# FIELD TRIP REPORT
# SEG-SGA Student Chapter UniLaSalle France


Year 2019-2020

Institut Polytechnique UniLaSalle
Campus de Beauvais
19 rue Pierre Waguet
BP 30 313 60 026
BEAUVAIS Cedex, FRANCE

# Introduction

The student chapter association of UniLaSalle organized this year a field trip in France, from the 9th to the 11th of October. The main objective is to discover the mining history of Alsace. It includes historic silver mines of Sainte-Marie-aux-mines and former potash mines near Mulhouse.

This field trip has been planned since few months, but our team was waiting for the right time to organize it. Due to COVID 19 and our class schedule, the weekend from the 9th to the 11th of October appeared to be the best solution. Fortunately, despite the COVID, all the planned activities were able to take place in good conditions.

As the road to Alsace is long, we have planned a stop on Friday to visit the CIGEO project site which was on the way. It is an underground laboratory made to study the possibility of storing radioactive waste in depth. The second day was dedicated to the visit of two old mines at Saint-Marie-aux-mines. The first one was organized with the Tellure mining center and the afternoon the Gabe Gottes mine with the ASEPAM association. Then we were able to see the quarry of Saint-Pierre-Bois (host in granitic formation). The last day of the field trip was centered around the Potash industry with the visit of the "Carreau Rodolphe" and the Kalivie museum with two former miners.

The group was composed 9 students but two of them took part in only one day (indicated by *) . The detailed list is available below

| Name | **SEG Member (Y/N)** | **Formation** | **University** |
|---|---|---|---|
| Alexandre LE BOULCH | YES | MSc Earth Sciences - Mines and Quarries | UniLaSalle |
| Léon FOUCAULT | YES | MSc Earth Sciences - Mines and Quarries | UniLaSalle |
| Amélie PINSON | NO | MSc Earth Sciences - Mines and Quarries | UniLaSalle |
| Pierre LAINE | YES | MSc Earth Sciences - Mines and Quarries | UniLaSalle |
| Valentin CALANI | YES | MSc Earth Sciences - Mines and Quarries | UniLaSalle |
| Paul BAREIX | NO | MSc Earth Sciences - Hydrogeology | UniLaSalle |
| Guihlem GABRIEL | NO | MSc Earth Sciences - Geotechnic | UniLaSalle |
| Jérémy CHAPELLE* | NO | Technician in Geology | UniLaSalle |
| Arthur CHATELIN* | NO | Bachelor degree in Earth Sciences | UniLaSalle |

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# Table des matières

# Visits

## The CIGEO project

For the first day of their trip, the eight students of the student chapter has had the opportunity to visit the Industrial Center for Geological disposal named CIGEO. Located in Meuse in the east of France, this project consists in experimenting several methods to optimize highly radioactive long-lived waste storage in deep geological layers.
The first step of our visit was a short presentation of the site and its issues. It has permitted to unravel some facts about radioactivity, understand the place and the range of this project in the nuclear storage and explain the value of the site of Bure. Nowadays, only the laboratory is built there (already at 490 m depth) but in the final stage the storage complex will stand near the same area at 500m depth with kilometres of underground galleries.
Obviously, the location hasn't been randomly chosen but decided according to the particular properties of the geological layers of the area. Indeed, the geological context consist in a ~130 m thick layer of homogeneous mudstones little tectonized over their geological history. The very low hydraulic conductivity and the no fracturing of the layer creates a natural security against pollutant migrations in addition to anthropic ones. These characteristics are primary because the future site will welcome highly radioactive long-lived nuclear waste produced by our daily electric consumption for hundreds of thousands of years. A part of these waste already exists and are currently stored in surface explaining the necessity of highly secure storages. Moreover, the project is sized to contain the waste already present and those planned by future nuclear power plants.
The second step was the visit of the underground site, this labyrinth is an experimental site which allow engineers to observe and experiment three different points:

- Several digging methods with different machines (tunnel boring machine, hydraulic rock-breaker …) to better build the future nuclear storage and limit rock physical alteration. It includes support methods which are essential in deep projects as this one.
- Storage of waste in this deep environment which include many instrumentations to assess geological parameters and facilities reactions (arch and voussoir) especially to resist to convergence (deformation of galleries due to lithostatic pressure and alpine stress).
- Ways of withdrawal which mean that each cell containing nuclear wastes must be removable at any time.

As mentioned before, the current site is experimental and will never welcome any nuclear waste. All these experiments aim to build the real storage site as better as possible.
The facility initial shape is quite simple, the main tunnel is used to circulate and move whereas secondaries perpendicularly ones which are used as storage spaces. Nuclear wastes will be store in cylindric cells places in the reduced diameter tunnels.
The third and last step of our tour was the discover of the surface technologic showroom of the project. Indeed, many test and engine has been realised to experiment adding and removing of nuclear wastes and all accident and hazard which could possibly happened. This centre gathered all these results explaining goals, innovating methods especially create for this project.
For example, the resistance of the concrete storage cell falling down or innovated methods to recycle a part of these waste. Another example was the potential storage system including pushing robots, storage cells and transport machines which has been created to experiment and demonstrate the workability of this method.

*Figure 1 : One of the gallery of the CIGEO project (500m deep)*

*Figure 2 : The group in the gallery*

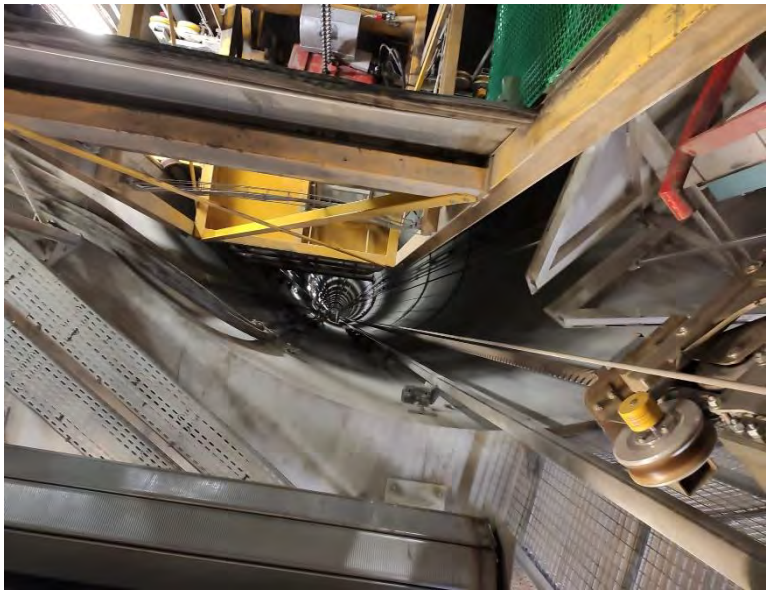

*Figure 3 : The laboratory lift*

## Tellure's Mine

The second day of the field trip, the 10th of October was dedicated to Sainte-Marie-aux-Mines's silver mines located in the Eastern part of the Vosges mountains.

The first mines at Sainte-Marie-aux-Mines appeared in the 10th century but most of the activities took place in the 16th century. More than a thousand mining works have been identified along the 7 main veins hosted in gneissic rocks. The activity of these mines has strongly decreased with the discovery of new deposits in Mexico and Peru at the beginning of the 17th century. Some of the old galleries were re-explored in the 18th century and then definitively abandoned.

The Tellure mining center organize visits in some of these galleries. The main objective of this activity was to explore an old mine and its associated mineralization in situ. The guide explains to us the methodology of miners of the 16th century, which use fault perpendicular to the mineralization to progress more easily in the gneiss utile they reach a mineralized vein. Galleries from the 16th century can be differentiated because they were dug using picks, compared to 18th century galleries which used explosives.
Even though no ladder from the 16th century was yet in place, we were able to take the same path as the former miners through the shafts they had dug using modern caving equipment.

*Figure 4 : A sporty descent towards the mineralisation*

Known for his silver, the copper was also one of the commodities represented inside the mines by minerals like Azurite, Malachite or Chrysocolla. We were able to observe metric mineralized veins with barite and calcite too.
The lower part of the mine is also known to have a massif Fluorite vein which is crossed from one side to another by a gallery. One of the most impressive moments of this activity for sure!

Our group spend more than 3 hours underground. It was really interesting to see mineralization and structures from inside that we use to see on outcrop or in drill core

*Figure 5 : Part of a Barite vein with Chrisocolla and Quartz*

*Figure 6 : The tricky mine entrance*

*Figure 7 : Chrisocolla and malachite (no sample were taken as it is a protected area)*

## Gabe Gottes Mine – ASEPAM

*Figure 8 - The SEG-SGA French Student Chapter of UniLaSalle in front of the Gabe Gottes Mine entry*

On Saturday 10th at the beginning of the afternoon, our journey continued in the "Val d'Argent" (Silver valley) almost 2 kilometers further East, still in the domain of Saint-Marie-aux-Mines. The ASEPAM (Speological Association for the Study and Protection of Ancient Mines) – which exists for over 30 years now – did a reminder about the geological context of the Alsace and more precisely of the Val d'Argent. The history of the Gabe Gottes Mine had also been introduced: firstly exploited in the XVIth century, the mine opened and closed from time to time from the XVIIIth century to the early of the XXth century; the mine closed definitely in 1940 and was the last mine in activity of Saint-Marie-aux-Mines. Then, we entered the underground mine in a gallery long of 140 meters at the first level. The mine was exploited mainly for its silver minerals (like the argentiferous galena) by hand and then with black power and dynamite. In the middle of the XXth century, the silver was no longer exploited to the profit of the native arsenic. Other arsenic minerals can be observed like the grey coppers. Some traces of sulphides exist as well as traces of cobalt with the presence of a pink mineral named erythrite. A beautiful vein in one of the secondary galleries can be observed as shown below: this is the Giftgrube vein. After its formation, this vein has undergone a tectonic breakout that can be easily measure and that is about 2 to 3 meters. We arrived at the beginning of another gallery from another mine and that concluded our visit.

*Figure 9 - Giftgrube vein of Gabe Bottes Mine*

*Figure 10 : Vein with Erythrite and Barite*

*Figure 11 : Chalcopyrite in the mine*

*Figure 12 : The "Grey Copper", commonly known as Tetrahedrite*

## Saint-Pierre-Bois Granite quarry (Sablières J. LEONHART)

On Saturday afternoon, second part, we visited the little quarry of Saint-Pierre-Bois owned by Sablières J. LEONHART. With a new permanent crushing and screening installation, built in 2019, the quarry is able to produce 100 000 tons of aggregate per year. These products are mainly dedicated to road and railway embankment, concrete and also little size to big size boulders for rockfill.

*Figure 13: Our group at the entrance of the quarry.*

**A unique geology**

The quarry is exploiting a Carboniferous two micas granite from the Dambach-Scherwiller massif delimited, eastward, by the fault of Vosges and, westward by the Permo-trias Villé basin. The quarry is close to the western edge of the granite were the first sediments, from the erosion of this granite, of the Villé basin were deposited in little channels on the hercynian unconformity. This old face (figure 2) is the best outcrop in the Vosges massif showing the hercynian unconformity.


*Figure 14: An old face of the quarry showing the granite underlaying the Permian sediments and separeted by the hercynian unconformity.*

**A little quarry but strategic**

In Alsace region, the main geological unit is the west European aborted rift where the Rhine flows and spread its sediments in this huge plain. Indeed, there are plenty of quarries exploiting alluvial deposits in lakes. These alluvial sediments are rounded, smooth and relatively small. In comparison, there are only three massive rock quarries in Alsace, located in the eastern part of the Vosges massif from south to north. Aggregates from massive rock quarries are sharp, angulous and can be bigger than alluvial aggregates. Thus, it is strategic for Sablières J. LEONHART to optimize their deposit with bigger aggregates which are quite rare in this region, with a better price it's profitable. An investment for a new permanent crushing and screening installation was obvious to increase the production and improve the

quality. The process is simple, one gyratory crusher followed by a three levels screener with associated conveyors (figure 3). The common size products are 0-6 mm, 6-10 mm, 10-14 mm.

*Figure 15: The new permanent crushing and screening installation. Sablières J. LEONHART.*

## The visit of Carreau Rodolphe

With our fieldtrip team, we made a step at the ancient potash mine called Carreau Rodolphe, located at Pulversheim, and now closed since 1976. In 1904, Joseh Vogt discover a potash deposit in the Mulhouse basin, then the Kali St Thérèse firm was created in 1910. The first shaft (Rodolphe I) was dug in 1911 and reach the deep of the potash at 694m, and the second shaft (Rodolphe II) was finished in 1928 to reach a deep of 744m. Next to these shafts, some infrastructures was built for the treatment of the potash as the mixing building, the dryer and so one. 1600 miners worked on the mine site in 1950, 900 at the surface and 700 under the ground with a lot of heavy machines to dig and to transport the potash. With the guide with we were lucky to visit the building of the shaft Rodolph I, then we saw the changing room were “the citizen become a miner”. Some clothes were hung in the air, some tolls were presented as perforators used in 1950, and also the flashlight with their batteries.

After that, we visited the room where alternators convert the alternative electric current into continuous current, and a big wheel around on which an iron wire was wrapped allowing the cabins to be raised and lowered under the ground. Then we visited a shed were some machines (which have been used under the ground) are exposed, like the big blower, and other machines for the dig as the tracing machine and for the transport. At the end we visit a reconstitution of the equipment used for digging the postash layer, and on one side some ceiling and wall supports, with adjustable pistons were presented as if we were at 600m deep.

The visit was a wonderful jump in the past, with some accessories and equipment keeping from this old time. The guide also made the big wheel work, and it was very impressive so see that it still works! Some of the machine were restored, but some infrastructures are not restored, and we hope that the site will attract some visitors to continue the restoration.

*Figure 16 : Headframe of Rodolphe 1*

*Figure 17 : The "Mineur continu Type JEFFREY 120 HR"*

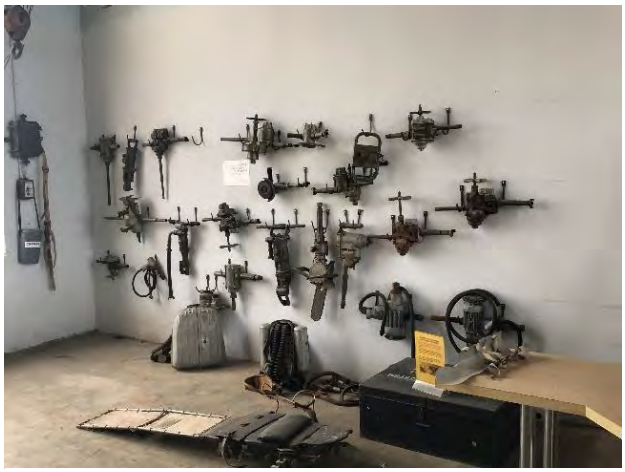

*Figure 18 : Different types of Jackhammer*

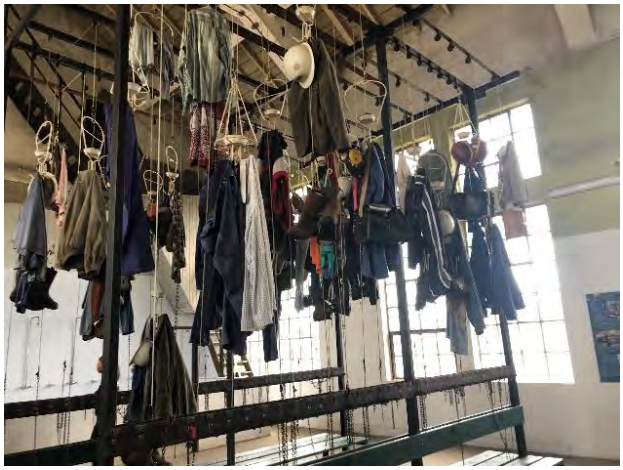

*Figure 19 :* "room of the hanged" in *the Carreau Rodolphe*

*Figure 20 : Haveuse (Mining cutter) in surface*

*Figure 21 : The "Mineur continu Type PAUDRA E295*

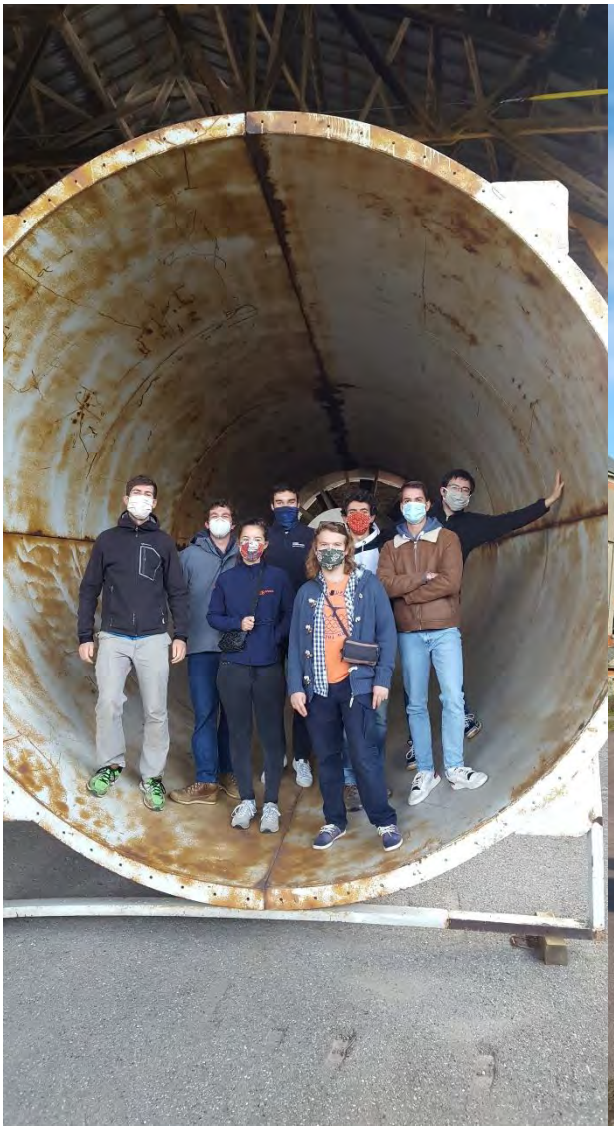

*Figure 22 : The team inside an old ventilation unit*

*Figure 23 : The team in front of the Headframe of Rodolphe 2*

## Kalivie Museum

On the 10th of October afternoon, we visited one of the old Alsace's potassic mine settlements in Arenberg, more precisely at the Joseph-Else mine. This mine has been in activity between 1904 and 2002.

The Joseph-Else mine is one of the last mine which remains currently in place with all its buildings and one of its two wells. Kalivie association now handles this mine and organises excursion and visit of the site. The different buildings have been restored: some have been sold to companies and other rehabilitate into their old function as for example lockers. A geological museum is now located in the main buildings and enlighten the geological story of the Alsace's potassium salt. One of the well is now the property of STOCKAMINE, a waste storage company.

An old miner made the visit for us. It started with a quick presentation of the history of the site and a quick outside tour of the buildings. Then, the new director of the geological museum made a presentation of the geological story of the potassium salt deposit in the region. We resume with the viewing of the MDPA (Mines de Potasse d'Alsace) presentation video relating the exploitation process of potassium salt: well operation, operation machine, workers habits, etc.

We ended our afternoon in Joseph-Else mine by the visit of the "salle des pendus" which is the room where miner came to change themselves before going down into the mine. This room has kept all its old furniture and ambiance. The old miner ended the visit by telling us his own story about his life as a miner in this mine; it was full of little stories and emotion

*Figure 25: Geological museum of Kalivie*

*Figure 26: "Salle des pendus", the locker*

*Figure 24: Students group with the old miner "Pauli"*

## Fundraising program

To lower the price of the field trip, a fundraising program has been realized before the field trip.
We received 750$ from the Stewart R. Wallace Fund (611€).
Eramet, provide us 500€, and we also receive 300€ from our school UniLaSalle.

The funds we received from SEG and Eramet were used to cover accommodation costs, transportation and the activities.

| Items to consider | Description | Price/Person (€) | Quantity | Price in euros € | Price in dollars $ |
|---|---|---|---|---|---|
| | | | | | |
| Participants | Members | | 7 | - | - |
| Accomodation | Hostel "Ibis Budget" at Sélestat, 2 nights | | | 372 € | $ 401,49 |
| Transport | Car of student chapter member | 130 | 2 | 260 € | $ 280,80 |
| Visit of mining sites | Silver gold mine of Tellure (Sainte-Marie aux Mines), underground personalized guided visit (45€/person) | 42 € | 7 | 294 € | $ 317,52 |
| | Quarry of Saint-Pierre-Bois | 0 | 7 | 0 € | $ - |
| | Visit of "Carreau Rodolphe", old Potash mine near Mulhouse. | 7 € | 8 | 56 € | $ 60,48 |
| | Visit of the museum of the Mine and Potash at Mulhouse | 6 € | 7 | 42 € | $ 45,36 |
| | Silver mine (Saint Barthélémy) or Silver Mine of Gabe-Gotte, Underground visite by ASEPAM association with mineralogical and geological activities. | 8 € | 7 | 56 € | $ 60,48 |
| Food | 30€/ per person per day (3 days) | 90 € | 7 | 630 € | $ 680,40 |
| | | | | | $ - |
| **Total** | | | | 1 710 € | $ 1 846,53 |
| Personal participation without Fundings | | | | 244 € | $ 263,79 |
| UniLaSalle fund | | | | 300 € | $ 324,00 |
| Eramet fund | | | | 500 € | $ 540,00 |
| Grant from the SEG | | | | 611,00 € | $ 750,00 |
| Total with Fundings | | | | 298,75 € | $ 322,65 |
| Personal participation | | | | 42,68 € | $ 46,09 |

# Acknowledgement

We would like to thank all the persons who made this trip possible.

First, we would like to thank each organization or association hat made this field trip possible despite the situation. We discovered much more than what we expected thanks to them.

Then we would like to thank strongly **Eramet** for their financial support. This is the second consecutive year that they are funding us, and we thank them for their trust.

Thanks to the **SEG** for giving the opportunity to students to realize such activities.

Thanks to **UniLaSalle** and our teachers that encourages us in our projects.

And finally, all the members of our student chapter who helped with organization.