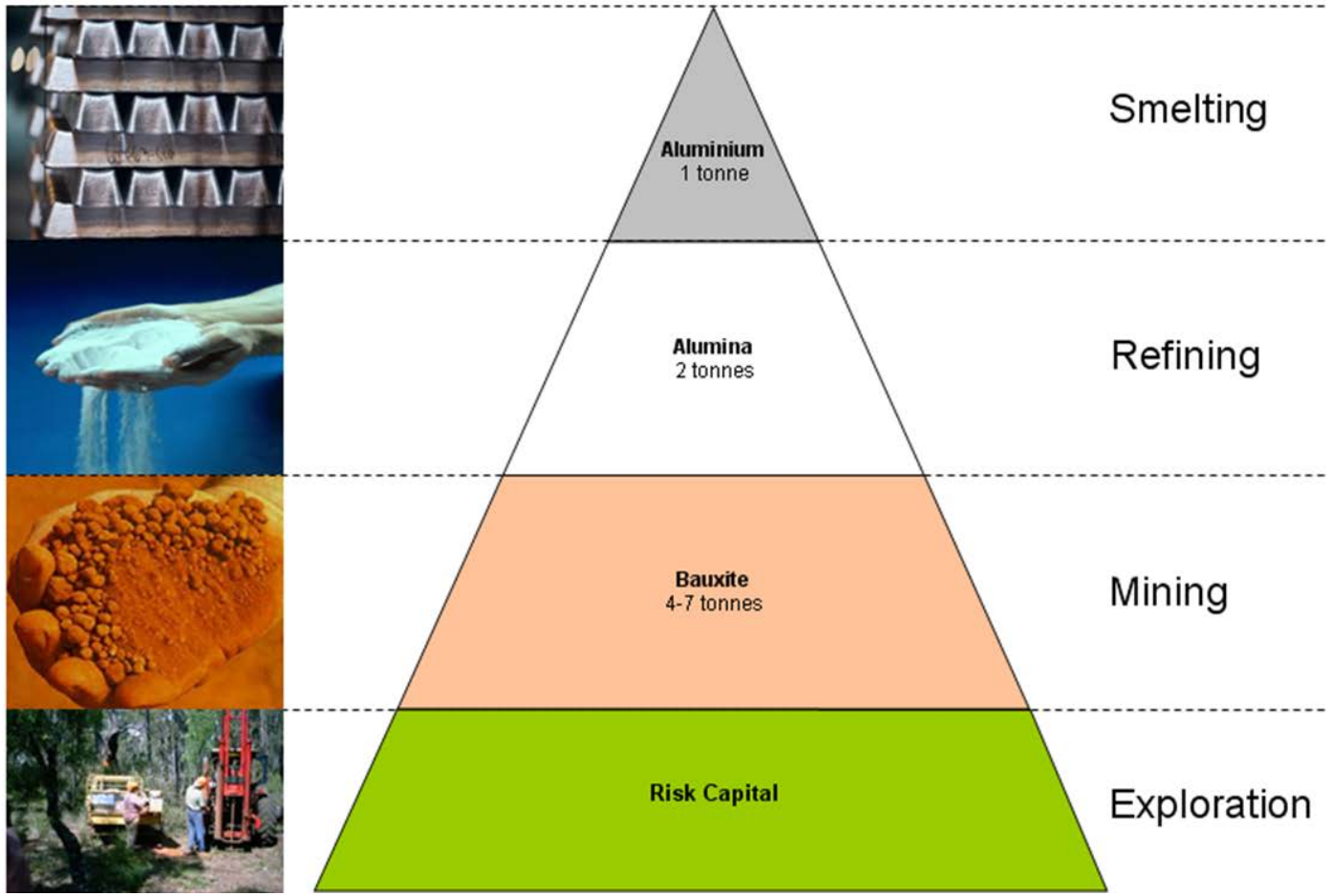
Bauxite & Alumina

From Bauxite to Alumina – Materials and processes

Aluminium production – From mining to metal



Hydro's Bauxite and Alumina activities are in northern Brazil

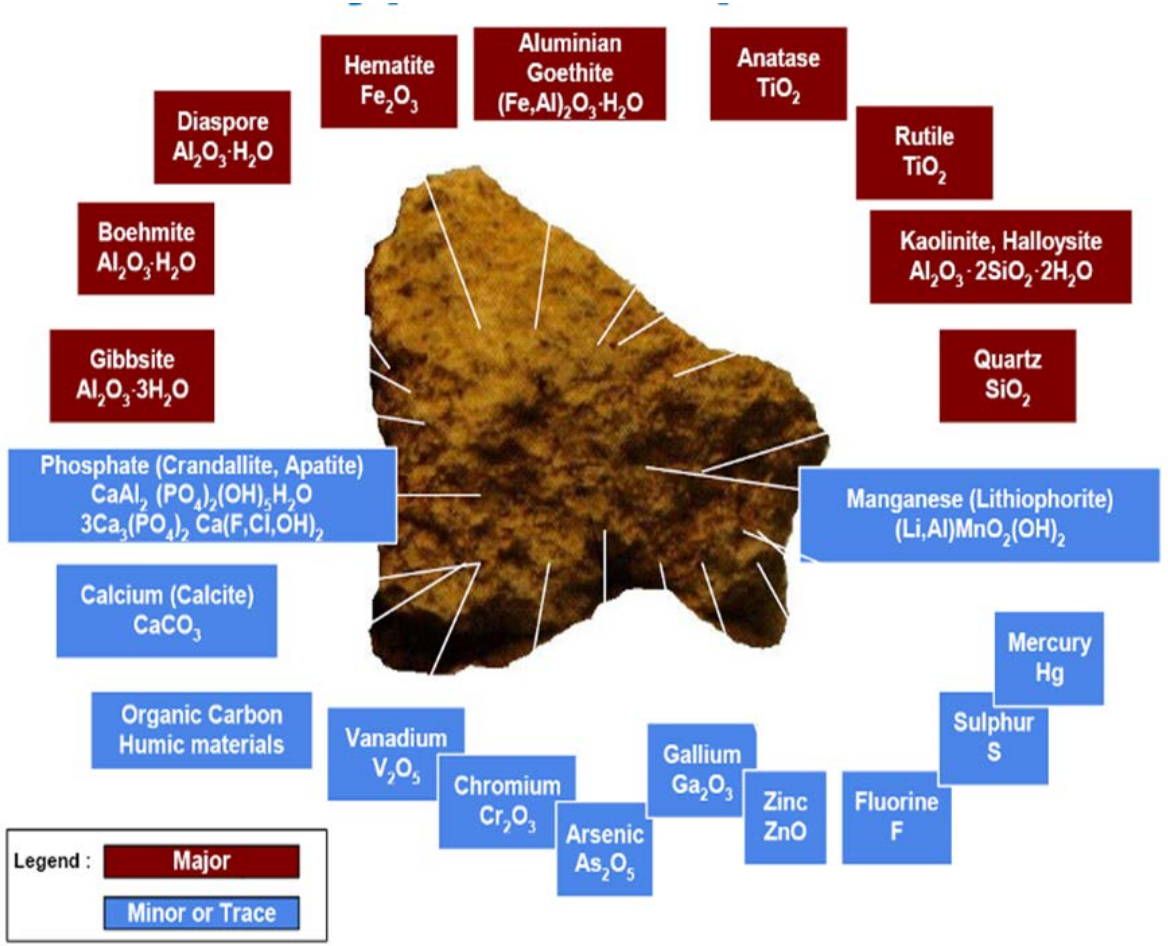
Paragominas Google Earth. About 7 km diameter

01

Bauxite mining

Bauxite

- Bauxite is the ore from which most alumina is produced
- Depending on the composition of the mother rock, the various bauxite deposits have different content of minerals and elements



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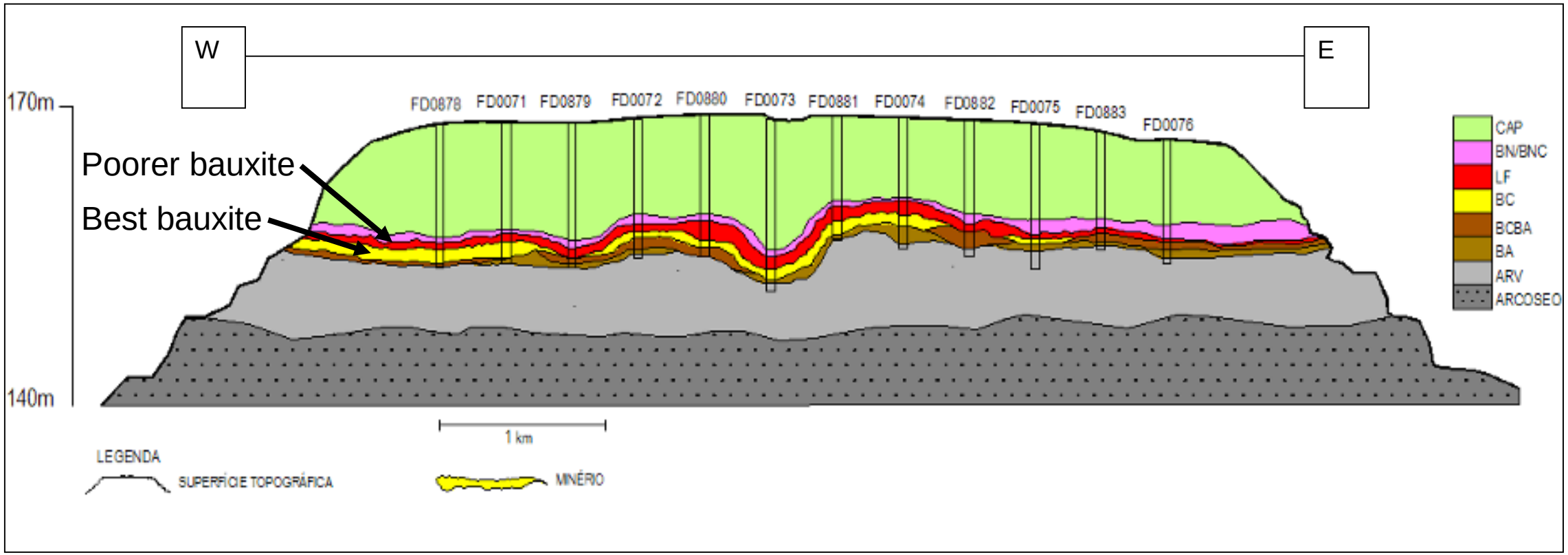
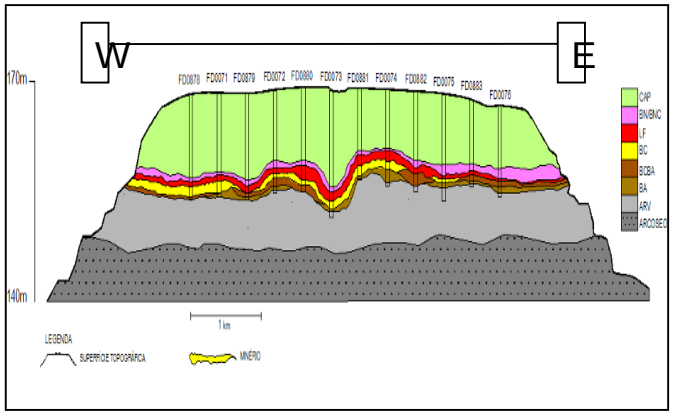
Bauxite mining

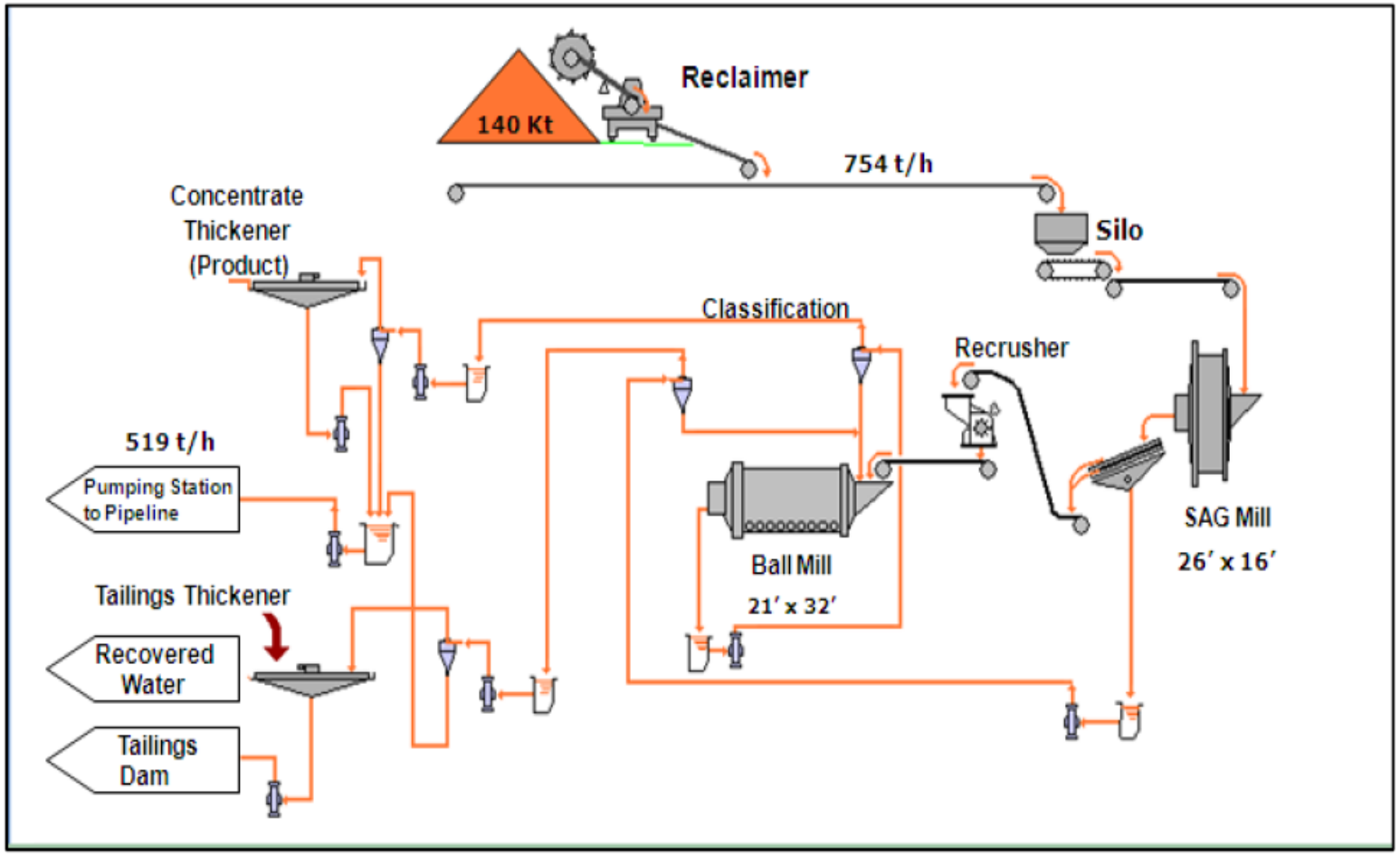
- In Brazil bauxite is typically situated on plateaus and is covered by >10m of overburden



Bauxite mining



Bauxite Beneficitaion



Fines, mainly reactive silica, is separated out. 519 out of 754 t/h is 69%

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Bauxite Pipeline – From Paragominas mine to Alunorte refinery

>220 km long pipeline with bauxite slurry

02

Alumina refining

Alumina

- The chemical formula for aluminium oxide is Al_2O_3 and it is commonly referred to as alumina
- Alumina as produced in the Bayer process is a white, inert and odourless powder and is mainly used as raw material for aluminium production.

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Alunorte - The world's largest alumina refinery

- Ownership
  - Hydro 91%, CBA 3.6%, Japanese companies 5.4%
- Start-up
  - 1995
- Capacity
  - 6.3 million tonnes Aluimina
- Cost position
  - First-decile conversion cost
- Employees
  - ~1 500

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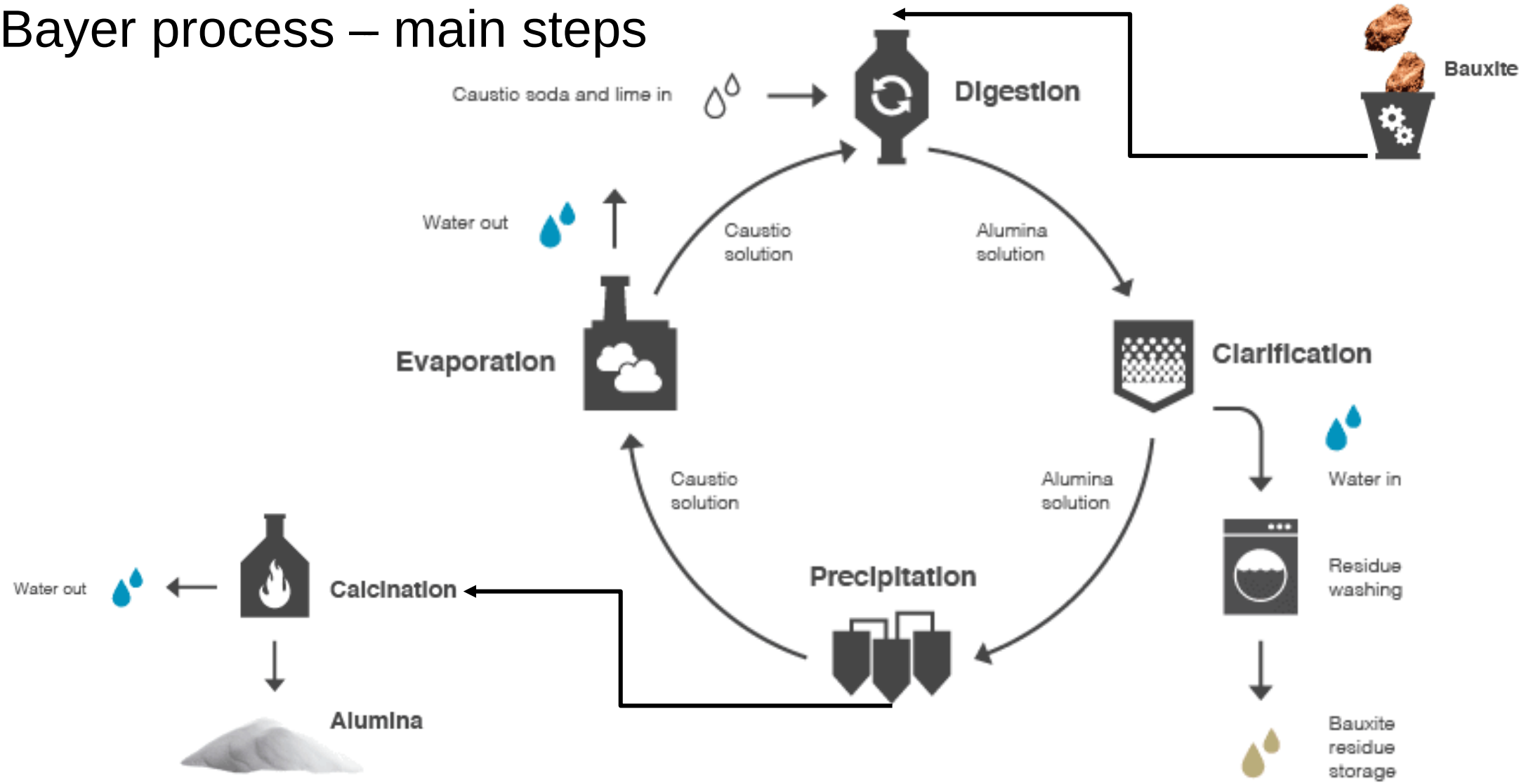
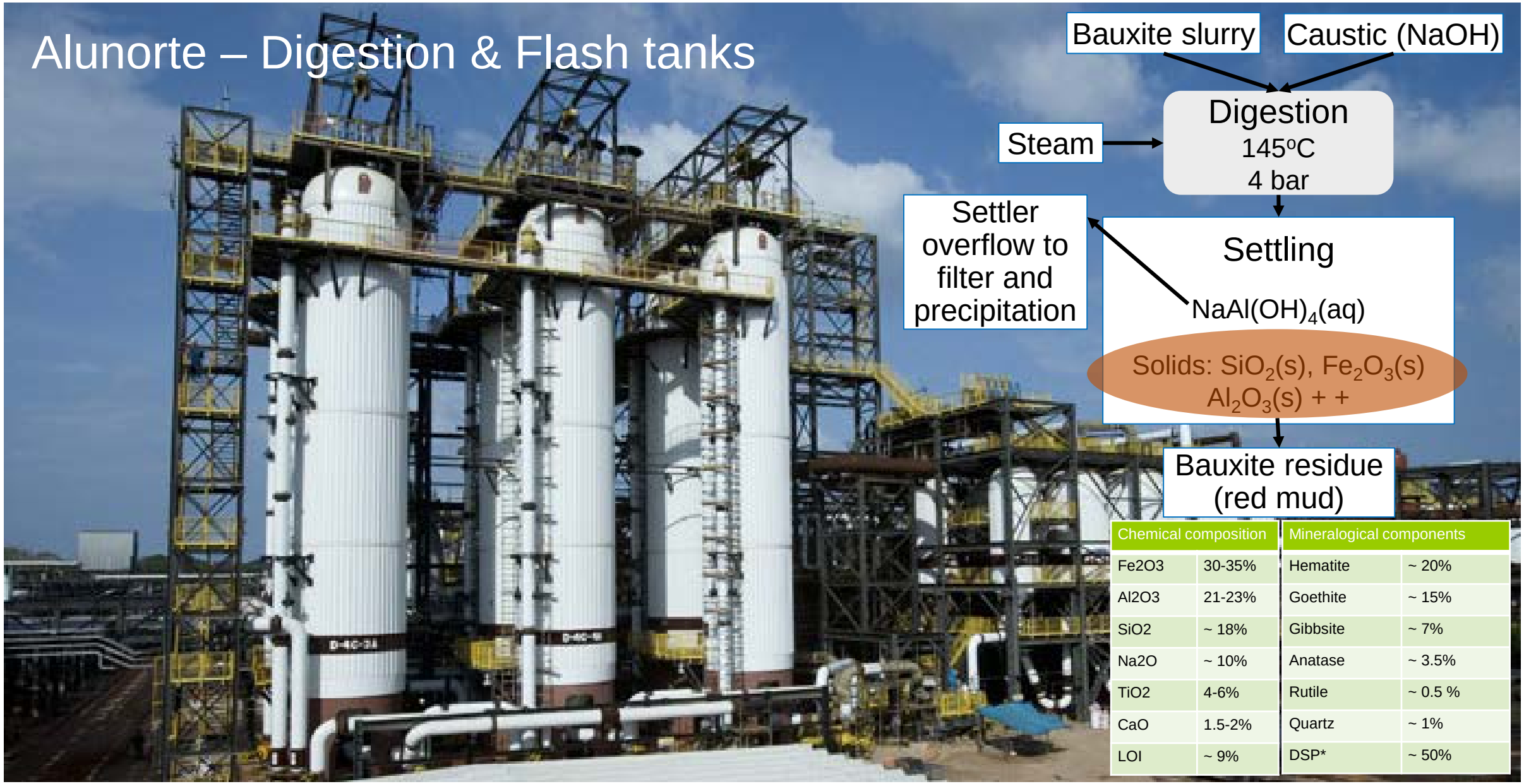
Port
Alunorte
Bauxite Residue (red mud)
Albras
Google Earth

Bayer process – main steps



Alunorte – Slurry Mix preparation
Mixing of bauxite and NaOH solution

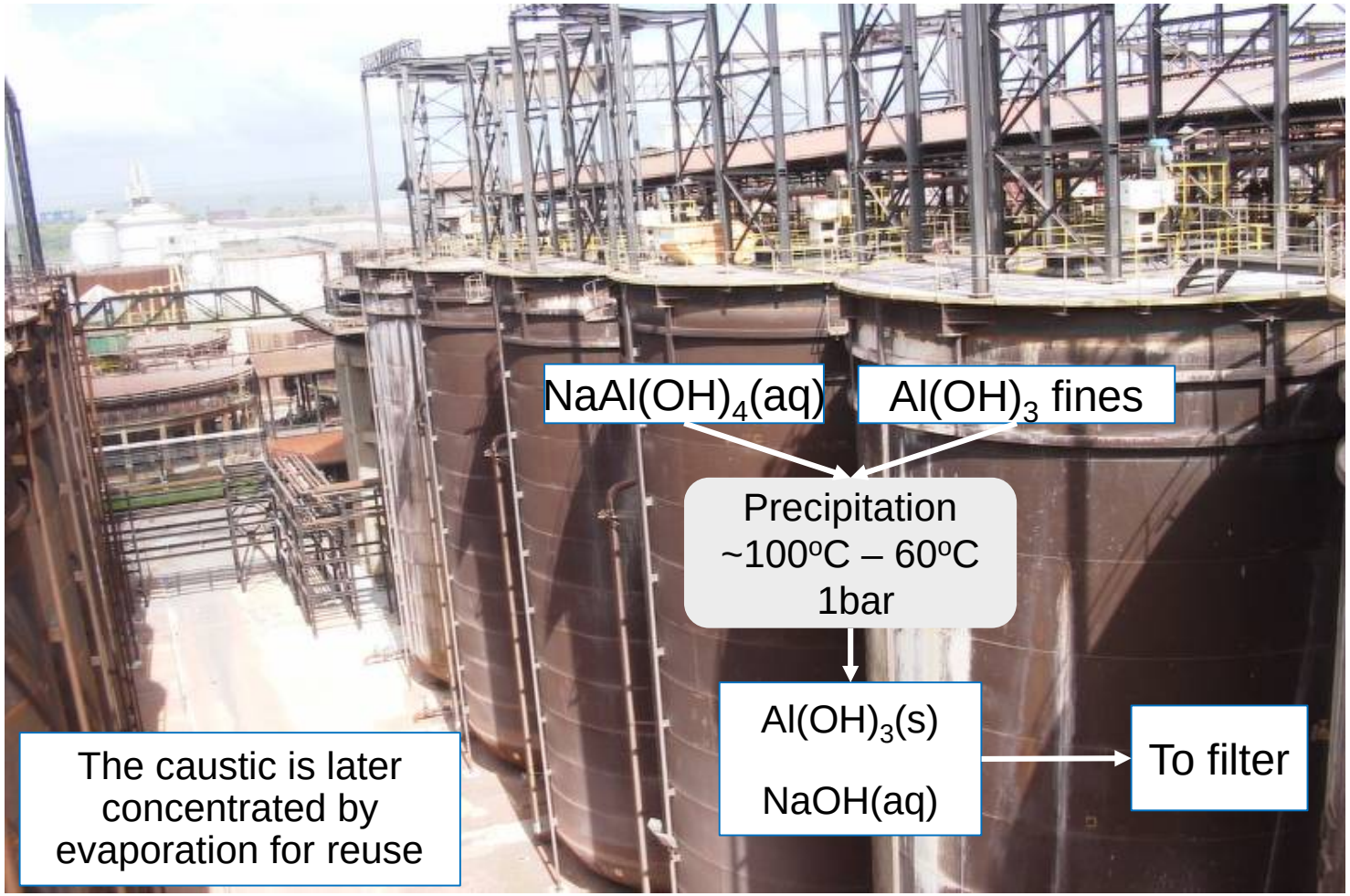
Alunorte – Digestion & Flash tanks



Chemical composition		Mineralogical components	
Fe2O3	30-35%	Hematite	~ 20%
Al2O3	21-23%	Goethite	~ 15%
SiO2	~ 18%	Gibbsite	~ 7%
Na2O	~ 10%	Anatase	~ 3.5%
TiO2	4-6%	Rutile	~ 0.5 %
CaO	1.5-2%	Quartz	~ 1%
LOI	~ 9%	DSP*	~ 50%

* DSP (de-sillication product) is a sodium aluminium silicate: Na6[Al6Si6O24]Na2X, where X = SO_4^{2-}, CO_3^{2-}, Cl^- , $Al(OH)_4^-$, OH^-

Alunorte – Precipitation & Filtration



Precipitation is slow! Several days are required

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Alunorte – Classification & Discharge

$Al(OH)_3$ is classified by settling. The coarse fraction is washed and transferred to calcination. The fines are used as seeds in the precipitators

Alunorte – Calcination

$Al(OH)_3$ is calcined to Al_2O_3 in fluid-beds at about 1000°C. There are strickt quality requirements for the end product: Purity, particle size distribution, phase composition, BET and sufficient mechanical strength are important parameters. The alumina is shipped in bulk world wide.

04

B&A
R&D
examples

Dare2C - Environmentally Friendly Concrete Construction

- Goals
  1. Replace portland cement clinker with **Bauxite Residue** will reduce CO_2 footprint
  2. Develop a low pH concrete recipee. Aluminium will replace regular steel reinforcement to manage the lower pH
- Optimally combine 1 and 2
- But success also if 1 or 2 are acheived separately

Partnere i prosjektet: Hydro, Norcem, Veidekke Entreprenør, Sintef Byggforsk og NTNU. Hydro er prosjekteier og -leder. Støttet av Forskningsrådet.
Se https://www.tu.no/artikler/dumt-sporsmal-ga-ideen-til-det-som-kan-lose-to-miljoproblem/412138?key=pjBlgFIR

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