The Mineral Carbonation Process: who can use it and why?

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Project: Carbonate production by sequestration of industrial CO_2: revalorization of mine and industrial waste

Mineral Carbonation: what is it?

A Natural Process

The CO_2 from the atmosphere reacts with rocks and minerals

This reaction gives another solid: stable, inert, non-toxic

→ Perfect form to permanently and safely sequester CO_2

Example of Mg-bearing rock : serpentinite

Magnesium carbonate: Magnesite

Example of Ca-bearing rock : anorthosite

Calcium carbonate: Calcite

Efficient but slow kinetics in nature

Solution?

→ Accelerating the reaction rate

How?

→ Various paths: dry carbonation, aqueous carbonation

→ Optimizing the reaction parameters

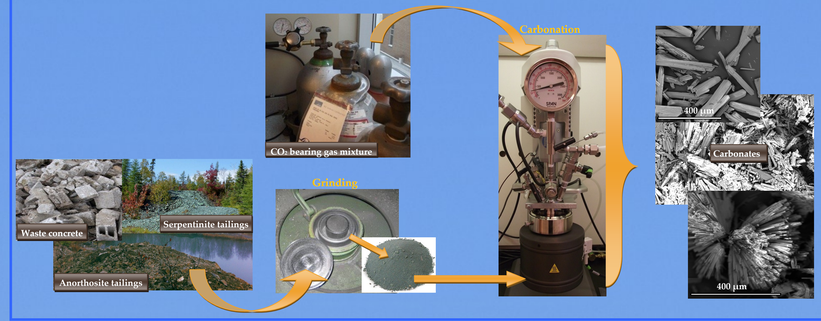
→ Working with various materials (wastes, rocks and minerals)

→ Enhancing the reactivity of the material

In a reactor

CO_2 bearing gas mixture + ground mine/industrial wastes →

Favorable conditions → ≈ 80% CO_2 capture → Carbonates



The Mineral Carbonation Process: useful?

In industry...

The process use gaseous effluents and as such :

→ no need of a pre-concentration or capture step

→ no need of 100% CO_2 gas or high pressure

→ possible with a mixture of CO_2 (up to 30%), H_2O, N_2, NOx, SOx...

→ At least 80 % of the CO_2 emissions is stored at low cost.

The process would be applicable to large CO_2 emitters like in the steel, aluminum, copper, cement and petroleum industries...

And waste management

Mine waste

Use of tailings:

→ Decrease size of dump

→ Revalorization and added value to an otherwise waste material

Feed examples:

Chromite, ilmenite, talc, soap stone, nickel exploitations tailings, etc.

Industrial waste

Use of industrial residue:

→ Decrease amount of discharge

→ Decrease sizes of disposal site

→ Revalorization and added value

Feed examples:

Waste concrete and cement, various bricks and granulates, etc.

Is it that easy?

Challenges

⚠ Convincing the companies of the efficiency of the process.

This comes with:

→ Scaling up of the process on site

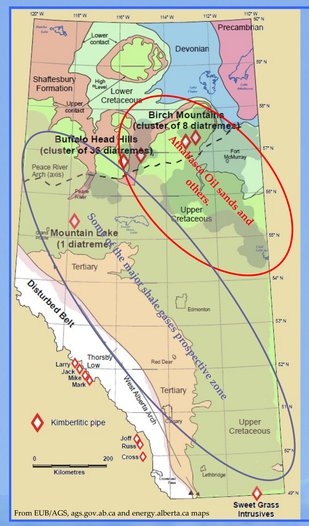
→ Installing the pilot plant on an industrial site

⚠ Having the material close to industrial sites/major GHG emitters:

→ Various materials tested : wider possibilities (sandstone, granite, basalt, peridotite, etc.)

⚠ Acceptance from the public

Applicability to Alberta



Materials available:

→ Kimberlite (See map)

→ Mafic sills and lava (Southern Alberta Rockies)

→ Mafic rocks (NE Alberta)

→ Waste concrete and aggregates (Airdrie, Mountain View…)

→ And possibly sandstone, granite...

Industries

→ Steel, tubing and alloy plants

→ Cement, aggregate and ready mix plants

→ Oil refineries, petrochemical producers and plastic manufacturers...

Localization: Calgary, Edmonton, Red Deer, Sylvan Lake, Fort McMurray, Scotford...

Conclusion

Use of gaseous and solid wastes: CO_2 emitted + mine/industrial wastes → Lower CO_2 emissions + recycle wastes + value-added/ environmentally safe product : Carbonates