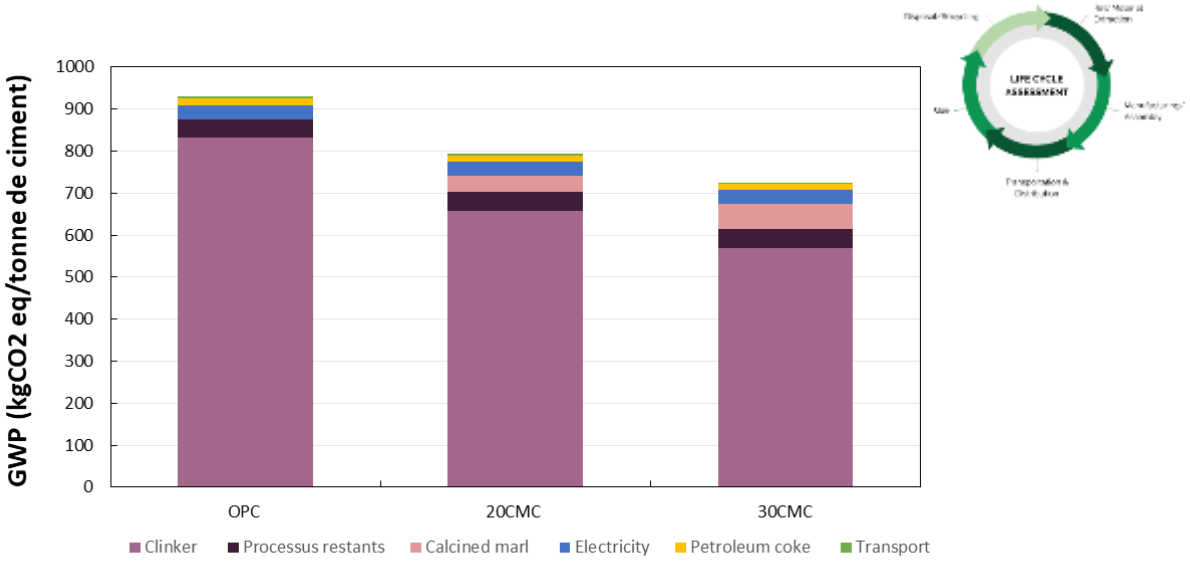


Concrete performance





Scale-up


GWP (kgCO2 eq/tonne de ciment)
1000
900
800
700
600
500
400
300
200
100
0
OPC
20CMC
30CMC
Clinker
Processus restants
Calcined marl
Electricity
Petroleum coke
Transport

What a future mine waste storage facility could look like !

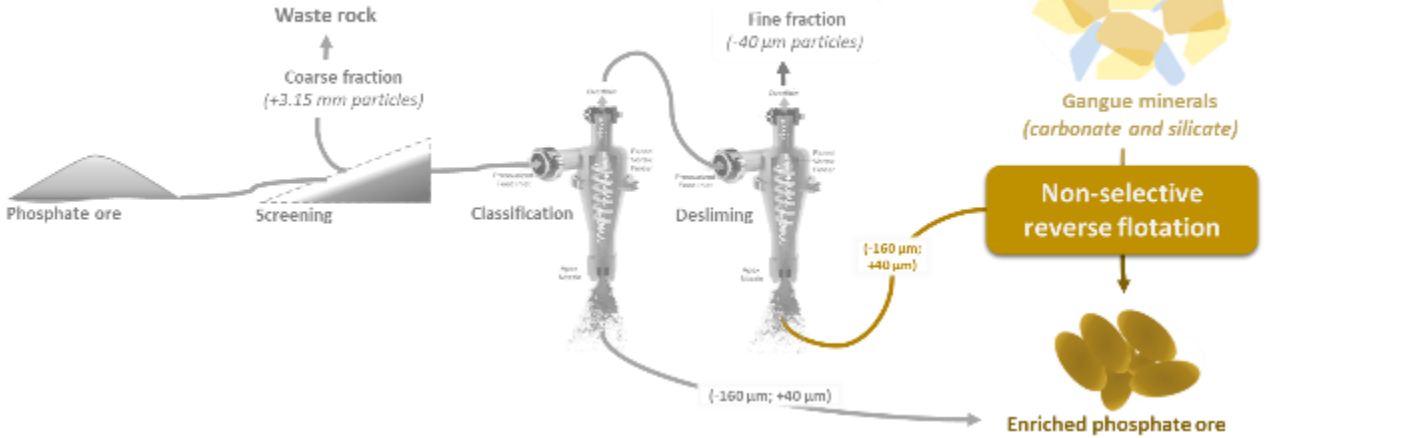
CIRCULAR MINE
Making zero mine waste a reality

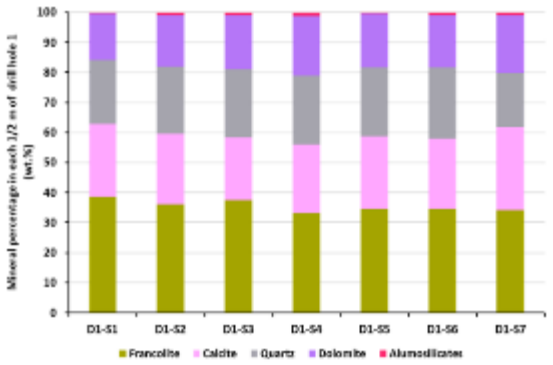
- Making Zero Mine Waste a Reality
- Increase the profitability, sustainability and safety of your mine by recycling your tailings
- Transform mine waste into a valuable and profitable resource

Phosphate Beneficiation – Future Actions

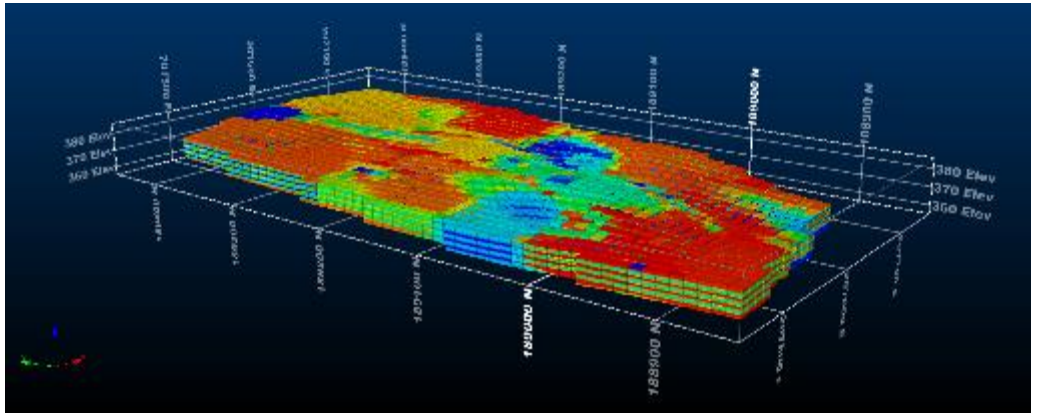
FUTURE ACTIONS to change **CURRENT PROCESSING** methods

Phosphate tailings
Morocco





The variation in modal mineralogical composition with depth in drill hole1



Phosphate Beneficiation – Future Actions

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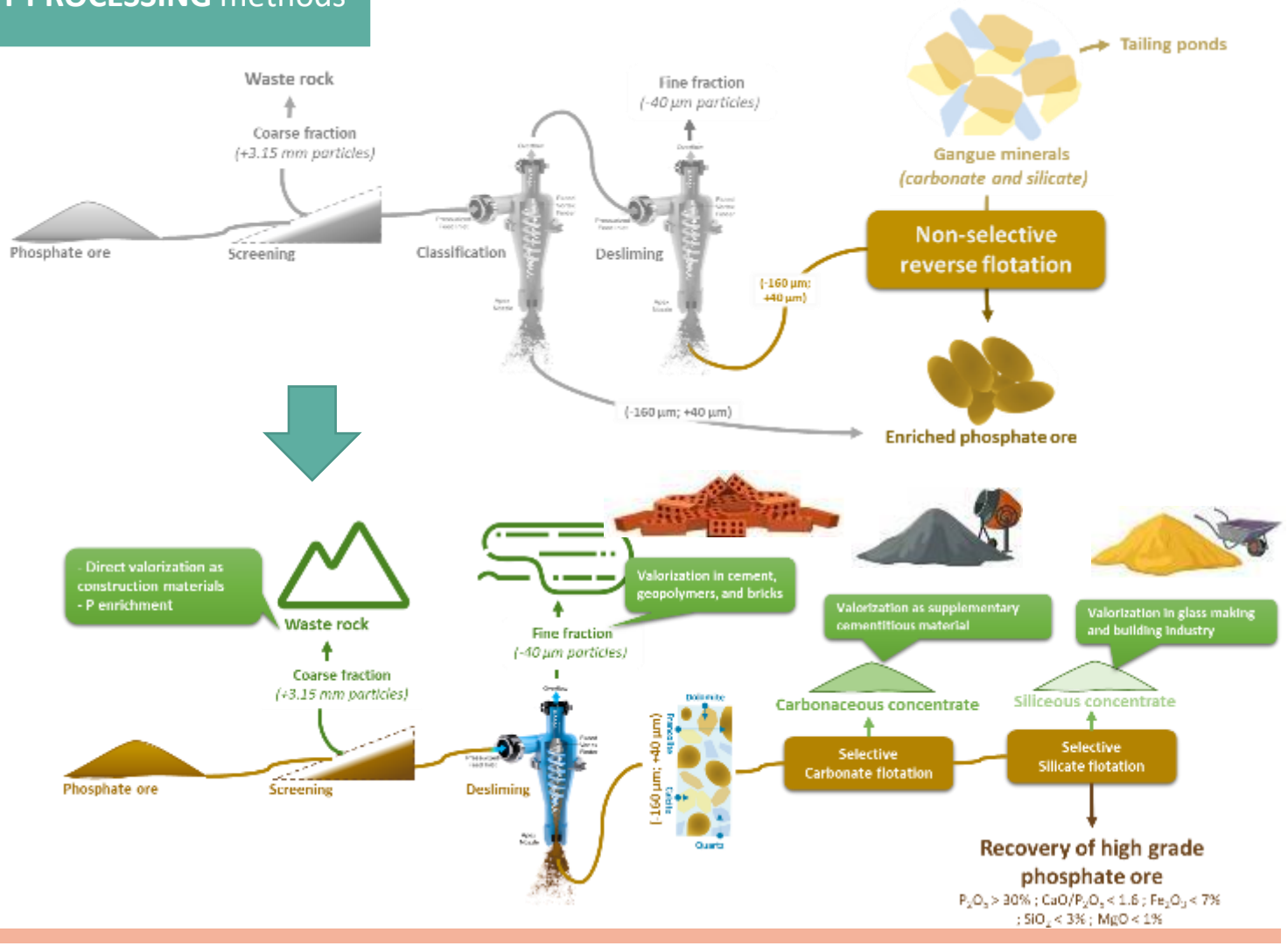
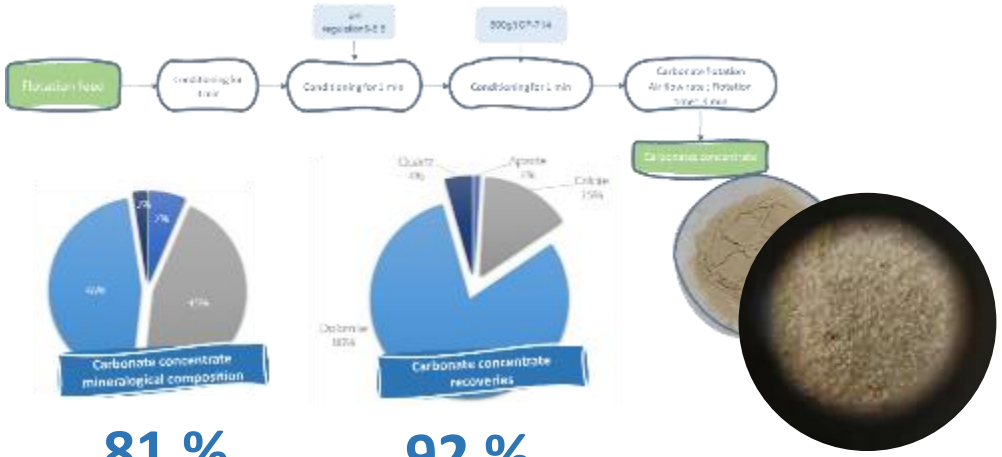
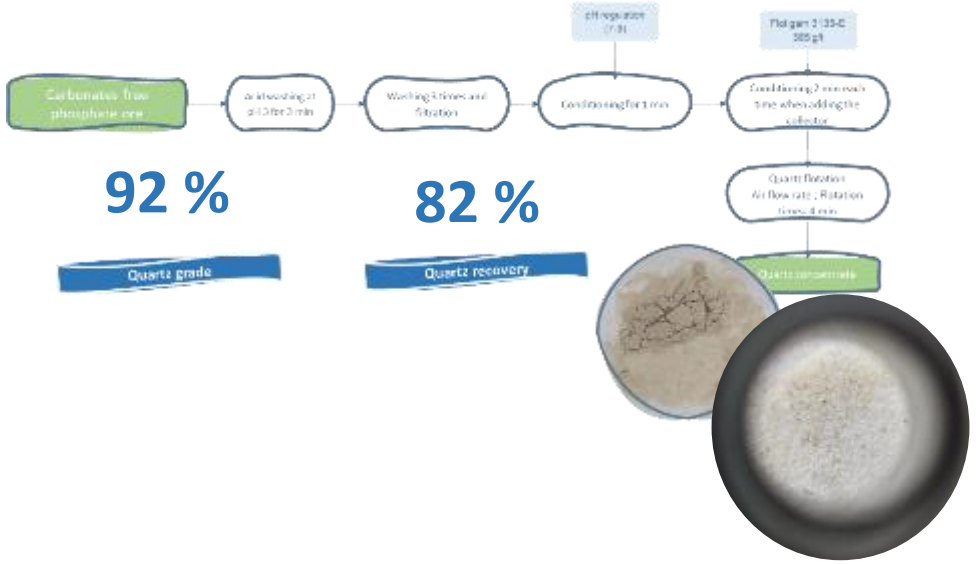


Phosphate Beneficiation – Future Actions



81 % **92 %**



92 % **82 %**

Source: Projet AS34 – Flottation 2019 – 2023 I Thèse Manar Derhy 2023

CONCLUDING REMARKS

Circular economy is NOT about ***one manufacturer changing one product****,*

it's all about the ***interconnecting companies*** *that form our infrastructure and economy* ***coming together****, it's about* ***synergy****, it's about* ***rethinking the operating system itself****,*

we have a ***fantastic opportunity to open new perspectives, and new horizons****, instead of remaining* ***trapped in the frustrations of the present****,*

with ***creativity and innovation****, we really can* ***rethink and redesign our future***

University Mohammed VI Polytechnic

MIT Global Summit on Mine Tailings Innovation

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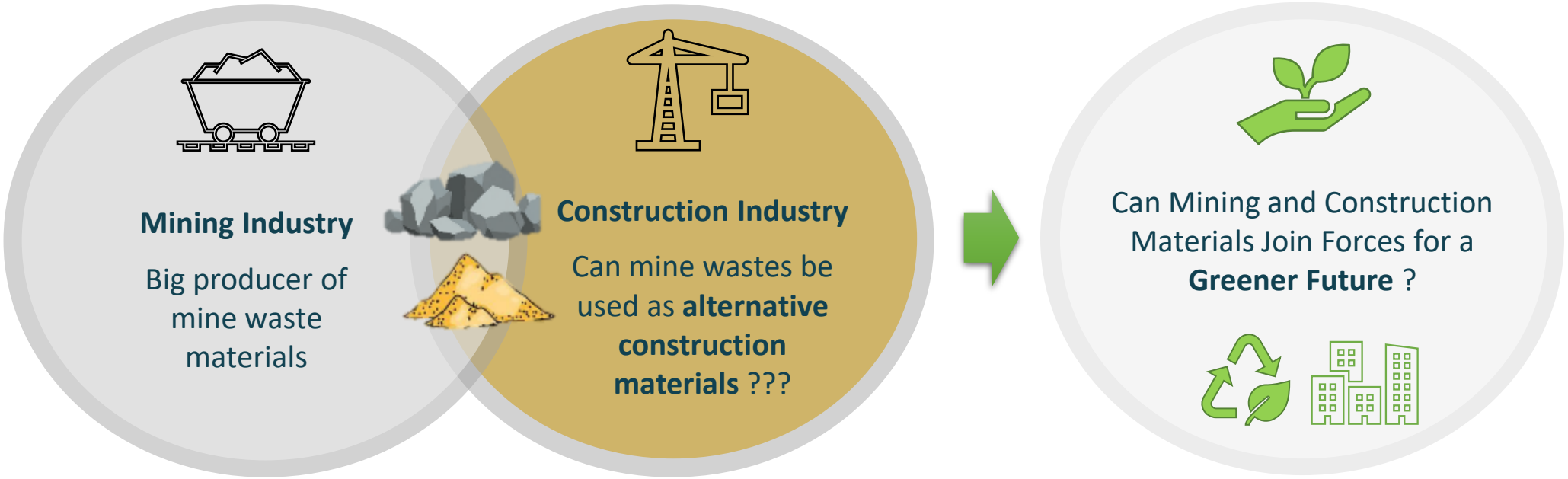

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Email : yassine.taha@um6p.ma