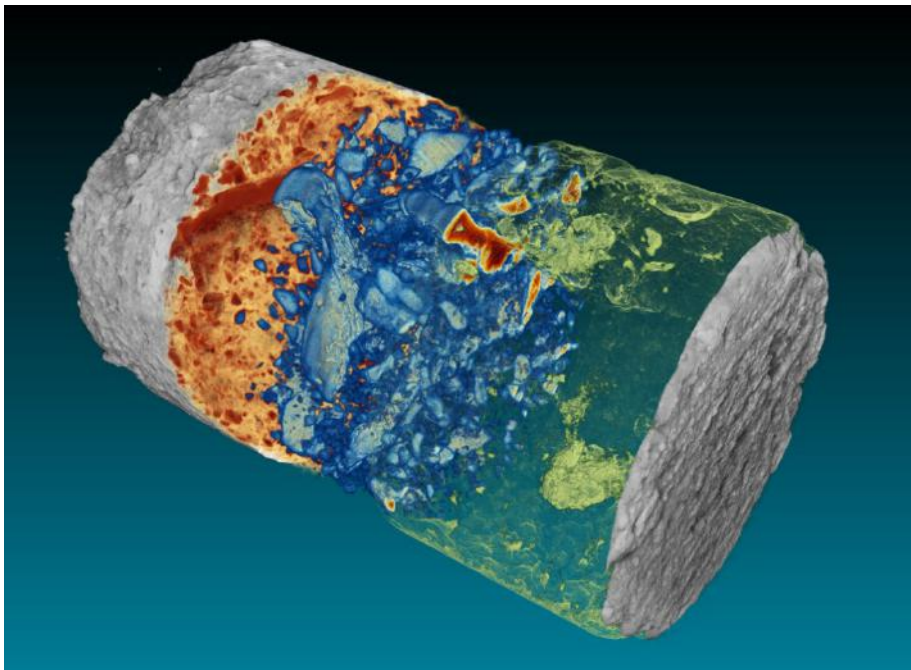




# Voxilon

*Workflow-driven Digital Material Analysis*

# Digital Material Analysis **Flaws**



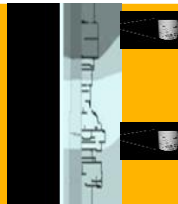
Management

Under-exploited data



More and more data

Bigger and bigger data



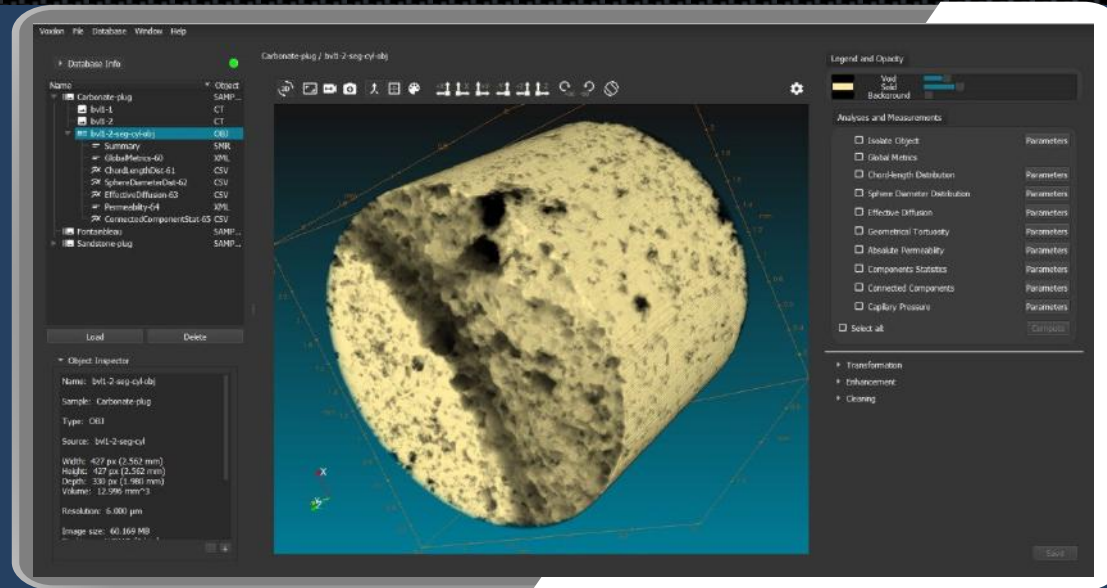
Representativity

Upscaling

# Voxilon's Missions

Get closer than ever to real-time digital material analysis

- ✓ Workflow-driven
- ✓ Easy-to-tame interface
- ✓ Fast and accurate simulations
- ✓ Result-focused



# Data-to-Results Workflow



# Voxilon is



## a 3D image database management system

Easily manage and access  
all your tomographic data  
and related files



## a 3D image visualization and processing software

Visualization and image  
processing filters  
in an easy-to-tame interface



## a numerical simulation platform

Simple yet powerful,  
Voxilon is easily extendable

---

**Voxilon is the integrated, workflow-driven numerical material analysis software.**

# Key Benefits



## Fast

**Swiftly get representative data**

from your high resolution 3D  
images  
with Voxilon's tailored algorithms



## Flexible

**Never get stuck again**

Keep on working while your most  
demanding computations are running,  
thanks to Voxilon's modular architecture.



## Organized

**Organize your projects**

Instantly access your images and data  
from your own secured database,  
within Voxilon's easy-to-tame interface.

# Key Benefits



## Fast

**Swiftly get representative data**

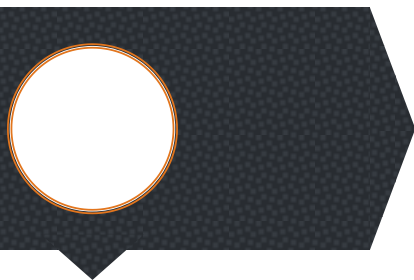
from your high resolution 3D  
images

with Voxilon's tailored algorithms

# Key Benefits

## State-of-the-art algorithms

15 years of research from our founding team in Geosciences Montpellier (CNRS / University of Montpellier).



## Fast

**Swiftly get representative data**

from your high resolution 3D  
images

with Voxilon's tailored algorithms



# Key Benefits



## Fast

Swiftly get representative data

from your high resolution 3D  
images

with Voxilon's tailored algorithms

## State-of-the-art algorithms

15 years of research from our founding team in Geosciences Montpellier (CNRS / University of Montpellier).

	Permeability (mD)	Computation time
OpenFOAM	586	27 hours <small>DELL R820 rack server 96 cores / 1TB RAM</small>
IFPEN lab	569-886	3 to 4 hours
IFPEN algorithm	433	~1 hour
<b>Voxilon</b>	<b>552</b>	<b>38 seconds</b>

*Computations made on a Berea sandstone image provided by IFPEN (269\_Ftb\_GW3)  
Hardware setup: HP Z840 workstation 32 cores / 256 GB RAM*

# Key Benefits



## Fast

**Swiftly get representative data**

from your high resolution 3D  
images

with Voxilon's tailored algorithms

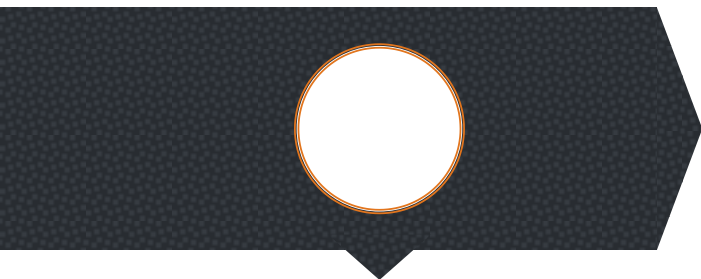
## State-of-the-art algorithms

15 years of research from our founding team in Geosciences Montpellier (CNRS / University of Montpellier).

## HPC expertise

Our R&D team includes experts in scientific code optimization.

# Key Benefits



## Fast

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from your high resolution 3D  
images

with Voxilon's tailored algorithms

## State-of-the-art algorithms

15 years of research from our founding team in Geosciences Montpellier (CNRS / University of Montpellier).

## HPC expertise

Our R&D team includes experts in scientific code optimization.

## Academic partnerships

Our key partners include IFPEN and DMEX (University of Pau / Carnot ISIFoR).

# Key Benefits



## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.

# Key Benefits

## Possible configurations



## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.



### Single Laptop

# Key Benefits

## Possible configurations



## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.



## Single Workstation

# Key Benefits

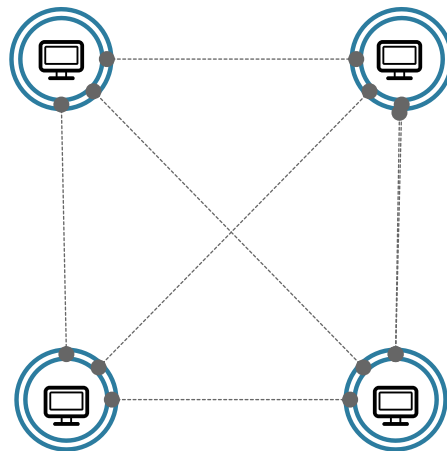


## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.

### Possible configurations



### Local Network

# Key Benefits

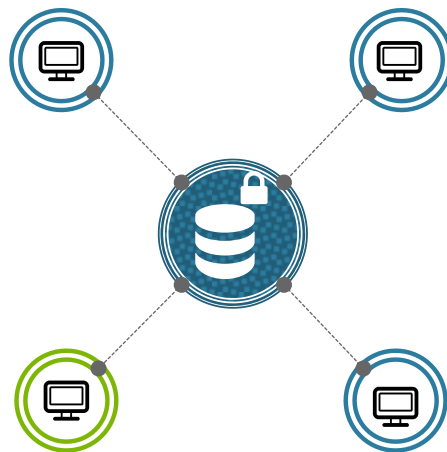


## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.

### Possible configurations



**Local Network  
with File Server**



# Key Benefits

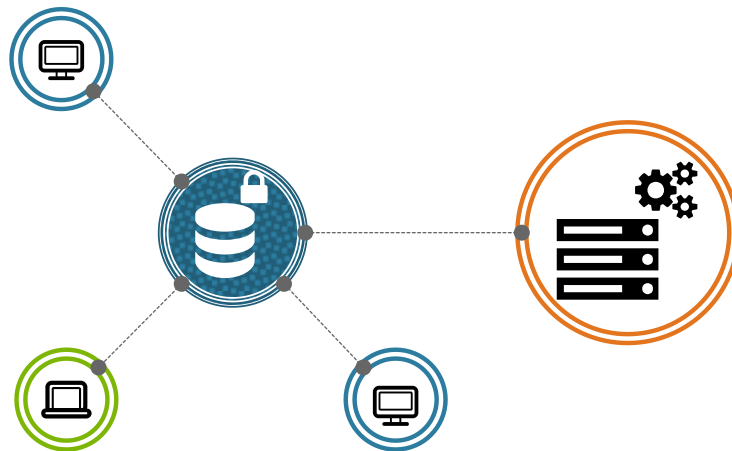


## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.

### Possible configurations



**Local Network  
with HPC Cluster**

# Key Benefits

Coming Soon



## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxilon's modular architecture.

### Job scheduler

Easily sort and prioritize your simulations.

# Key Benefits

Coming Soon



## Flexible

### Never get stuck again

Keep on working while your most demanding computations are running, thanks to Voxelon's modular architecture.

## Job scheduler

Easily sort and prioritize your simulations.

## Scripting

Add your own simulation codes to the platform.

# Key Benefits



## Organized

### Organize your projects

Instantly access your images and data  
from your own secured database,  
within Voxilon's easy-to-tame interface.

# Key Benefits

## Hierarchical organization

Samples, raw and processed images, results, metadata: everything in the same place.



## Organized

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### Secured access

Access several databases over your local network. Create collections to organize your projects.

# Key Benefits



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within Voxilon's easy-to-tame interface.

### Hierarchical organization

Samples, raw and processed images, results,  
metadata: everything in the same place.

### Secured access

Access several databases over your local network.  
Create collections to organize your projects.

### Process tracking

Voxilon keeps track of the sources, parameters,  
timestamps, etc. for every single process  
and verifies the integrity of all your files.

# Key Benefits

Coming Soon



## Organized

### Organize your projects

Instantly access your images and data  
from your own secured database,  
within Voxilon's easy-to-tame interface.

## Cross-data analysis

Analyze results from different samples  
in a given project.



# Key Benefits

Coming Soon



## Organized

### Organize your projects

Instantly access your images and data  
from your own secured database,  
within Voxilon's easy-to-tame interface.

## Cross-data analysis

Analyze results from different samples  
in a given project.

## Workflow automation

Deep learning allows to ease image processing  
and segmentation.

# Data-to-Results Workflow

## Georessources

Exploration & production	Petrophysical characterization of geomaterials
--------------------------	--

Sequestration & underground storage	Evaluation of storage and disposal capacities
-------------------------------------	---

Geothermal	Fracture monitoring Estimated production potential
------------	---

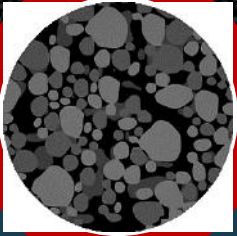
## Synthetic materials

Conception	Exploring 3D morphology Evaluation of their properties
------------	---

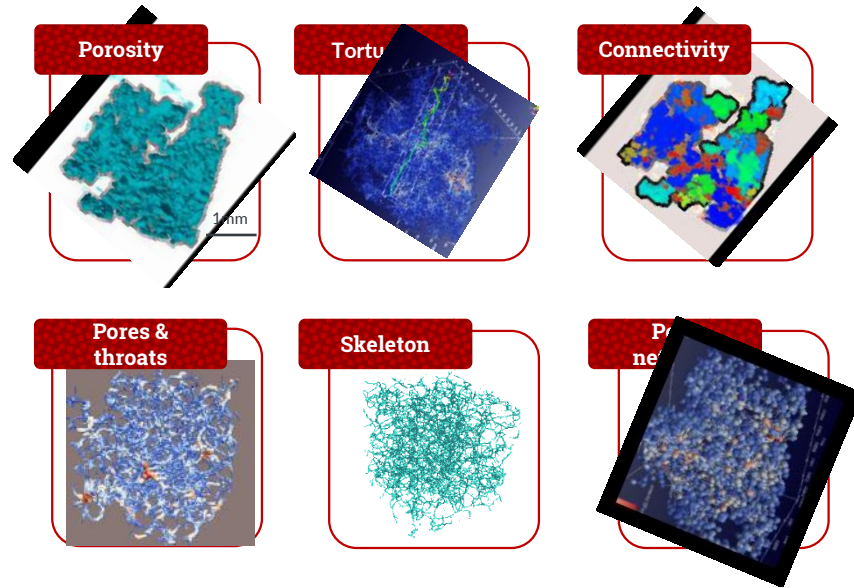
Development	Real 3D model construction for simulation
-------------	---

Control	Monitoring morphological evolution
---------	------------------------------------

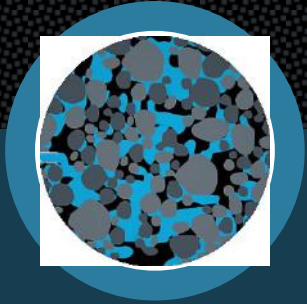
# Structural Properties



- Porosities
- Connectivity
- Geometrical statistics
- Element size distribution
- Geometrical tortuosity
- Formation factor

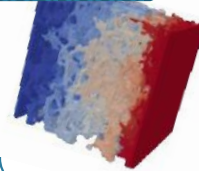


# Dynamical Properties

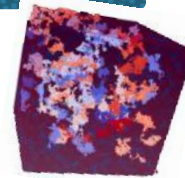


- Diffusive tortuosity
- Effective diffusion
- Capillary pressure
- Absolute permeability

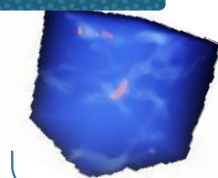
Pressure  
fields



Diffusion



Permeability



# About us

**257 k€**

AxLR SATT project

**340 k€**

Equity fundraising



**190 k€**

Subsidies

**100 k€**

Income

Voxaya is a spin-off from the Geosciences Montpellier laboratory, founded in 2014 and located in Montpellier (France).

# Current Team



**Olivier Rodriguez**  
CEO, PhD



**Vanessa Hébert**  
General Manager



**Philippe Gouze**  
Scientific Advisor, PhD



**Thierry Porcher**  
CTO



**Valentin Planes**  
R&D engineer



**Thomas Izard**  
R&D engineer, PhD



**Loren Marc--Fahmy**  
Marketing  
Communication



**Marie Leger**  
R&D engineer



*Oseo Startup Competition  
Montpellier (France), 2012*



*i-Lab Startup Competition Final  
Montpellier (France), 2015*



*France Tech Transfer Invest  
Paris (France), 2017*



*NETVA Competition Final  
Boston (MA, USA), Jul. 2017*

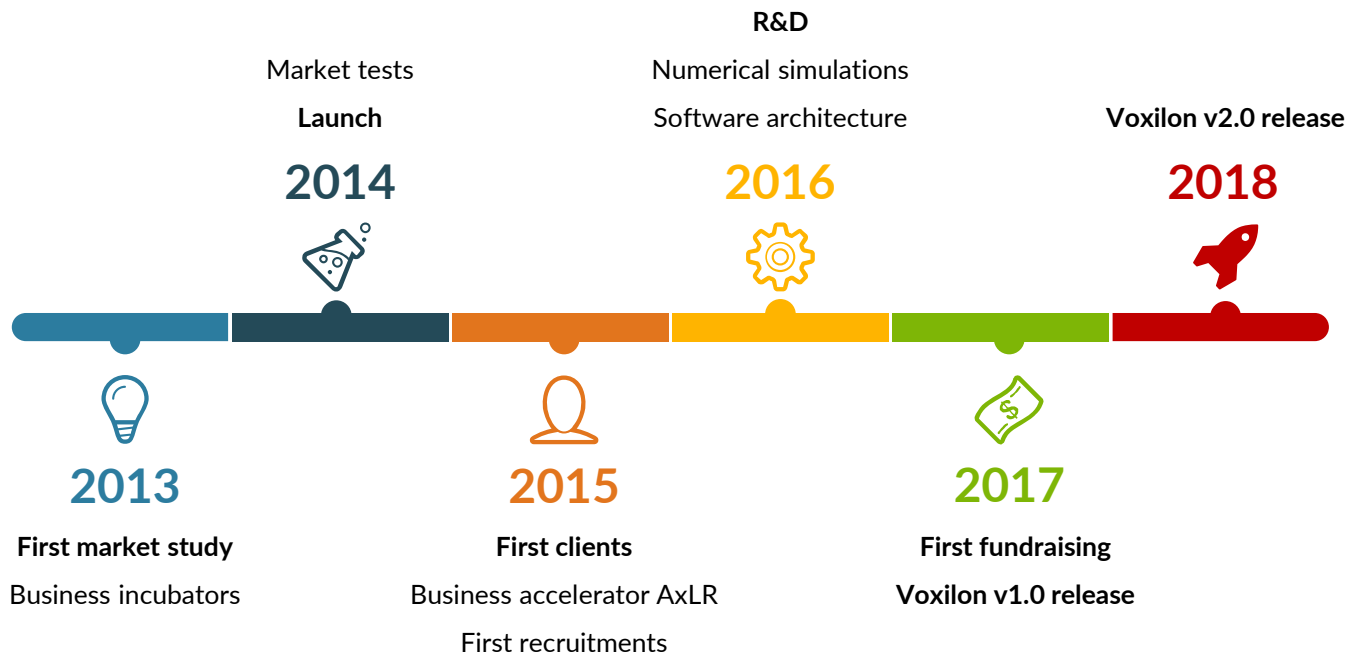


*SPE ATCE Startup Competition Final  
San Antonio (TX, USA), Oct. 2017*



*European Venture Contest Final  
Düsseldorf (Germany), Dec. 2017*

# Brief History



# Contact



[rodriguez@voxaya.com](mailto:rodriguez@voxaya.com)



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[www.voxaya.com](http://www.voxaya.com)



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Rond-point Benjamin Franklin  
34000 MONTPELLIER  
FRANCE





# Case studies

# Porous Materials Everywhere

## Rock samples

- Oil & Gas reservoir rocks samples
- CO2 storage

## Porous Ceramics

- Catalysts
- Chemical Engineering

## Membranes and Filters

- Waste water treatment

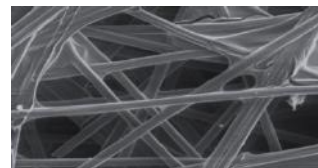
## Construction Materials

- Natural materials, concrete, bricks

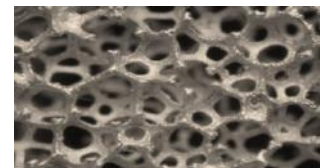
Paper



Fibrous Mat



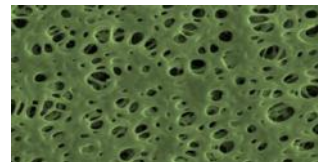
Metal Foam



Plants



Membrane



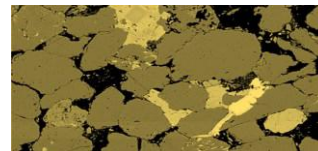
Granular



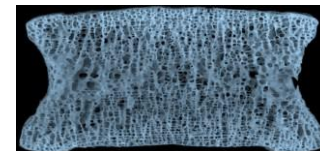
Snow Pack



Sandstone



Bone



Source: MEAL - McGill

# Aircraft Engine Parts



## Customer's need

Analysis and assessment of aircraft engine CMC internal parts



Examples of aircraft engine incorporating CMC components and CMC parts.  
Image credit: GE Aviation

## Voxaya's analysis



150 GB output data



36 000 regions of interest analyzed



> 1 000 generated CSV files



240 hours computation time

## Customer's benefits



Batch analysis of many samples



Visualization & quantification of exclusive properties



Assist in the parameterization of the experiments under constraints

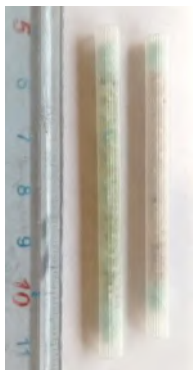


# Grain Column Analysis

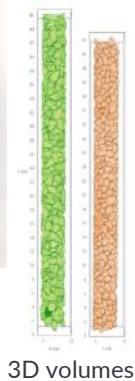


## Customer's need

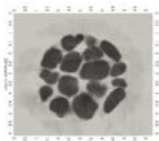
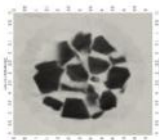
Statistical analysis on each grain, and the void between the grains.



Sample columns



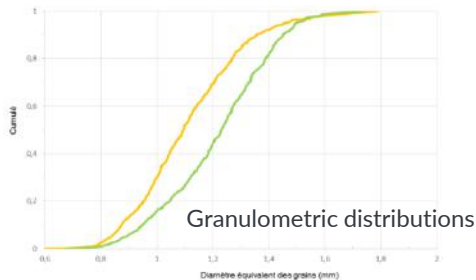
3D volumes



2D slices

## Voxaya's analysis

Characteristics	Product A	Product B
Number of grains	444	608
Intergranular porosity	52%	46%
Mean grain volume	0.8 mm <sup>3</sup>	0.6 mm <sup>3</sup>
Reactivity surface	2324 mm <sup>2</sup>	2284 mm <sup>2</sup>
Mean grain sphericity	2.2	1.4



## Customer's benefits



Comparative analysis of the filtration potential between two products



Validation of experimental measurements

Providing additional statistics

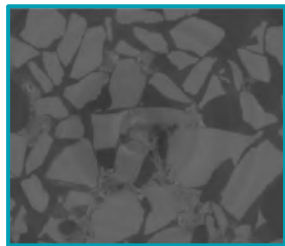


Visuals

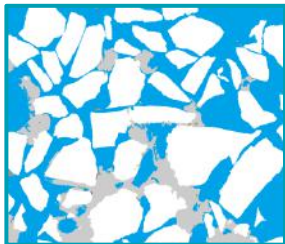
# Mine Dump Monitoring

## Customer's need

Examination of the structural evolution of matrix and porous phases

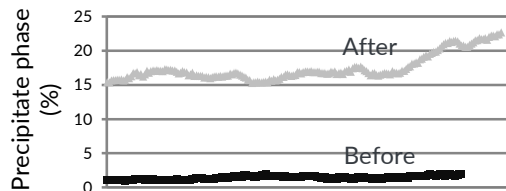


2D slice



Phase segmentation

## Voxaya's analysis



Volume profile through the sample

	Avant	Après
Matricial phase		
Precipitate phase	3%	18%
Porous phase	38%	31%

## Customer's benefits



Accelerate the interpretation of chemical analyzes



Localisation & quantification des modifications structurales



Company image and notoriety as an innovative method user

# Underground Storage Impact



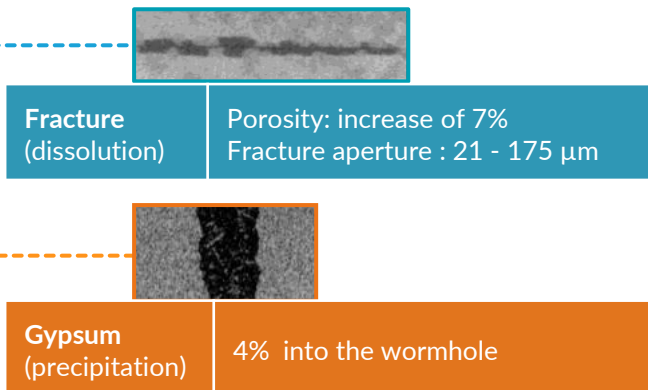
## Customer's need

Monitoring structural changes  
after acid fluid injection



Resulted 3D Image from  
before/after images  
comparison

## Voxaya's analysis



## Customer's benefits



Analysis of several phases  
simultaneously



Location of structural changes



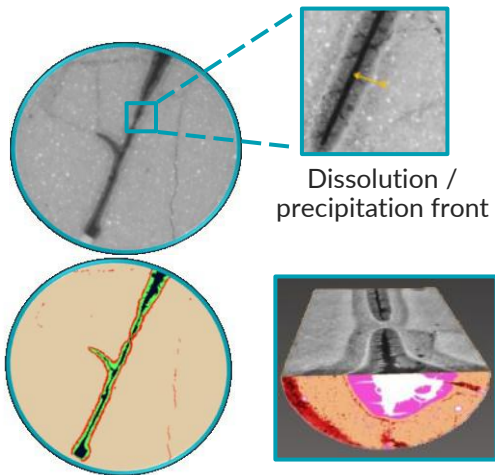
Discovery of an unidentified  
phase by laboratory analyzes

# Well Engineering



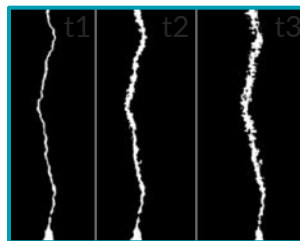
## Customer's need

Analysis of a fractured cement altered by fluids

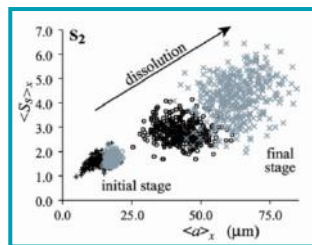


## Voxaya's analysis

Monitoring by imaging



Fracture aperture



Specific surface vs fracture aperture

## Customer's benefits



Visualization & analysis of several phases simultaneously



Visualization & quantification of exclusive properties



Assist in the parameterization of the experiments under constraints