Black Pool

The Berlage Thesis Project Proposal

Black Pool

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[Agnieszka Dabek]

Salomon Frausto
Head of Education

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Statement

The Black Pool is a communal swimming pool constructed out of by-product of coal mining industry-slag heap. It is an exemplary pool of a communal swimming pools network dedicated to a cross-national mining region spanning from northern France to Belgium (Nord-Pas de Calais Mining Basin FR, Borinage BE, Charleroi BE) (Northwest European Coal Seam).

Current Discourse

The first 'floating' swimming school was funded in 1786 by a swimming instructor called Barthélemy Turquin on bathing barge on the Seine river, near the Pont de la Tournelle in the 5th district of Paris.

Around a central rectangle, left open for the water of the river, four wooden pontoons were interconnected and covered with decks.

By the mid-nineteenth century, bathing and swimming barges had become a familiar sight along the Seine river. Amongs barbershops, first aid posts with beds, changing rooms and cafés, they were accomodating instruction rooms where swimming was taught even dry.

With the development of water pumping systems the activity of swimming was separated from that of hygiene. Swimming lessons were conducted in a few watertight basins suplied with filtered water pumped from rivers.

The expansion of swimming infrastructure in France took place in mid-twentieth century. After the failure of the French swimming team during the 1968 Summer Olympics, the French Ministry of Sport enhanced the popularisation of swimming across the country by construction of 183 prefabricated communal swimming pools of Tournesol type.

The process of underground coal extraction was traditionally based on cutting a network of rooms into the coal seams, which roofs were supported by left standing timber structures. This process of ground penetration developed a system of ventilation shafts and a network of underground drainage tunnels, preventing mines from flooding by subterranean water flows. Sometimes the tunnels were used for coal transportation by boats.

The above-ground coal mining infrastructure consisted of machines lifting the coal from underground, and a sequence of plants preparing coal for further distribution: sorting, washing off soil and rocks, drying, distilling coal tar, cooling and producing briquette.

The entrances to mines' shafts were equipped with changing rooms and bathrooms for colliers, where they washed the black dust off their bodies after work.

Project Definition

In Middle Ages there was a common belief that water channelled from the sea bottom was storaged in reservoirs located beneath mountains from which it sprang forth, giving rise to springs and rivers.

A Black Pool is a communal swimming pool constructed out of by-product of coal mining industry, a slag heap named Terrils de Loos-En-Gohelle, by processes like drilling, carving, cutting, digging, and crumbling of its structure.The pool is supplied with minewater obtained from flooded mine galleries.

The Nord-Pas de Calais Mining Basin, which mines had stopped operating in the second half od 20th century, is a part of a cross-national mining region spanning from France to Belgium. Its topography consists of approximately 200 slag heaps (terrils), fabricated mountains not fixed to the ground, which accreted together with mining industrial facilities, transport infrastructure and towns where the miners lived and worked. The existing chain of slag heaps forms a base for a communal swimming pools network dedicated to a cross-national mining region. The network makes up the contemporary swimming infrastructure in North region of France where half of the Tournesol swimming pools remain obsolete due to high refurbish costs and inadequate size to serve the region.

Methodology

As the project explores the potential of slag to be reused as a construction material for the swimming pool, physical models made out of material of similar prosperities to slag will serve as main design tool. This will help to develop and test construction methods and technologies (drilling, carving, cutting, digging, crumbling, etc.) and material performance. In the next phase the physical models will be 3D scanned and developed digitally at three scales: into swimming pool type, swimming pool mold and swimming pool elements presented in a form of plan and section drawings.

Typical machines and methods of excavating coal as well as studies of natural swimming pools types, volcanoes and pyramids (building types based on the concept of subtraction from the mass) will initiate the design phase.

Alongside with the design of exemplary community swimming pool an enigmatic set of swimming pools types adopted to slag heaps types present in the mining region crossing France and Belgium (Nord-Pas de Calais Mining Basin, Borinage, Charleroi) will be designed and presented in a form of matrix drawing. This drawing aims to explain the idea of network of communal swimming pools dedicated to the cross-national mining region.

Set of final deliverables:

-Atlas of Slag Heaps,
-Geological section of Slag Heap,
-Plans and sections in various scales: from swimming pool mold to entire slag heap,
-Emblematic set of swimming pool types dedicated to cross-national mining region.

Les terrils du Nord - Pas de Calais

Référencement du terril

APPL - N° du terril	T074a
DENO - Nom usuel du site	11/19 de Lens Ouest
COM 1 - Commune 1	LOOS-EN-GOHELLE
COM 2 - Commune 2	
COM 3 - Commune 3	
Intercommunalité 1	CALL
Intercommunalité 2	
Département	Pas-de-Calais

Typologie de terril

DATE - Date d'édification	1894
JDAT - Justification date	Activité du puits n°11
Concession minière	Lens
AUTR - Compagnie	Lens
AUTR - Groupe (1946)	Lens-Liévin
Unité de Production (1970)	U.P. Lens
Secteur (1978)	Secteur Ouest
Siège (1980)	Siège 19 de Lens
Origine des produits	Lavoir
Propriétaire (ou futur)	EPF-TSA
Gestionnaire	Commune
Type de gestion	Différenciée et ornementale

Caractéristiques particulières du terril

☑ Terril - monumental ☑ Terril - nature ☑ Terril - signal

☑ Terril - mémoire ☑ Terril - loisirs

Forme du terril originel: Grand terril moderne

Etat du terril

☑ Intact ☐ Disparu ☐ Conflit sur le devenir

☐ Exploité Echéance:

☑ Requalifié

Type de requalification

☑ Terrassement ☐ Dépollution

☑ Pré-verdissement ☑ Intervention douce

Maître d'ouvrage requalification: EPF

Maître d'oeuvre requalification: Paysagiste

Agence: Paysages

☐ Aménagé

Type d'aménagement

☐ Parc de loisirs ☐ Espace nature ☐ Zone d'activités

autre

Etat d'avancement

Maître d'ouvrage aménagement

Maître d'oeuvre aménagement

Caractéristiques physiques

		Classes
Surface (ha)		
Volume10 ³(m3		
Hauteur (m)	186	
Type de schistes		Noir
Granulométire		Fine à Grossière

Combustion isolée ☐ Oui ☑ Non

Pollution isolée ☐ Oui ☑ Non

Site / Situation / Accessibilité

Situation géographique	Semi-urbain (urbanisation minière)
Caractéristiques du site	Connexion trame verte
Accessibilité physique	Chemin

Usages

☑ Sportif ☑ Nature ☑ Chasse ☑ Evénementiel

☑ Loisirs de proximité ☑ Support éducatif et pédagogique

Dégradations

☑ Vandalisme ☐ Occupation sauvage

Statut écologique

☐ ZNIEFF I ☐ ZNIEFF II ☐ ZICO ☐ ZPS

☐ Natura 2000 ☐ Arrêté de protection de Biotope

Autre procédure de protection

Urbanisme

☑ Inscription POS / PLU: ND

Qualification écologique du terril

Valeur écologique des terrils de l'EPF (129 sites diagnostiqués)

1	2	3	4	5
☐	☐	☐	☑	☐

Typologies passées

Inventaire des terrils de 1969 ☑

Catégorisation de 1977: Catégorie 2 : exploitation certaine

Charte des terrils de 1992: Pérennisation

Qualification paysagère des terrils EPF de 1999: Terril intact, requalifié

Observations

La surface et le volume totale comprennent les Terrils 74 74a 74b. Ecopôle Base 11/19, site de la mémoire.

Document 1

Document 2

Document 3

Document 4

GENERAL INFORMATION ABOUT SLAG HEAPS IN NORD-PAS DE CALAIS MINING BASIN:

Type of shale

The nature of the shale substrate can be of several categories:
· Black.
· Red and black.
· Ash mixed: shale including carbonaceous particles residual.
· Slag: ash from coal-fired power stations.
· Red, black and charcoal.
· Black and ash.
· Red, black and ash.

Granulometry

The granulometry of shales can be of several categories:
· Coarse.
· Fine to coarse.
· Fine.
· Very fine to fine.
· Powdered.
· Powdery to coarse.
· Pulverulent to fine.
· Silt.

Insulated Combustion
Generally speaking, the slag heaps built before 1920 were little subject to elaborate wash. The anthrax particles present in the shale up to 30% of the total mass could enter into internal combustion.

Isolated Pollution
Overall, the heaps contain only minerals, other materials could have been stored (canvas of pits, Wood, metals, oils, plastics, etc.). Heavier pollutants in particular near the coking plants may have been stored more massively (phenols, tars, benzols, etc.).

Type of heap (construction method and period):

The heaps were developed in different ways, depending on the the nature of soils and technical means. This results in three main families of morphologies presented:
1.Flat Heaps:18th and 19th century.
2.Conical Heaps:19th and 20th century.
3.The great modern heaps: second half of the 20th century
+cavaliers, truncated heaps, sedimentation tanks, shales platforms, special ones.

TERRILS DE LOOS-EN-GOHELLE

A twin slag heap named Terril de Loos-En-Gohelle located in Loos-en-Gohelle in France. (Nord-Pas de Calais Mining Basin), (Northwest European Coal Seam).

Location: 50 ° 26 ‘46.55 “N, 2 ° 46’ 40.27” E

The nature of the shale substrate:
· Black.

The granulometry of shales:
· Fine to coarse.

Insulated Combustion: NO

Isolated Pollution: NO

Type of heap (construction method and period):
· the great modern heap.

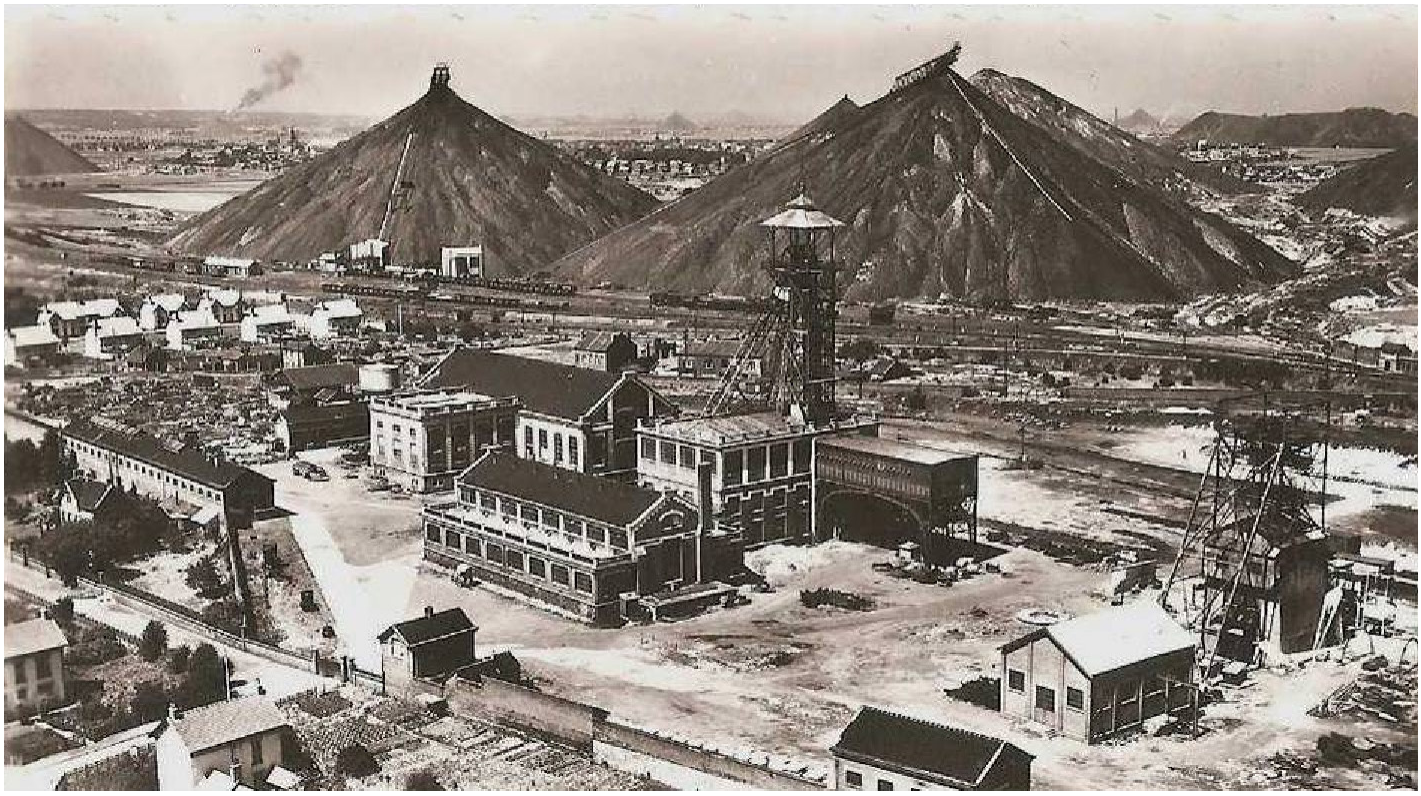
The great moder heaps are usually accompanied by coal slurry {mixture of solids (mined coal) and liquids (usually water) produced by a coal preparation plant. As a slurry, coal is separated from non-combustable components (ash) and can be fractionated by particle size as well. Coal slurry can be transferred by pipeline[1] or with specialised pumps such as a progressive cavity pump to pump the highly abrasive, corrosive and viscous coal slurry. Ideally, coal slurry consists only of crushed coal and water, which can be separated perfectly at low cost. In practice, the separation is significantly costly. Furthermore, the slurry consists also of very fine coal dust that results in a waste called black-water, which is stored in large impoundment ponds, often together with coal ash.} and settling tanks linked with washing plants.

At the foot of the twin spoil heaps, the shale platform of spoil heap no.74b used to accommodate a tailings pond linked to the washer for colliery no.11-19. Remaining intact, it has retained its original morphology.

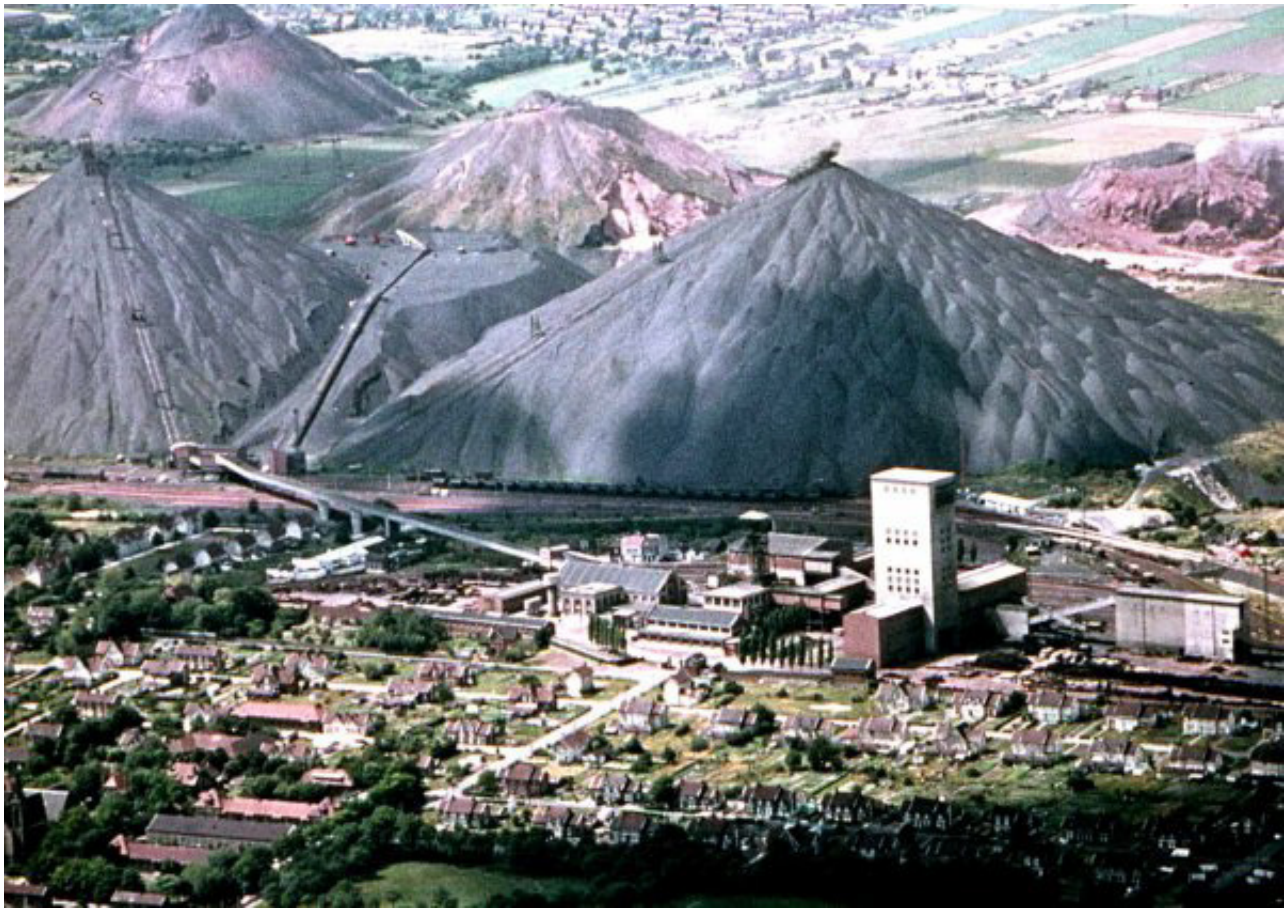
Glossaire de la base de données « Access » des terrils du Nord et du Pasde-Calais
http://www.bassinminier-patrimoinemondial.org/ressources/

http://www.chainedesterrils.eu/carte.html

https://fr.wikipedia.org/wiki/Liste_des_terrils_du_bassin_minier_du_Nord-Pas-de-Calais



Fosse (pit) n °11/19 of the mines of
Lens, Loos-en-Gohelle, 1930-1938

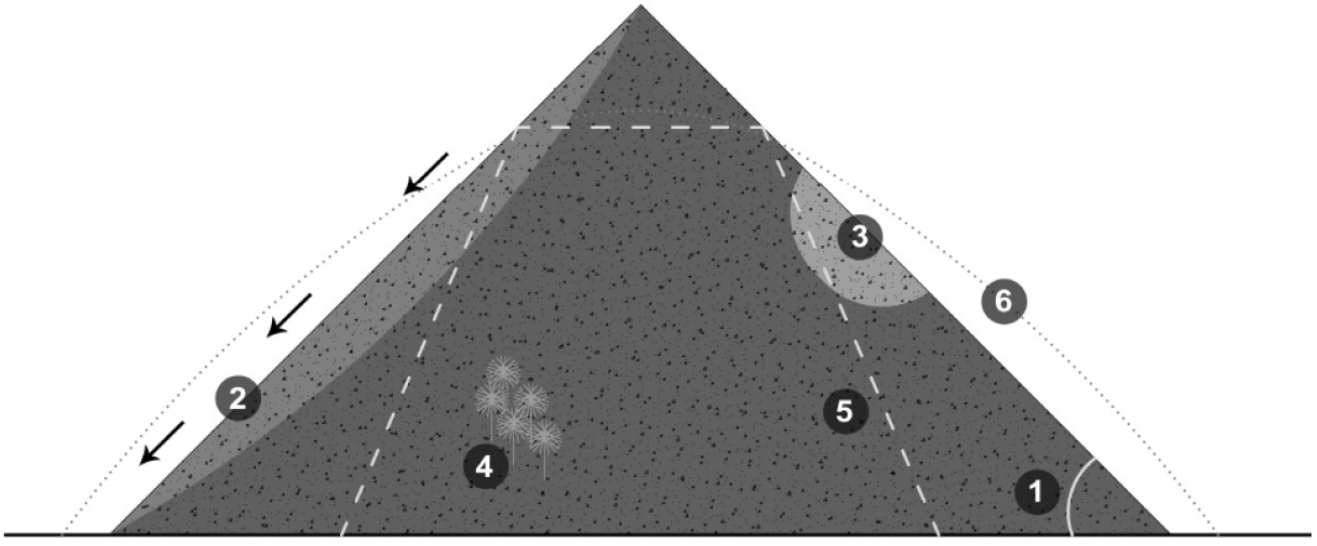


Fosse (pit) n °11/19 of the mines of
Lens, Loos-en-Gohelle, 1980

Section of coal mine, second half of 20th century.

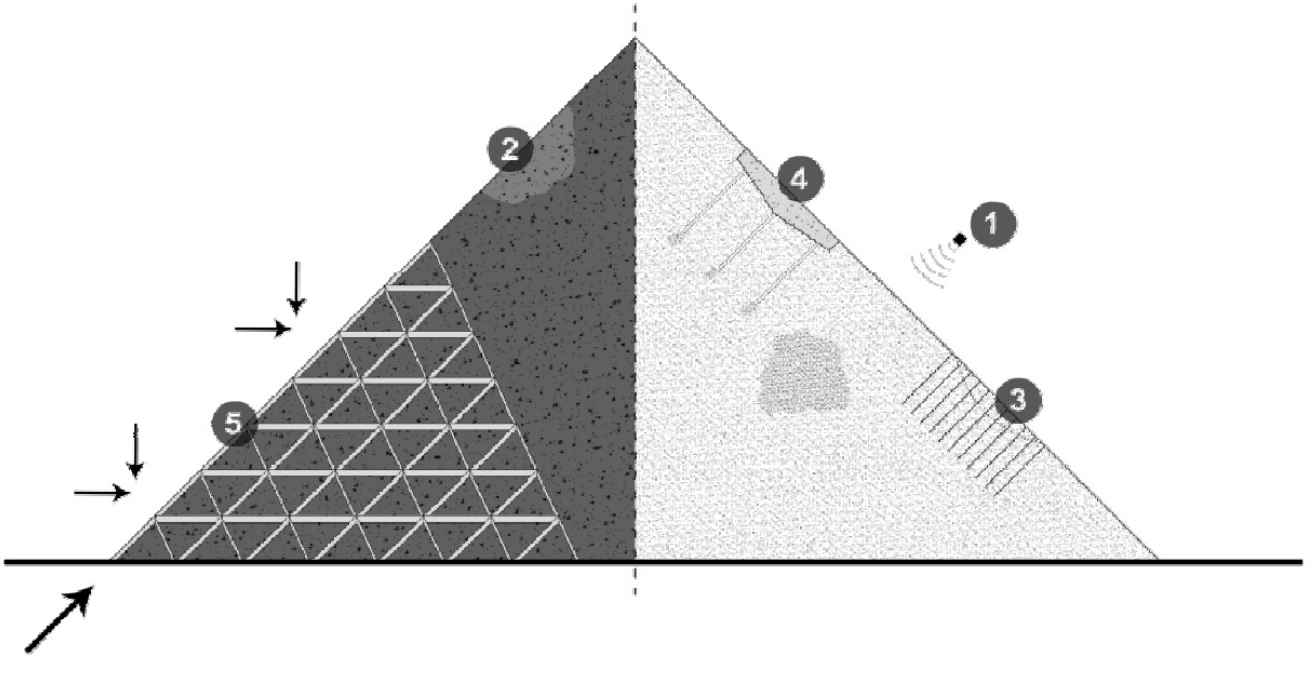
TOTAL STABILITY OF THE TERRIL INFLUENCED BY;

1. Natural Slope (Max. angle of substrate is depending on cohesion and angle of repose (friction))
2. Landslide / Debris flow (Geological phenomenon of ground movement with gravity as primary driving force)
3. Local stability (Result of a process that influenced substrate composition)
4. Vegetation (Influencing stability of topsoil)
5. Inner stability (Based on a platform of which the forces are equally guided down)
6. Transformation (Natural process or influenced by human activities)

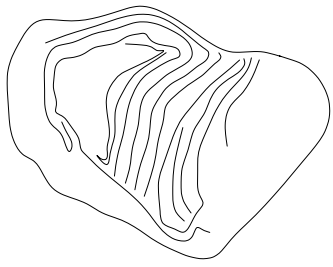


SOLUTIONS FOR STABILIZATING THE TERRIL GAINED THROUGH;

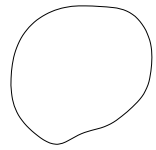
1. Sonar scan (Echo parameters used to ascertain sediment type to locate local density)
2. Grout injection (Local injection to connect diconnected densified areas)
3. Substrate reinforcement with pins ('Vernagelling' to generate more friction and decrease the shear effect)
4. Reinforect slab (Anchored with grout anchors the slab directly becomes a constructional surface)
5. External flexible structure (Superstructure leaning on the stable mass of the terril)



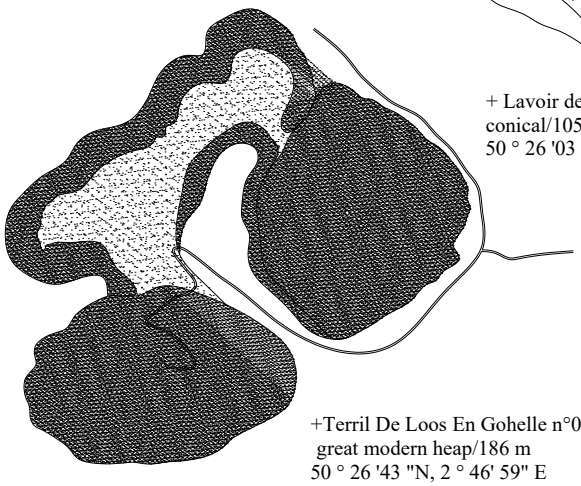
*materials shared by Mr. Ir. F. Geerts



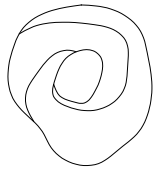
+ Lavoir de Fouquières n°094
conical/105 m
50 ° 26 '03 "N, 2 ° 53' 05" E

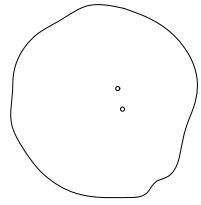


+ Lavoir de Fouquières n°260
settling pond/0 m
50 ° 25 '43.01 "N, 2 ° 53' 50.52" E



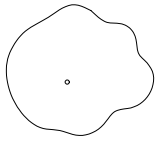
+Terril De Loos En Gohelle n°074
great modern heap/186 m
50 ° 26 '43 "N, 2 ° 46' 59" E



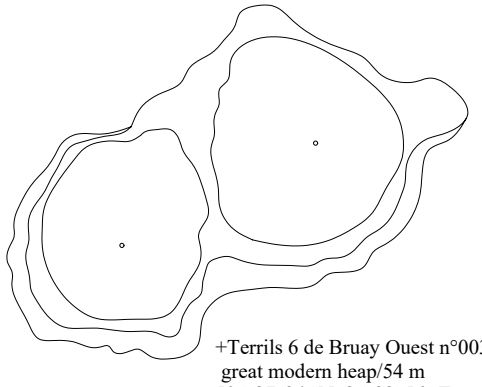


+Terrils e Lavoir Hénin West n°092
Terrils e Lavoir Hénin Est n°087
conical/75
conical/100
50 ° 25 '23 "N, 2 ° 58' 21" E
50 ° 25 '27 "N, 2 ° 58' 46" E

+Terril de Liévin n°076
conical
50 ° 23 '59.94 "N, 2 ° 49' 06.75" E

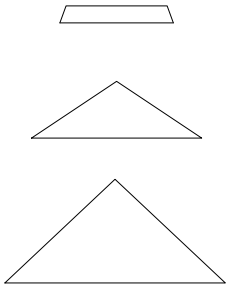


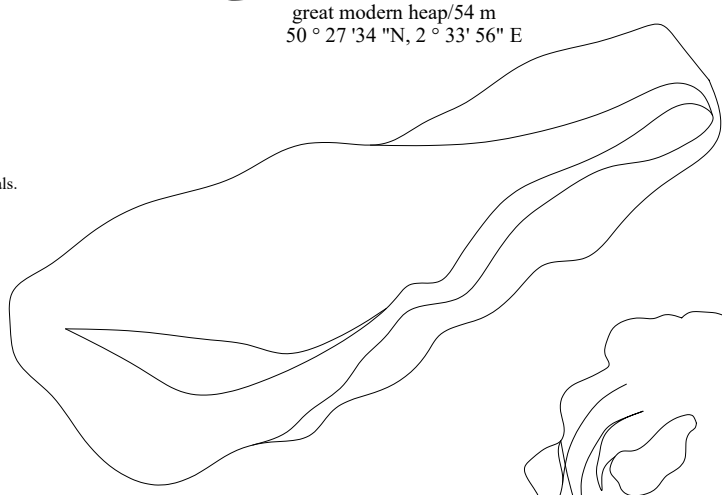
+Terril Renard n°162
conical/76 m/ramp
50 ° 19 '35.77 "N, 3 ° 22' 18.21" E

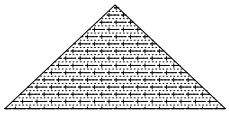


+Terrils 6 de Bruay Ouest n°003
great modern heap/54 m
50 ° 27 '34 "N, 2 ° 33' 56" E

TYPES OF HEAPS
/construction metods and period/
1.flat heaps,
18th-19th century,
100-300m long,
10-30 m high,
construction:
wagon tracks pushed by people, animals.
2.conical heaps,
19th-20th century,
100-200m radius,
100 m high,
construction:
ramps, cableways
3.great modern heaps,
2nd half of 20th century,
construction:
ramps, movable metal corridors,
conveyor belts, 'grasshoppers'
+cavaliers-unpacking,
+truncated/cut heaps,
+settling ponds,
+shales platforms,

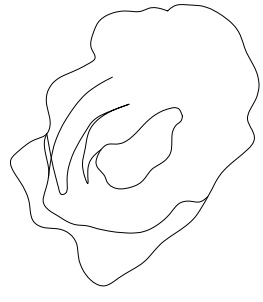




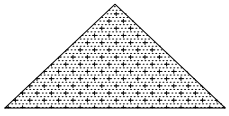


COMPONENTS OF SLAG HEAPS:
minerals,
parts of mine structure: wood, metals, oli,
plastic,
pollutants: phenols, tars, benzols,

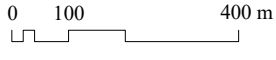
+Terril Pinchonvalles n°075
flat/35m
50 ° 24 '05.72 "N, 2 ° 48' 27.58" E



+ 24 Nord Courrières n°098
truncated heap/70 m
50 ° 28 '58.53 "N, 2 ° 55' 11.41" E



COMPONENTS OF TERRILS
LOOS-EN-GOHELLE
rocks from mine,
coal 1%
sandstone 20%
parts of mine structure: wood,



Catalogue of slag heaps in Nord Pas-de Calais mining region.

Student's drawing.

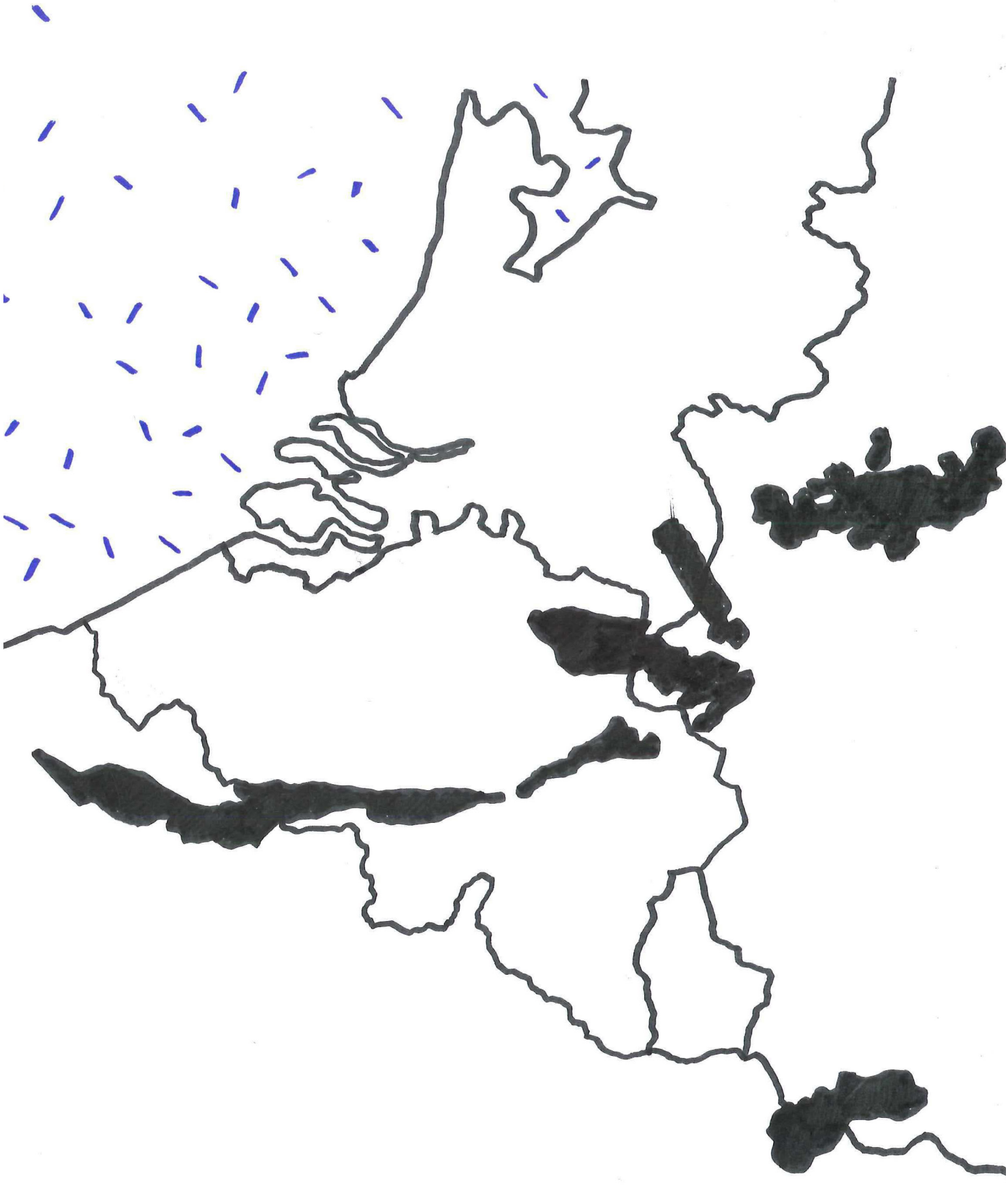
Construction methods of slag heaps.

Source: Debrabant, Virginie. Dumont, Gérard. Six, Audrey. *Des machines et des hommes : les techniques d'exploitation dans les mines du Nord-Pas de Calais*. France: Center Historique Minier. 2013.


21. - AUCHEL (P.-de-C.). - Fosse 5 - Le terril

Location of slag heaps in Nord-pas de Calais region.l

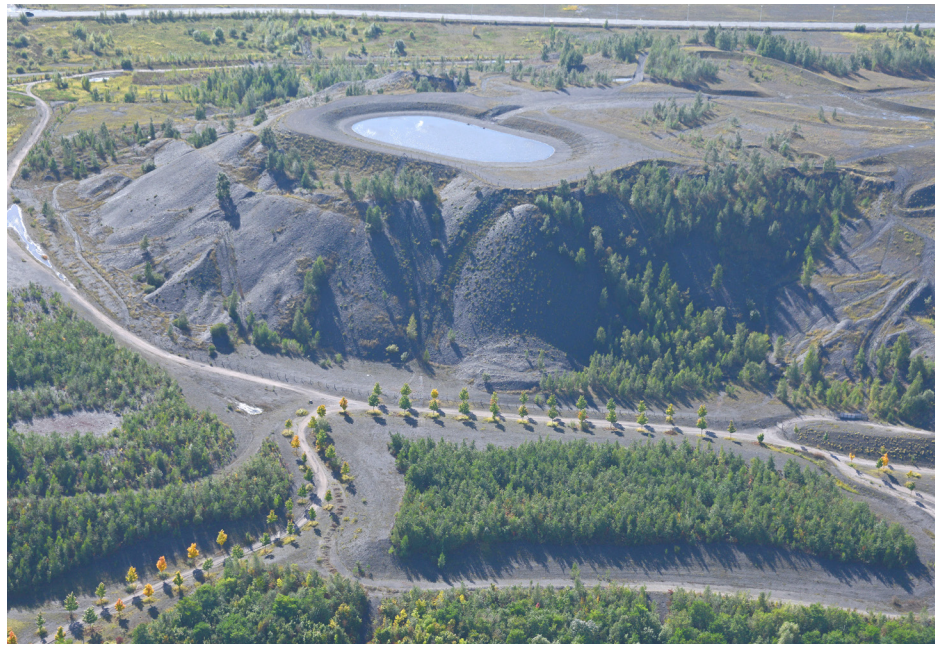
http://www.chainedesterrils.eu/carte.html



Northwest European Coal Seam.

SOURCE: http://www.bassinminier-patrimoinemondial.org

Pompe à feu de la fosse du Sarteau



SOURCE: Photograph taken by the author

Terril n° 116 and 117 dourges.

WATER INFRASTRUCTURE IN COAL EXTRACTION INDUSTRY

OPERATING MINES:
-fire safety installations in mines galleries,
-reduction of ash generated by coal extraction processes in mine galleries,
-mechanical coal sorting systems (WASHING PLANTS): water mixed with magnetites utilised in settling tanks and *tailings ponds*,
-vapour machines pomping water and dewatering mines galleries located below groundwater layer (mine water)-water utilised in rivers and lakes,
-on surface water cannals used for transportation of coal,
-washing facilities for miners,

NOT OPERATING MINES:
-subsidence lakes (land above empty mines galleries subsides below the underground water level); reclamation of land by pumping systems.
-mine water accumulated in empty mine galleries-some of them in Nord-pas de Calais region are filled up with slag.
-a mixture of water and clay is injected into slag heaps that burn inside.

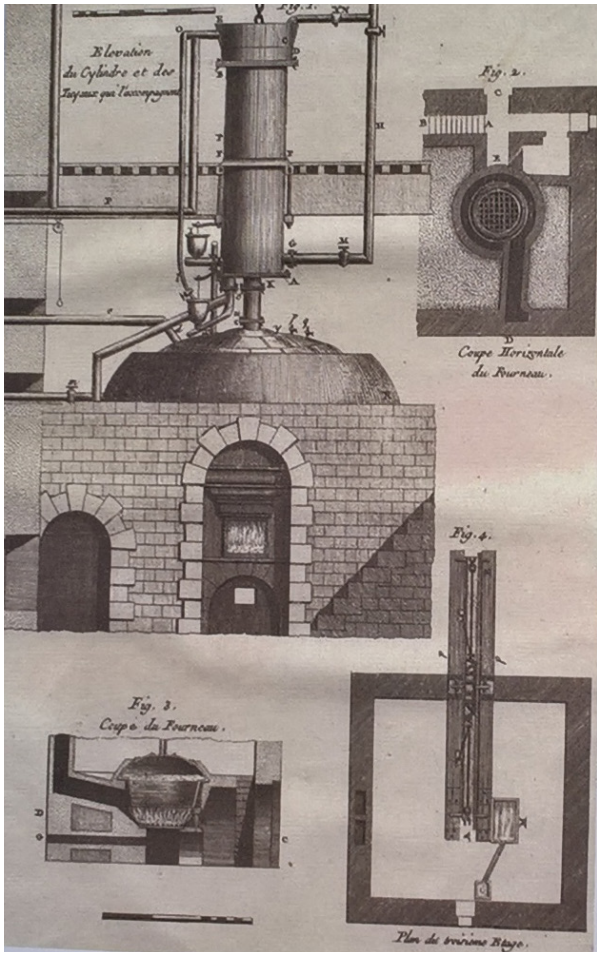
sources: THE MINING HISTORY CENTRE in Lewarde
.

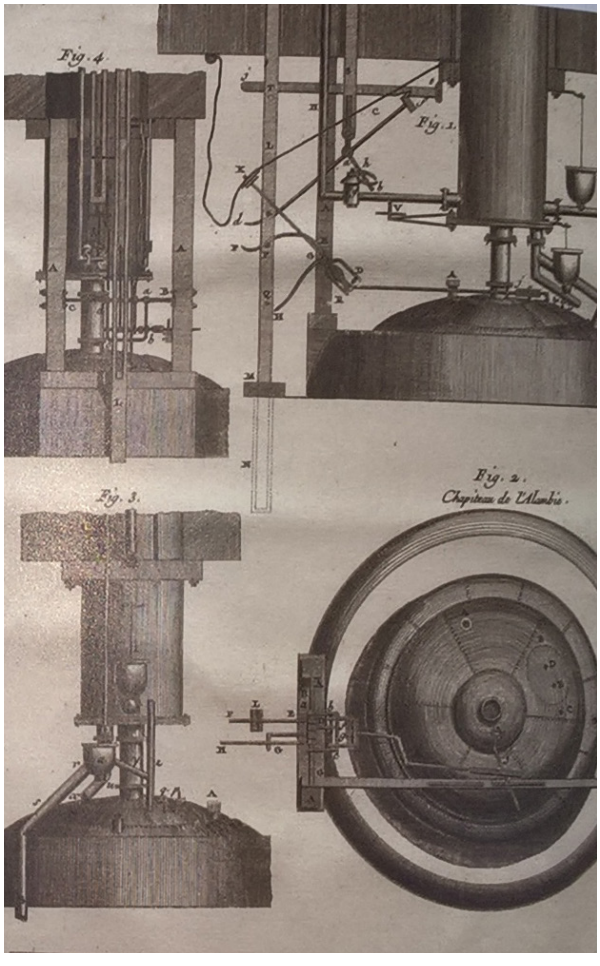
Pompe à feu de la fosse du Sarteau

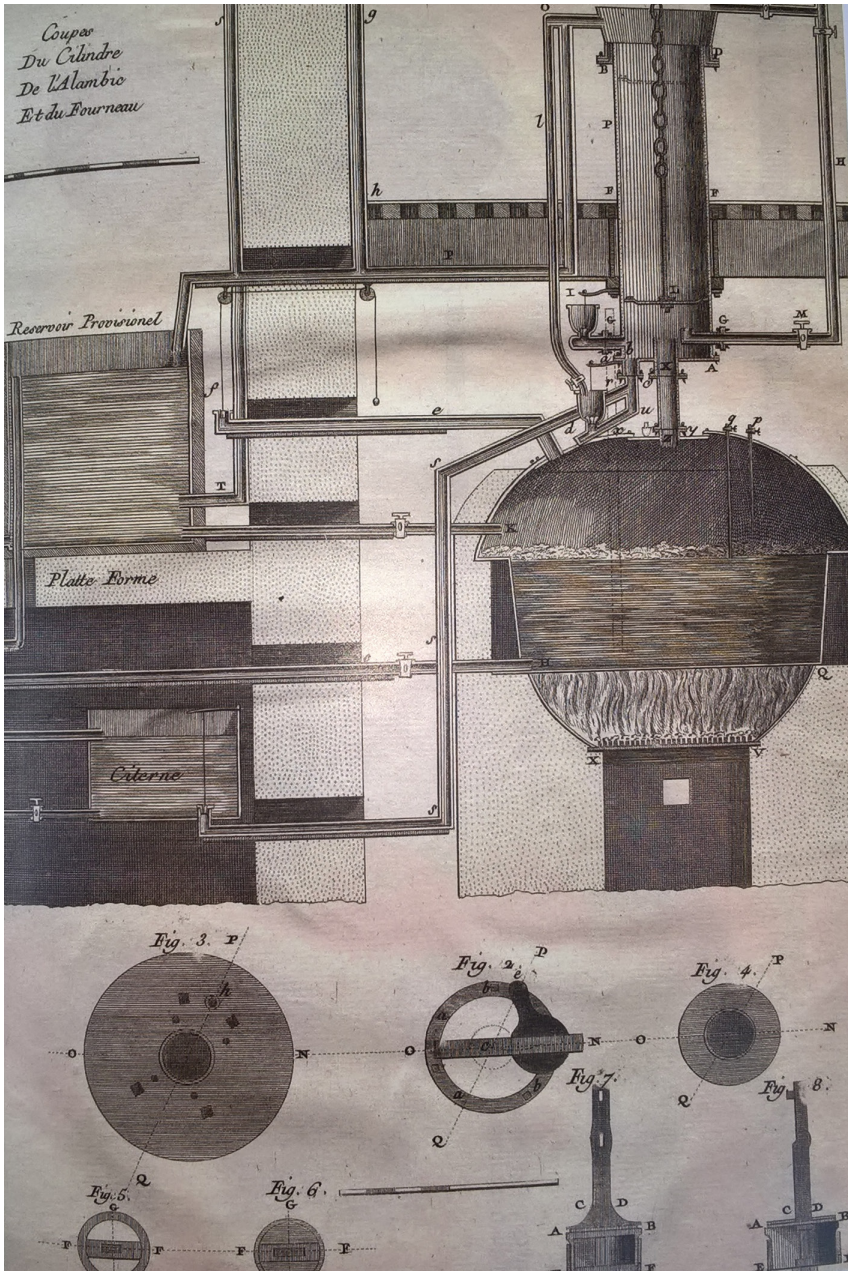
The location of the Sarteau colliery was chosen for its proximity to the left bank of the Escaut river. But this proximity made exploitation difficult because of infiltration of water into the tunnels. Completed in 1827, the «fire pump» building housed a steam machine that could ensure water drainage. Large in size, the pyramid base of this construction is uncharacteristic but was designed to prevent the building from shifting on the unstable ground. A large opening has been made in the upper part of its south-eastern facade in order to position the balancing pole (see archive).

The building is also topped by crenels and false-machicolations. With no functional purpose, these architectural details have borrowed some medieval elements, commonplace in industrial architecture from the first half of the 19th century. The fire pump ceased to be active in 1861. The building also bears traces of the Second World War. The Sarteau tower was turned into a blockhouse in 1939: the former openings were filled in, holes were made in the facades by murderers and a bunker was built behind the building. Classified as a Historical Monument.

http://www.bassinminier-patrimoinemondial.org.







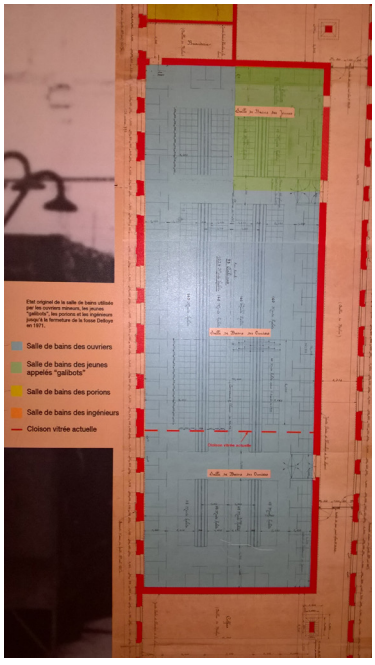
Mine pumps with steam engine.

Source: Debrabant, Virginie. Dumont, Gérard. Six, Audrey. *Des machines et des hommes : les techniques d'exploitation dans les mines du Nord-Pas de Calais*. France: Center Historique Minier. 2013.

First water pumps-steam engine machines.

First pumps used in mines invented by Thomas Newcomen in 1729. They were installed by Company of Mines d'Anzin in XVIII century. Depending on the situation the pumps were installed temporary or permanently. Inside galleries a channels gathering water and redirecting it towards main pit were created. The water was accumulated at the botton of the pit and pumped to the surface.

Later the channels were replaced by pipes tranfering water from galleries to underground reservois. Electric pumps transport the water to the surface.



washing facilities and changing rooms for coliers..

Source: Museum of Mining History in Lewarde, France..

GOEHMANN & Cie

MAISON FONDÉE EN 1890

POSITION DE DUSSELDORF
MÉDAILLE D'OR

EXPOSITION DE LIÈGE
MÉDAILLE D'OR

EXPOSITION DE SAINT-LOUIS
MÉDAILLE D'OR

Adresser la correspondance à

M. J.-B. CLAMENS. *21, Rue Godot-de-Mauroi, 21, PARIS*

BAINS-DOUCHES & VESTIAIRES

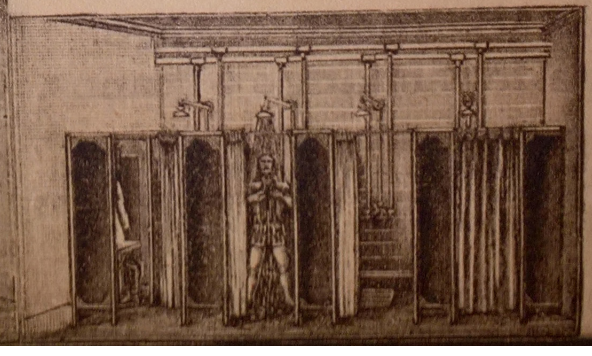
pour CHARBONNAGES

ATELIERS ET USINES MÉTALLURGIQUES

CABINETS D'AISANCE

contre l'ankylostomasie

CHAUFFAGE A VAPEUR économique pour Ateliers, Bureaux, Habitations.



Projets Devis et Références sur demande.

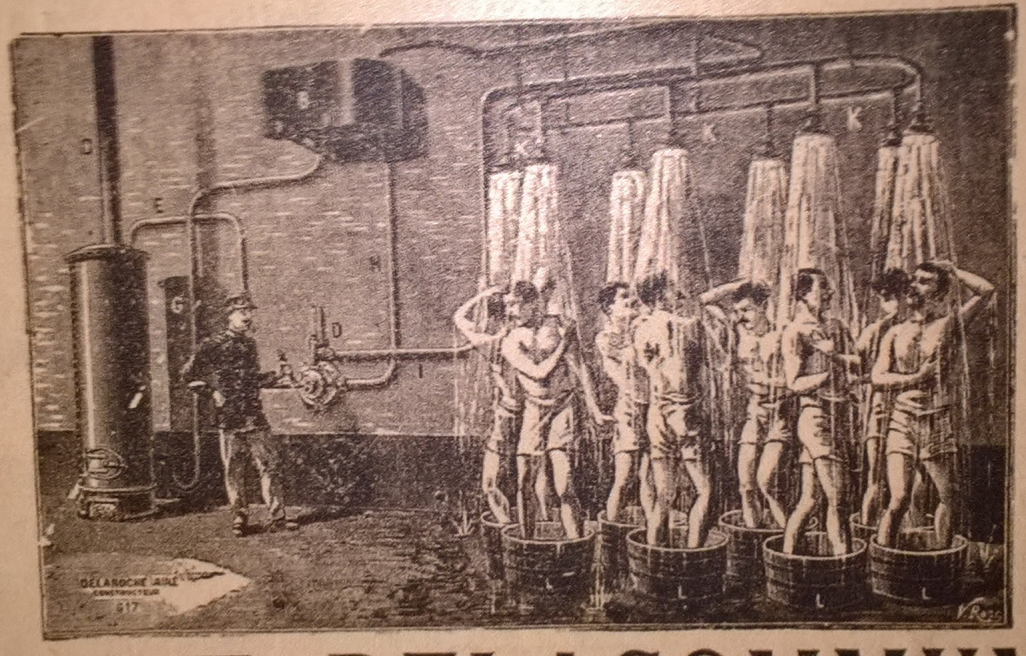
107

BAINS-DOUCHES POUR MINEURS

JECTEUR VALLETTE, seul appareil fixe évitant les refoulements de fumée quel que soit le vent

Envoi franco du Catalogue.

MÉLANGEUR D'EAU & DE VAPEUR DE SÉCURITÉ



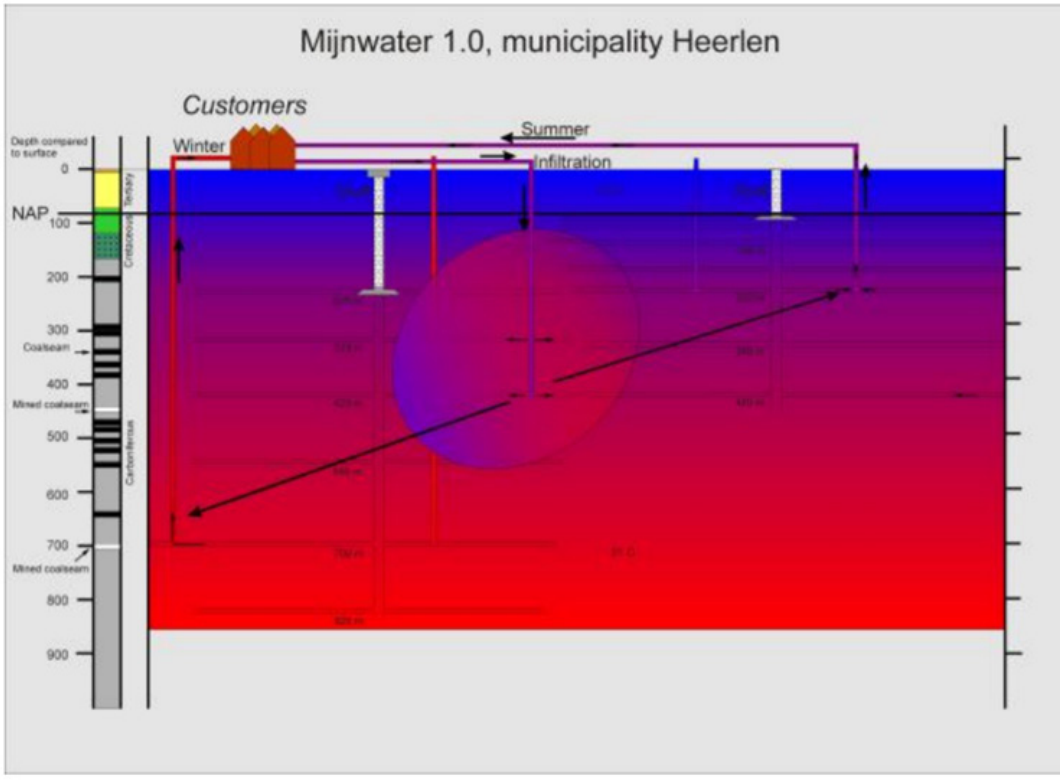
DOUCHES A CONSOMMATION LIMITÉE

Envoi franco du Catalogue.

P. & E. DELACOMMUNE

Petit-neveux de DELAROCHE

INGÉNIEURS-CONSTRUCTEURS



Schematic display of cross section of the mine water reservoir.

the well pump which brings the mine water from about 120 m deep to the surface and delivers it with a pressure head of 3 bars to the pressure boosting system.

Source: http://www.mijnwater.com.

MINE WATER

After the closure of the coal mines in Heerlen and the surrounding area the mine passages filled with groundwater, which is heated by the earth naturally. The geothermal source under our feet remained untouched for decades until the municipality of Heerlen conducted a study in 2005 into the possibility of using water from the mines for heating and cooling buildings, homes, and offices. That had far-reaching positive consequences

http://www.mijnwater.com

Centralny Zakład Odwadniania Kopalń (CZOK). Zadaniem Zakładu CZOK jest zabezpieczenie kopalń czynnych przed zagrożeniem wodnym poprzez odwadnianie zlikwidowanych kopalń węgla kamiennego z zastosowaniem pompowni stacjonarnych lub głębinowych.

Ilość wypompowanej wody przez pompownie CZOK w latach 2001÷2014.

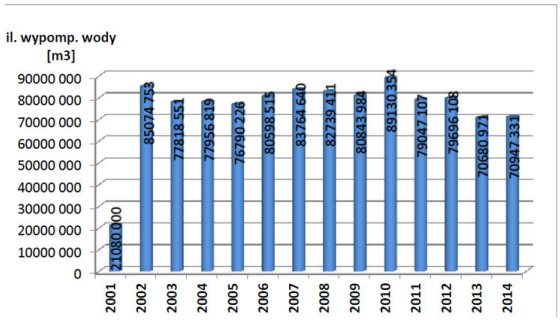


TABELA 1. CHARAKTERYSTYKA POSZCZEGÓLNYCH NIECEK

WYSZCZEGÓLNIENIE CHARAKTERYSTYCZNEJ CECHY	NUMER OBIEKTU					
	B1 BASEN PŁYWACKI	B2 BASEN REKREACYJNY	B3 BASEN HAMOWNY DLA ZJEŻDŻALNI	B4 DWA ZESPOŁY WANIEN DO HYDROMASAŻU - WHIRLPOOLE	B5 DWA ZESPOŁY WANIEN DO HYDROMASAŻU - WHIRLPOOLE Z SOLANKĄ	B6 ZESPOŁY ATRAKCJI - TUNEL WODNY
Powierzchnia lustra wody [m²]	312,5	82,5	13	6,4 (2 × 3,2)	6,4 (2 × 3,2)	22
Pojemność niecki basenu [m³]	562	82	4,6	3 (1,5 × 2)	3 (1,5 × 2)	20
Głębokość [m]	1,2-1,8	0,6-1,2	1,4	0,8	0,8	1,1
Zapotrzebowanie wody uzupełniającej, dane projektowe [m³/d]	26	16	-	6	4	8
Temperatura [°C]	25-26	28-30	28-30	35-36	30-34	30-32

SRK S.A., Zakład CZOK odwadnia 15 zlikwidowanych kopalń węgla kamiennego. Pompowane wody w 95 % zrzucane są, bez wykorzystania, do cieków powierzchniowych. Około 25 % pompowanych wód charakteryzuje się parametrami zbliżonymi do parametrów określonych dla wód pitnych. Jedynie 5 % sprzedawane jest innym podmiotom gospodarczym, do celów przemysłowych i technologicznych.

25% of mine water has a quality of drinking water.

http://srk.com.pl/

Tournesol piscine competition materials

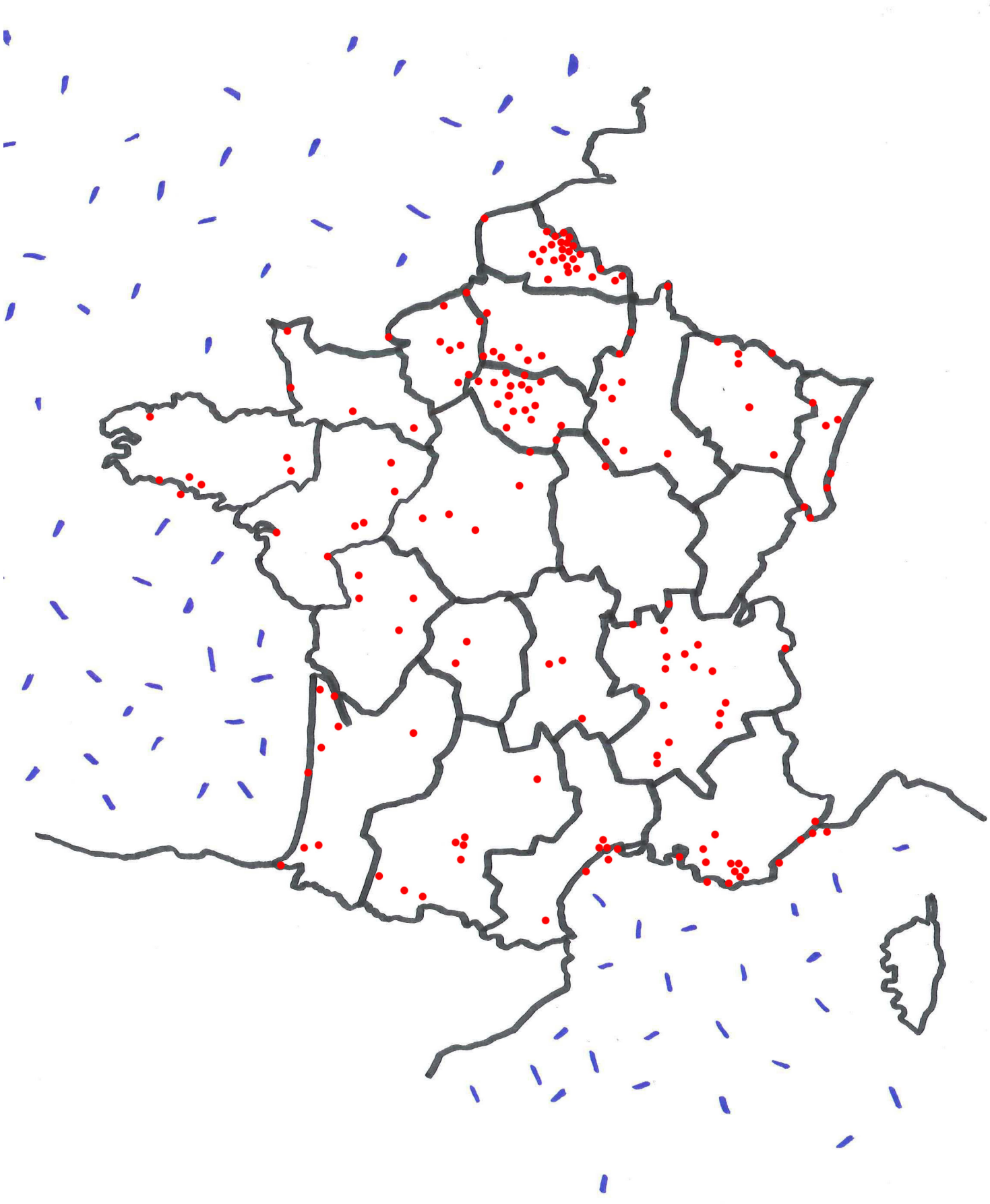
Tournesol piscine in Lille

SOURCE: Photograph taken by the author

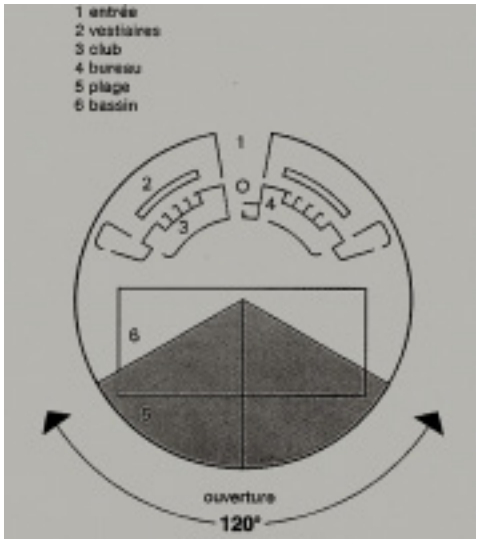
After the failure of the French swimming team during the 1968 Summer Olympics, the French Ministry of Sport enhanced the popularisation of swimming across the country by construction of 183 prefabricated communal swimming pools of Tournesol type. They were a result of lounched program called ‘1000 Pools’ and competition for swimming pool design. The Tournesol type was a winner. Other swimming pool types proposed in competition was calledas follows: Iris, Plein-Ciel, Plein-Soleil, Caneton.

The Tournesol type was designed by French architect Bernard Schoeller.The type was developed in two versions: with 50 m long pool and 25 m long one. The dome covering the pool has a diameter of 35 metres and covers area of 1000 sqm. 1/3 of the roof structure is movable and enable opening the pool during summer. The structure is based on steel arches with polyester membrane between.

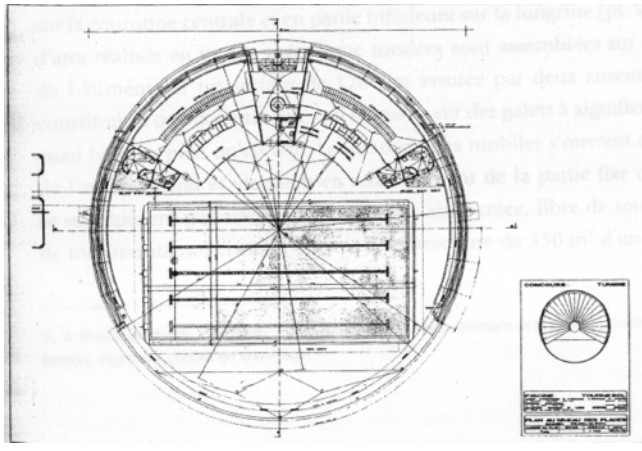
Recently, some of the Turnesol swimming pools were beeing refurbish. However, the dome which is a self sufficient form makes any extension difficult. The design has amazing spatial qualities and natural light, but it is barely insulated, too small, and not wheelchair-friendly.

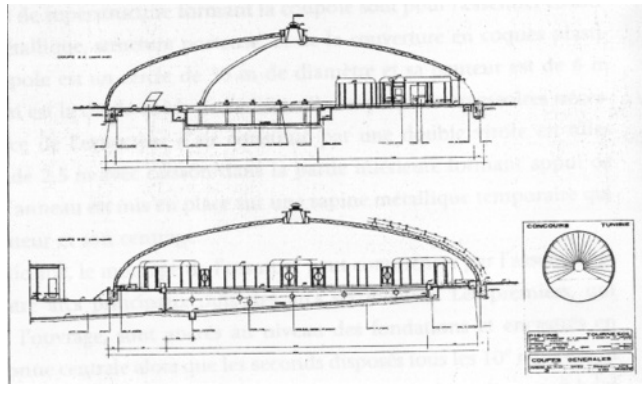


Location of Tournesol swimming pool types in France in 1975.



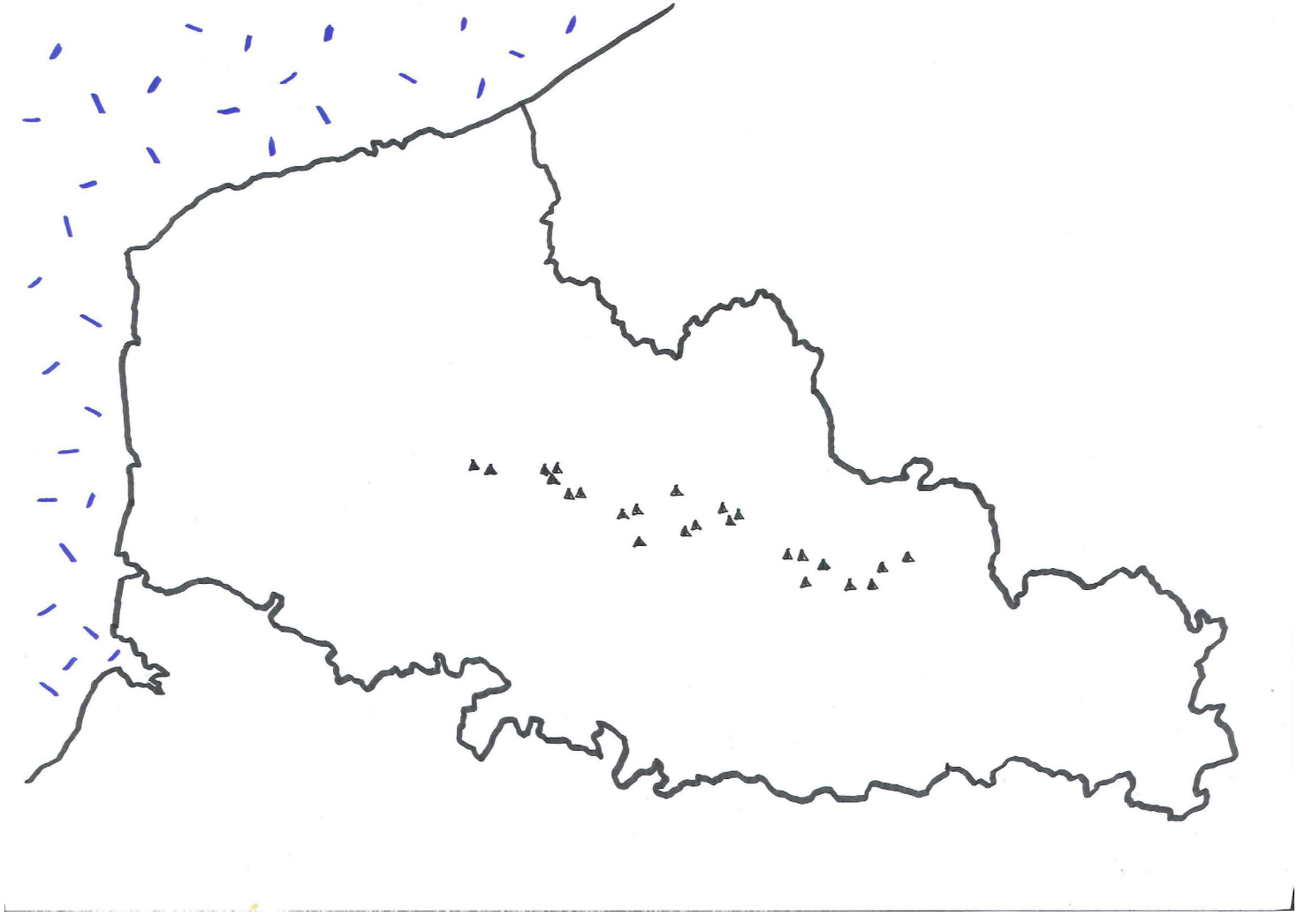
Ministère de la culture - base Mémoire



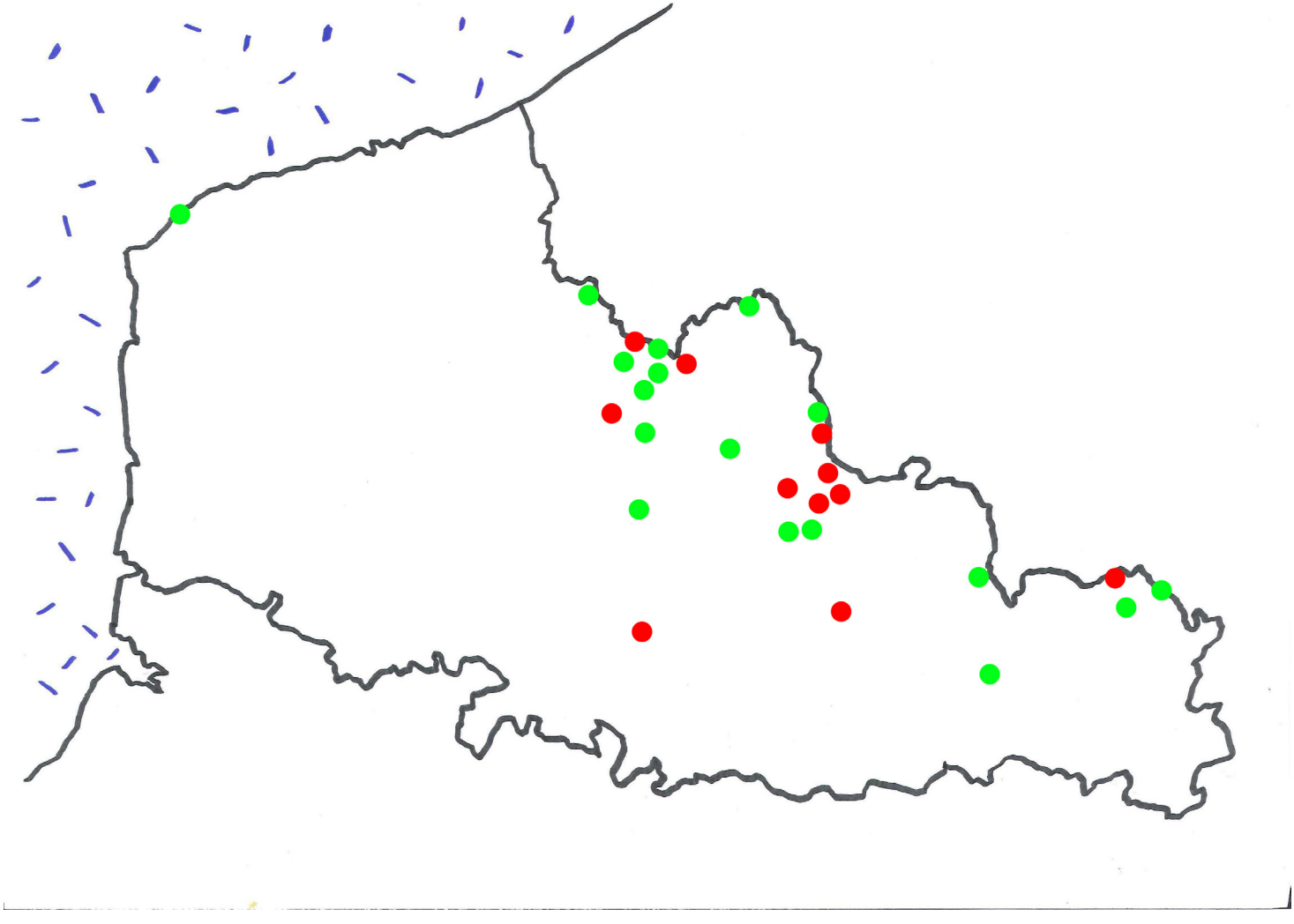


Plan and section of Tournesol swimming pool type-competition drawings.

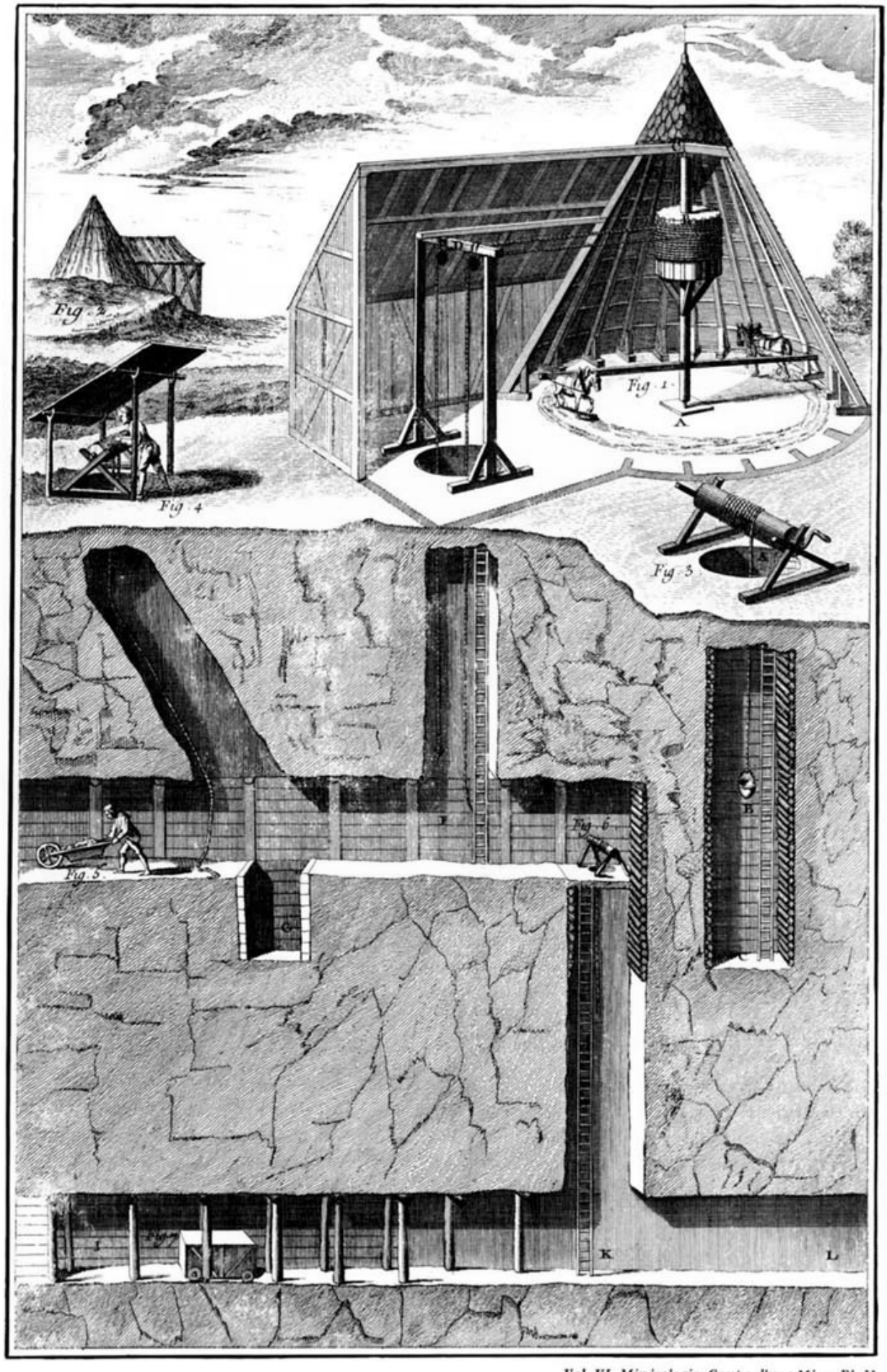
Recent refurbishment of Tournesol swimming pool in Lille.



Protected slag heaps in Nord-Pas de Calais Mining Basin.

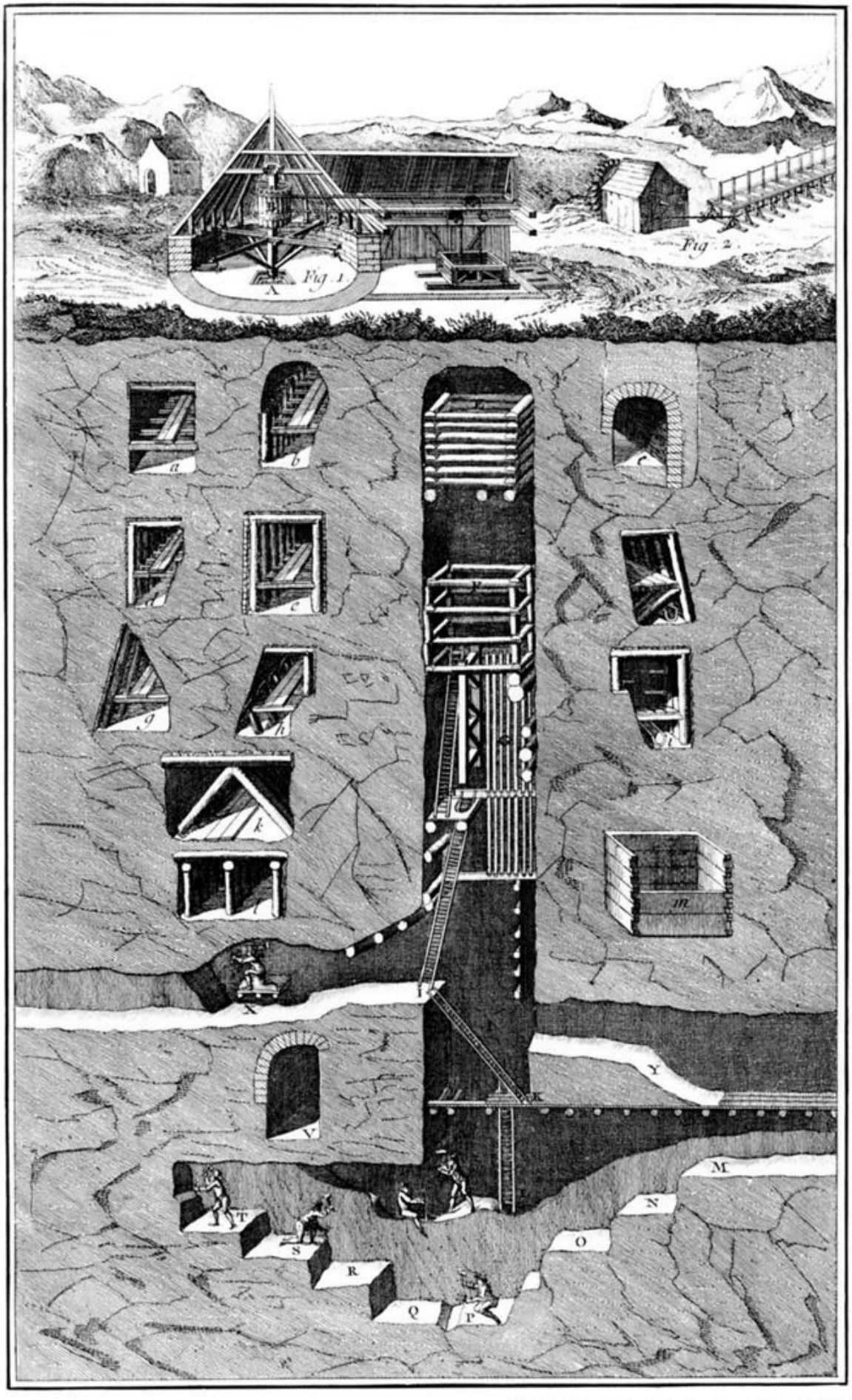


Location of Tournesol swimming pool types in Nord-Pas de Calais region. (year 2017) red-operating, green-not operating.



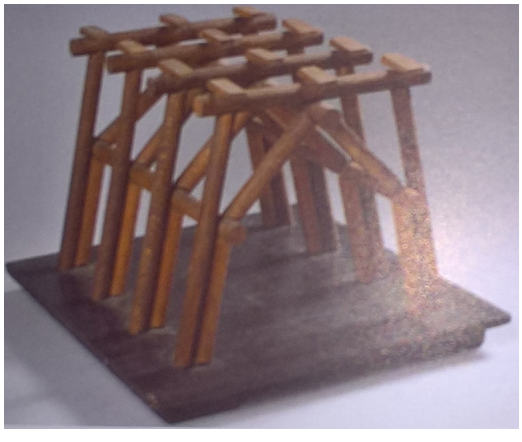
Vol. VI, Minéralogie, Coupe d'une Mine, Pl. II.

Plate 134 Mining VIII

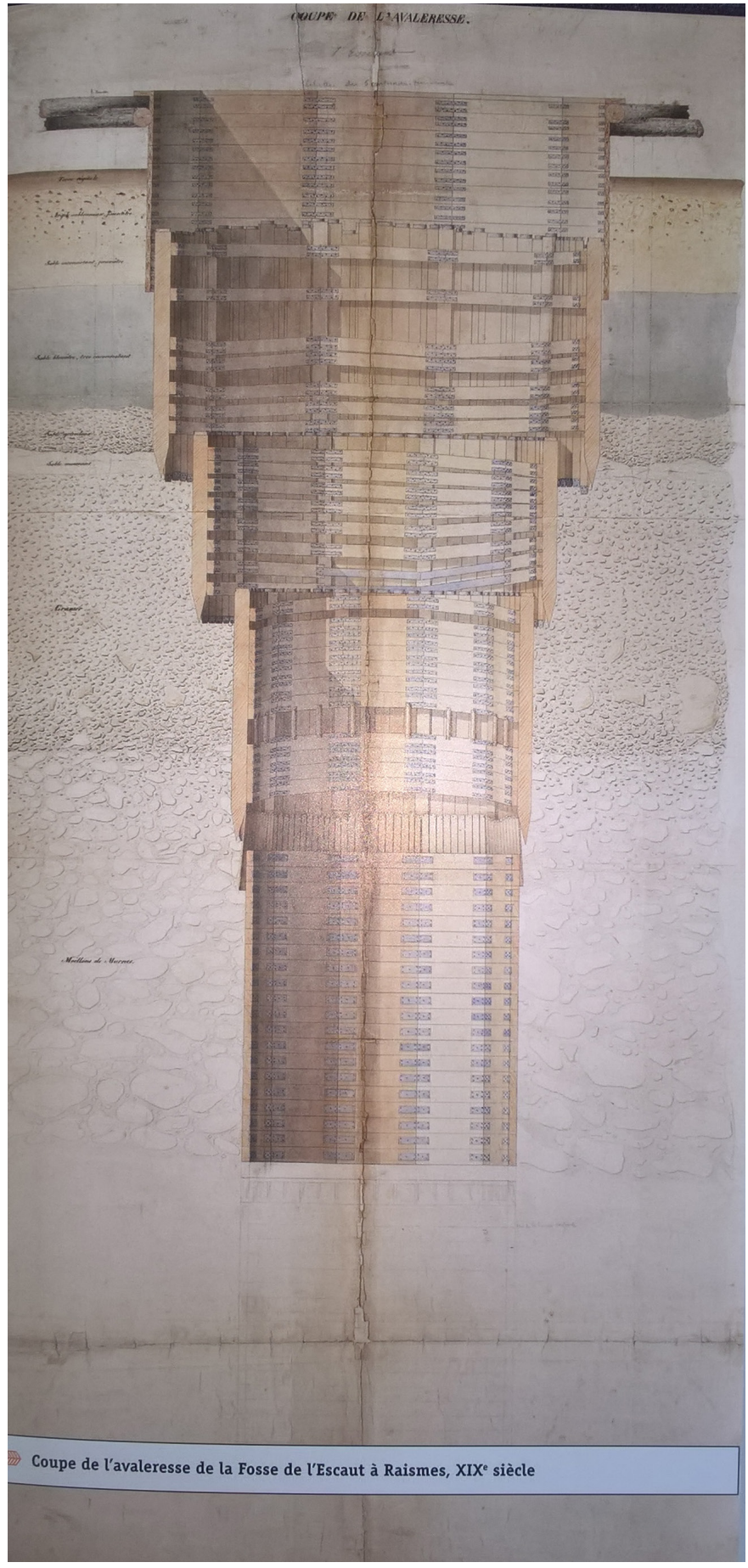


Vol. VI, Minéralogie, Coupe d'une Mine, Pl. III.

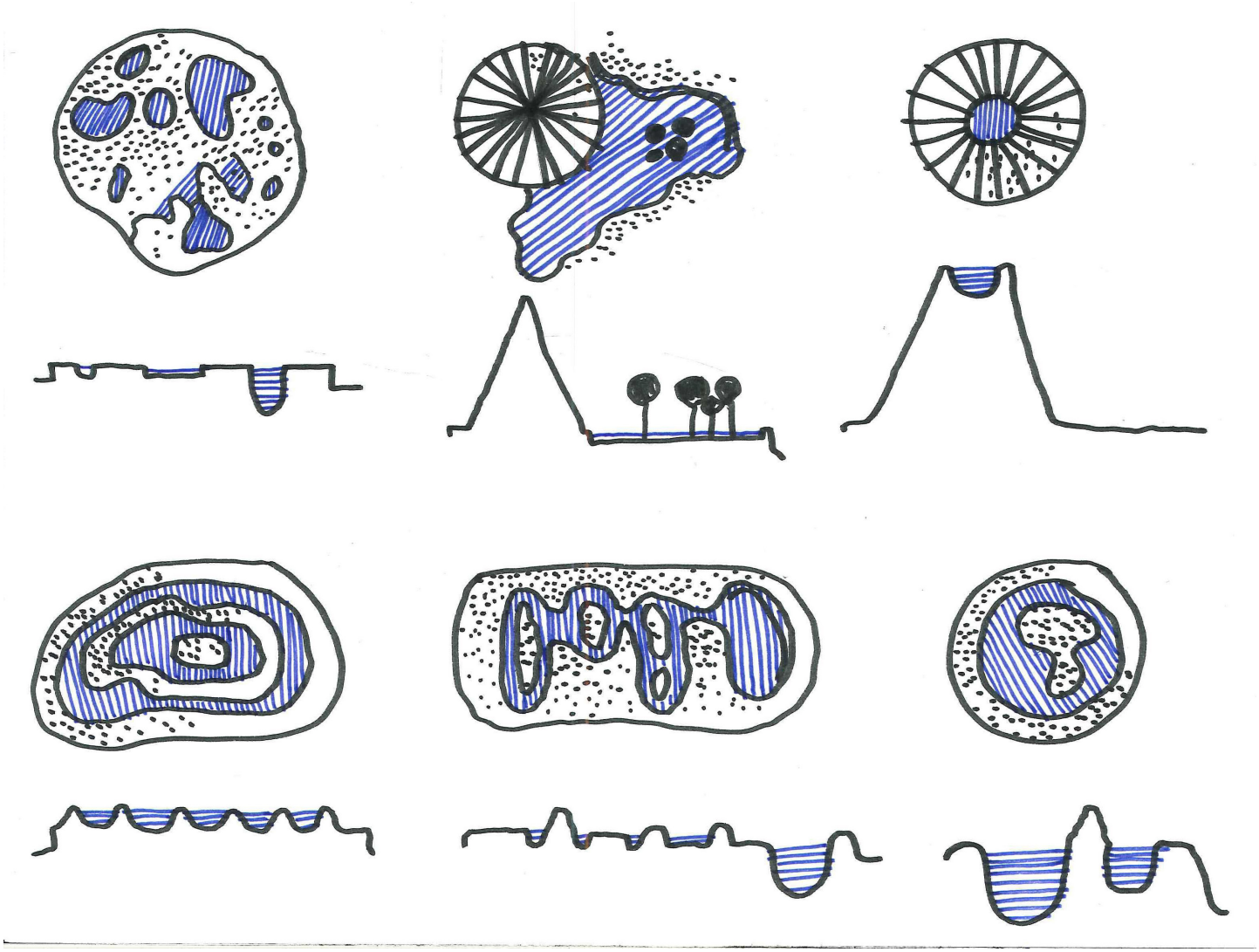
Avallesse:
In coal mines, a bure that one is occupied in digging, as long as one has not reached the coal.



Source: Debrabant, Virginie. Dumont, Gérard. Six, Audrey. *Des machines et des hommes : les techniques d'exploitation dans les mines du Nord-Pas de Calais*. France: Center Historique Minier. 2013.

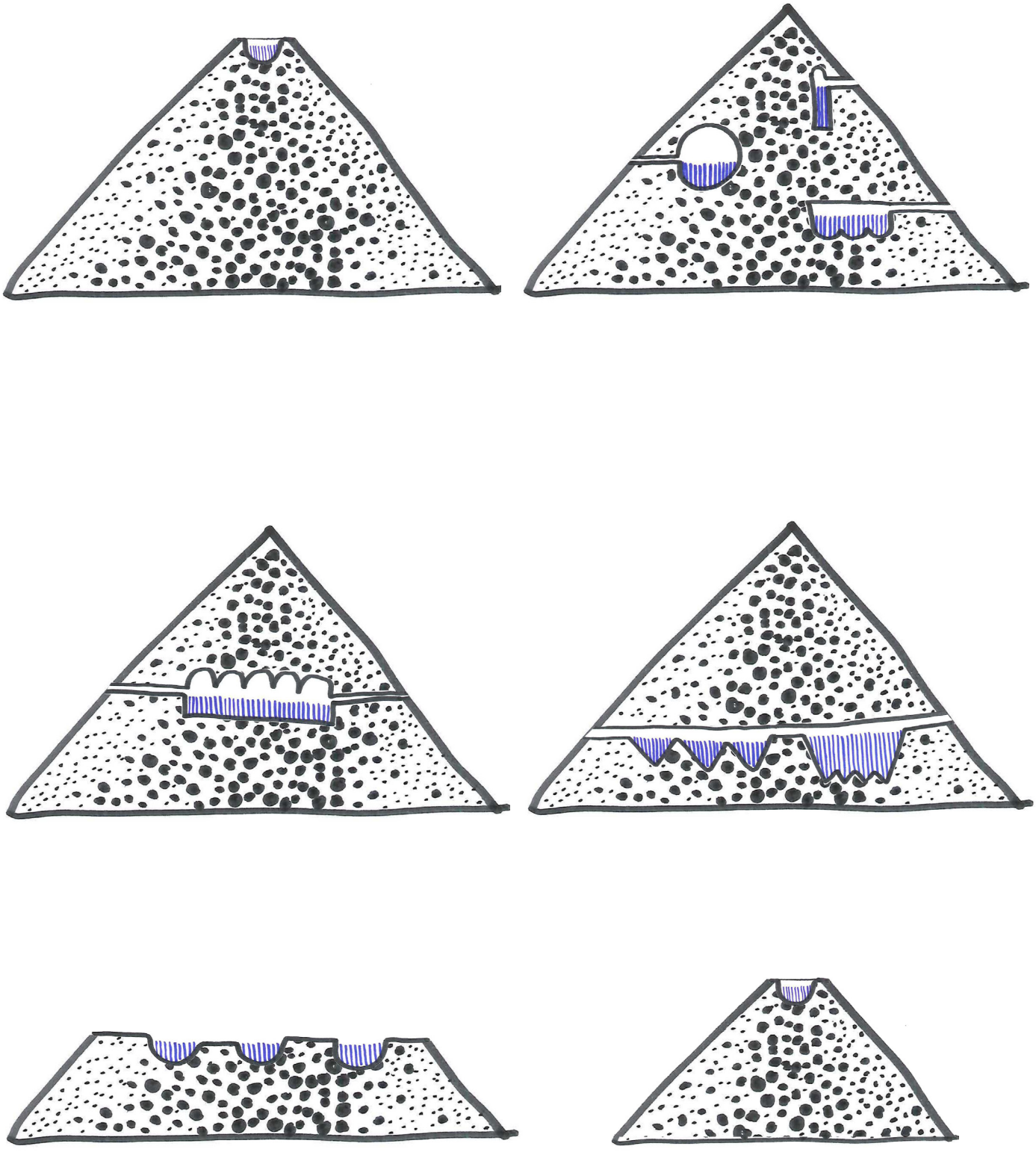


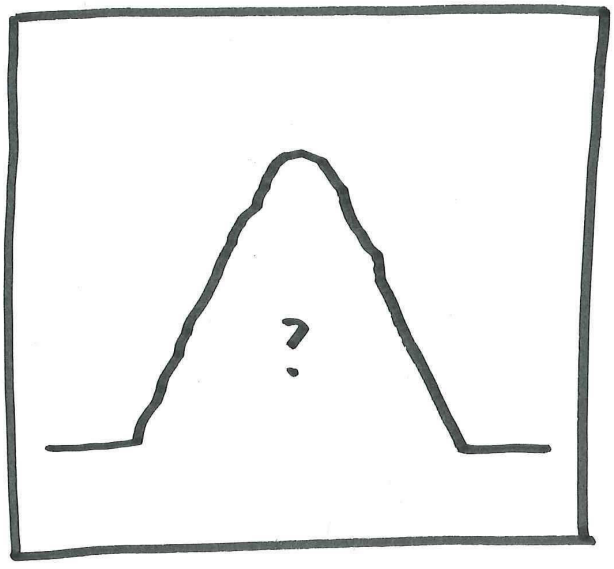
Coupe de l'avaleresse de la Fosse de l'Escaut à Raismes, XIX^{e} siècle

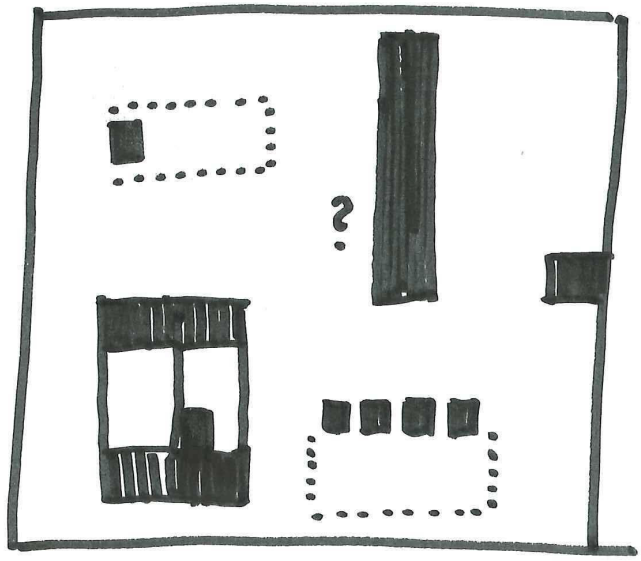


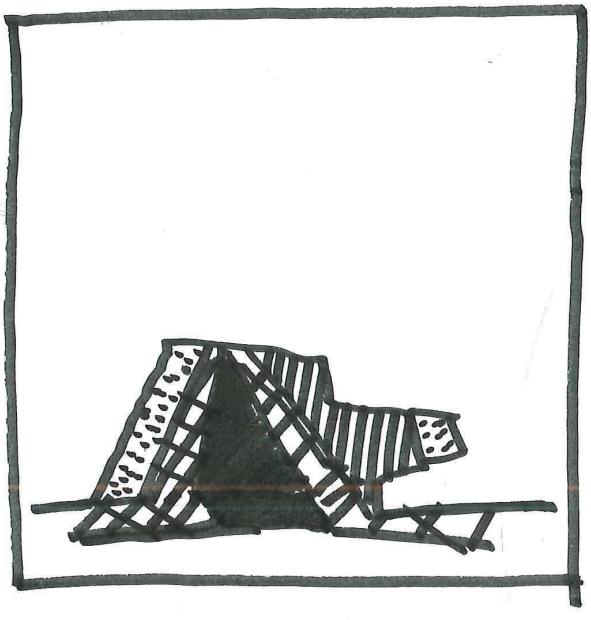
Preliminary sketches

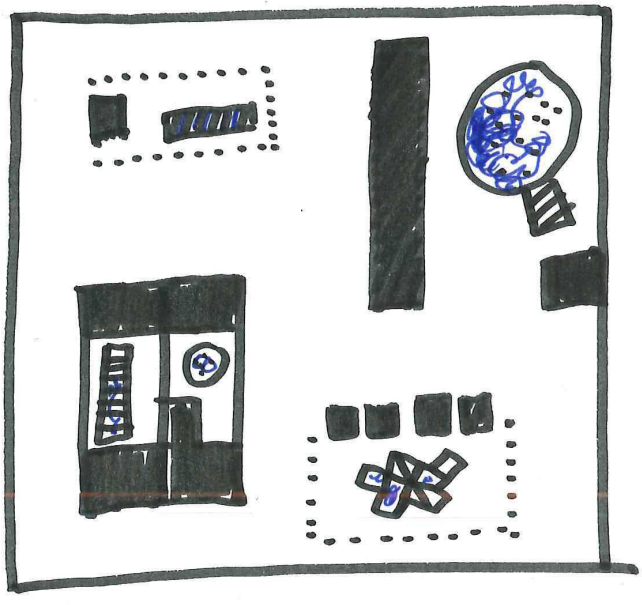
A Black Pool is a communal swimming pool constructed out of by-product of coal mining industry, a slag heap named Terril de Loos-En-Gohelle, by processes like drilling, carving, cutting, digging, and crumbling of its structure.

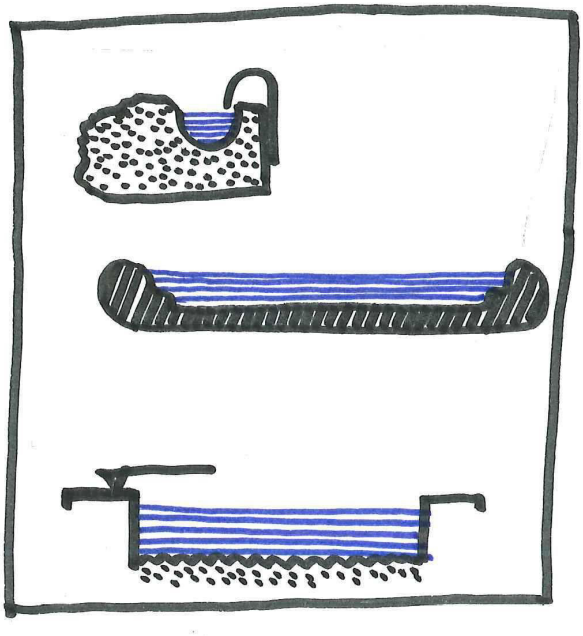


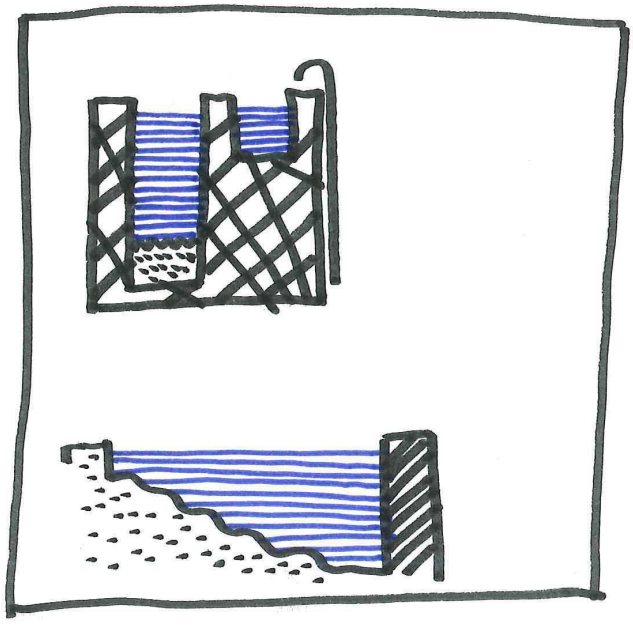


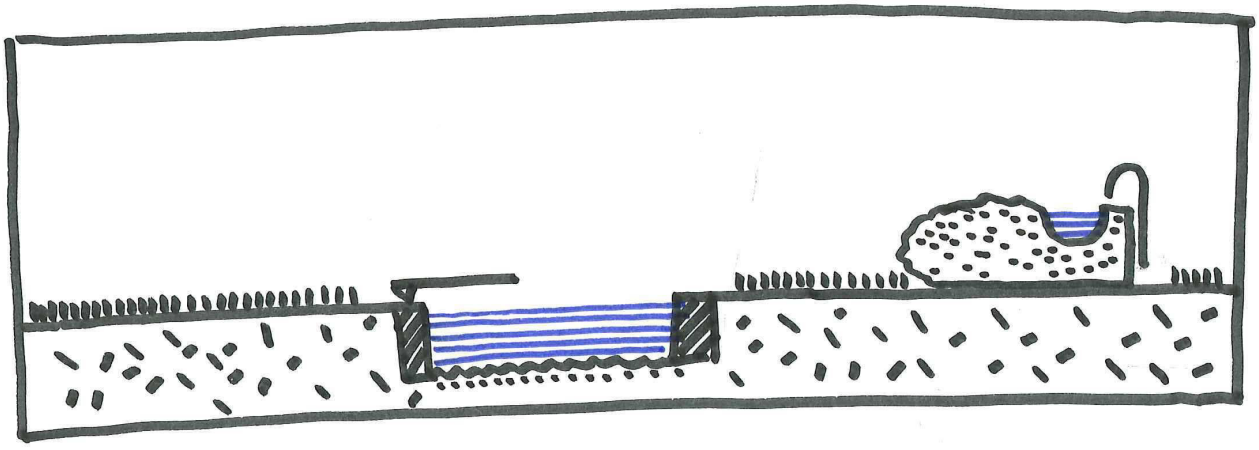


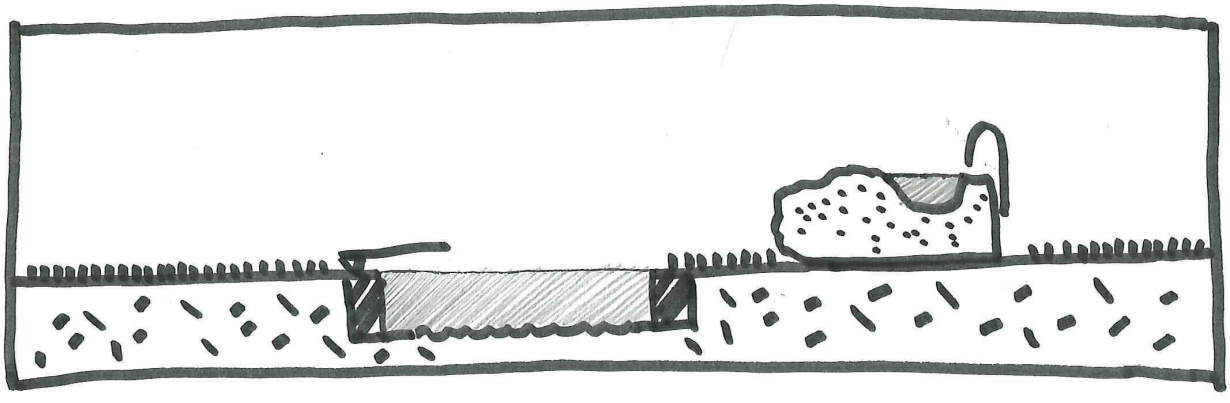


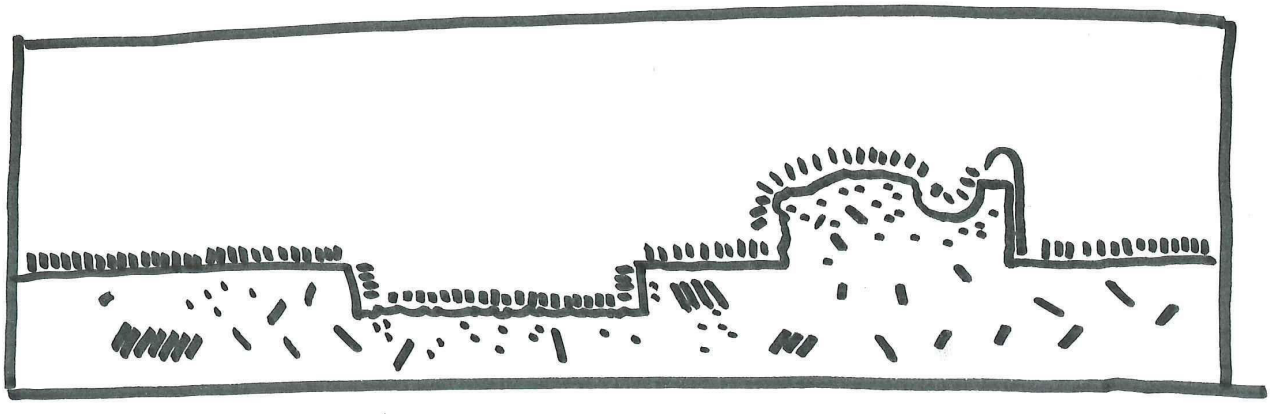


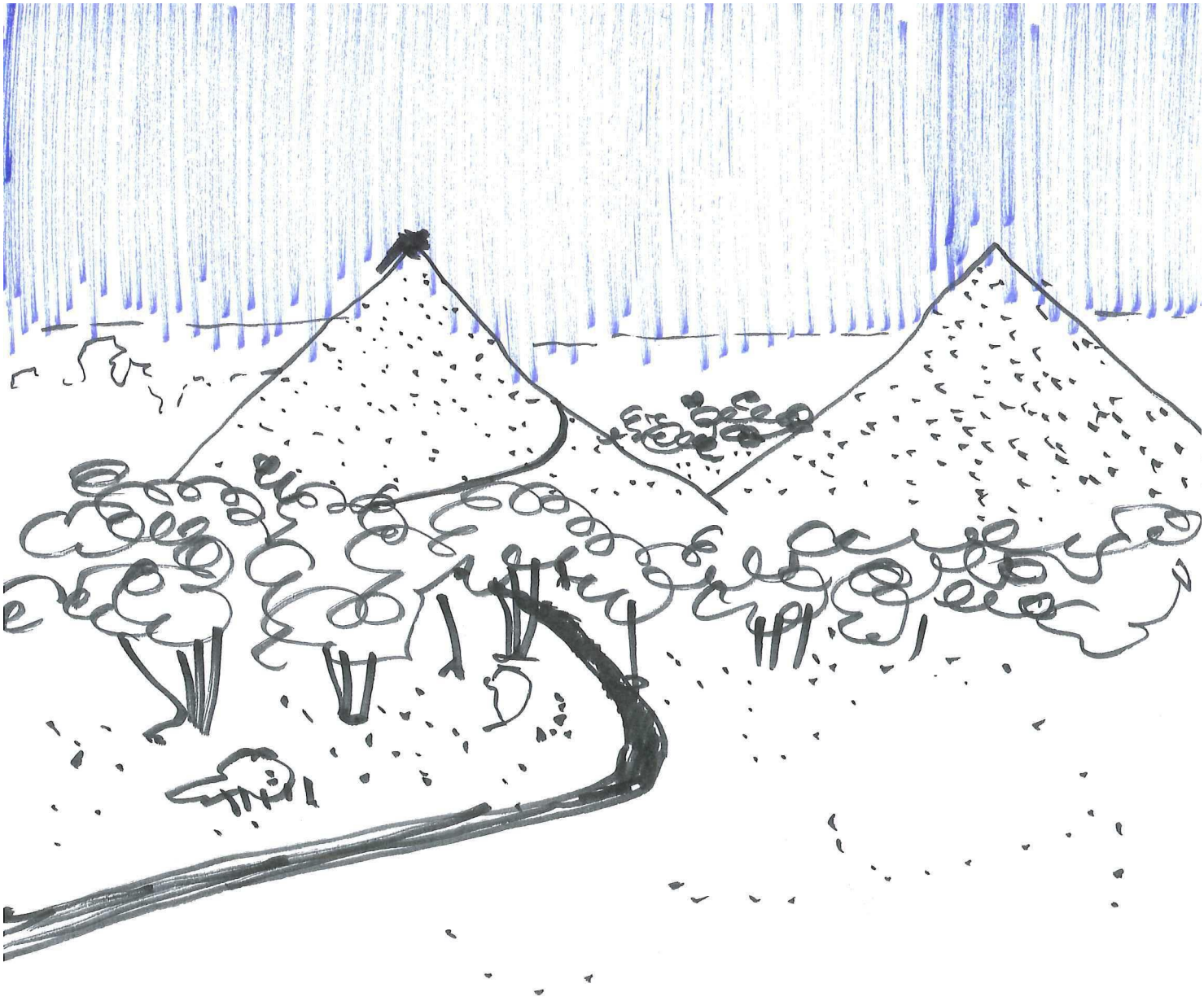


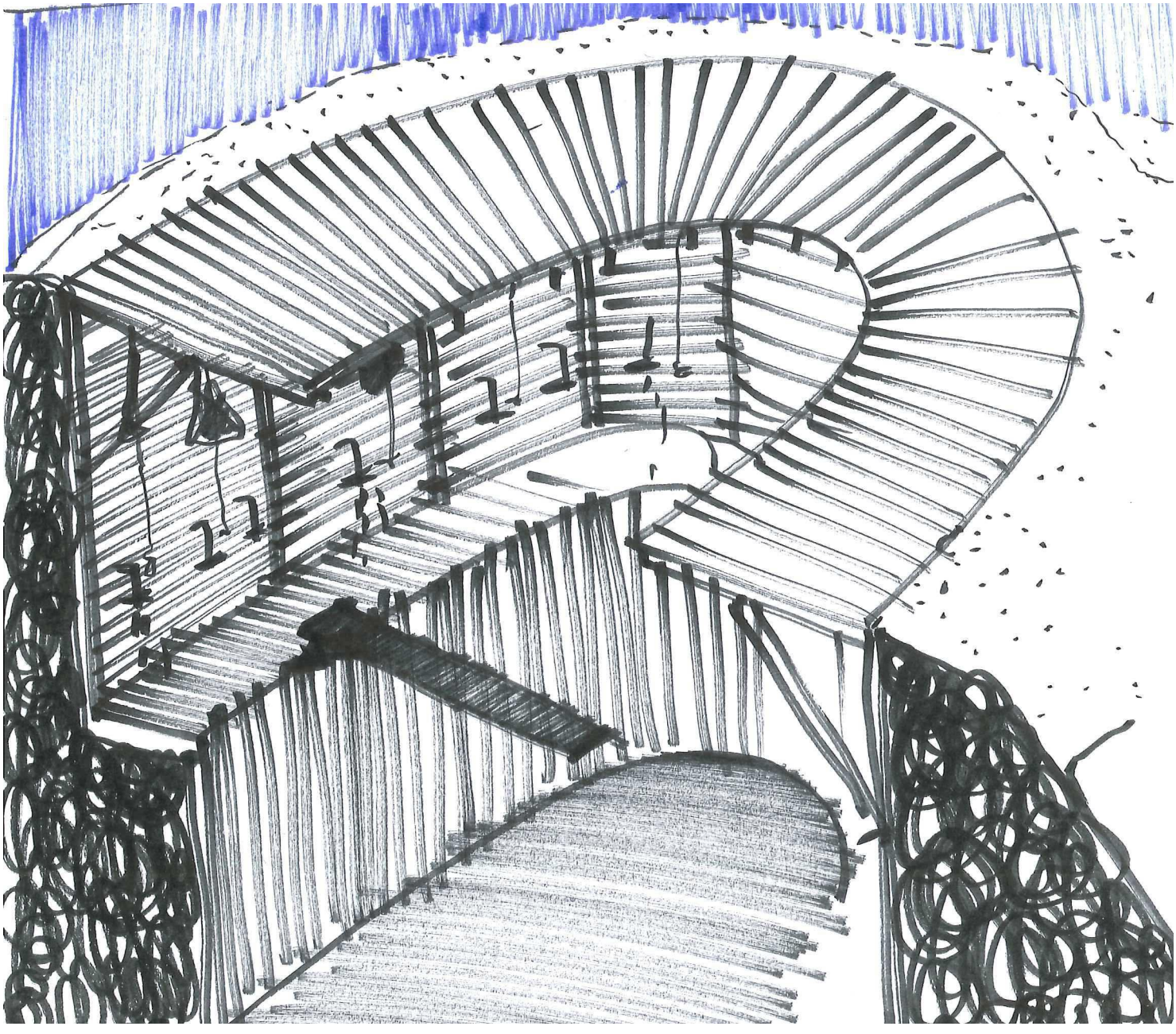


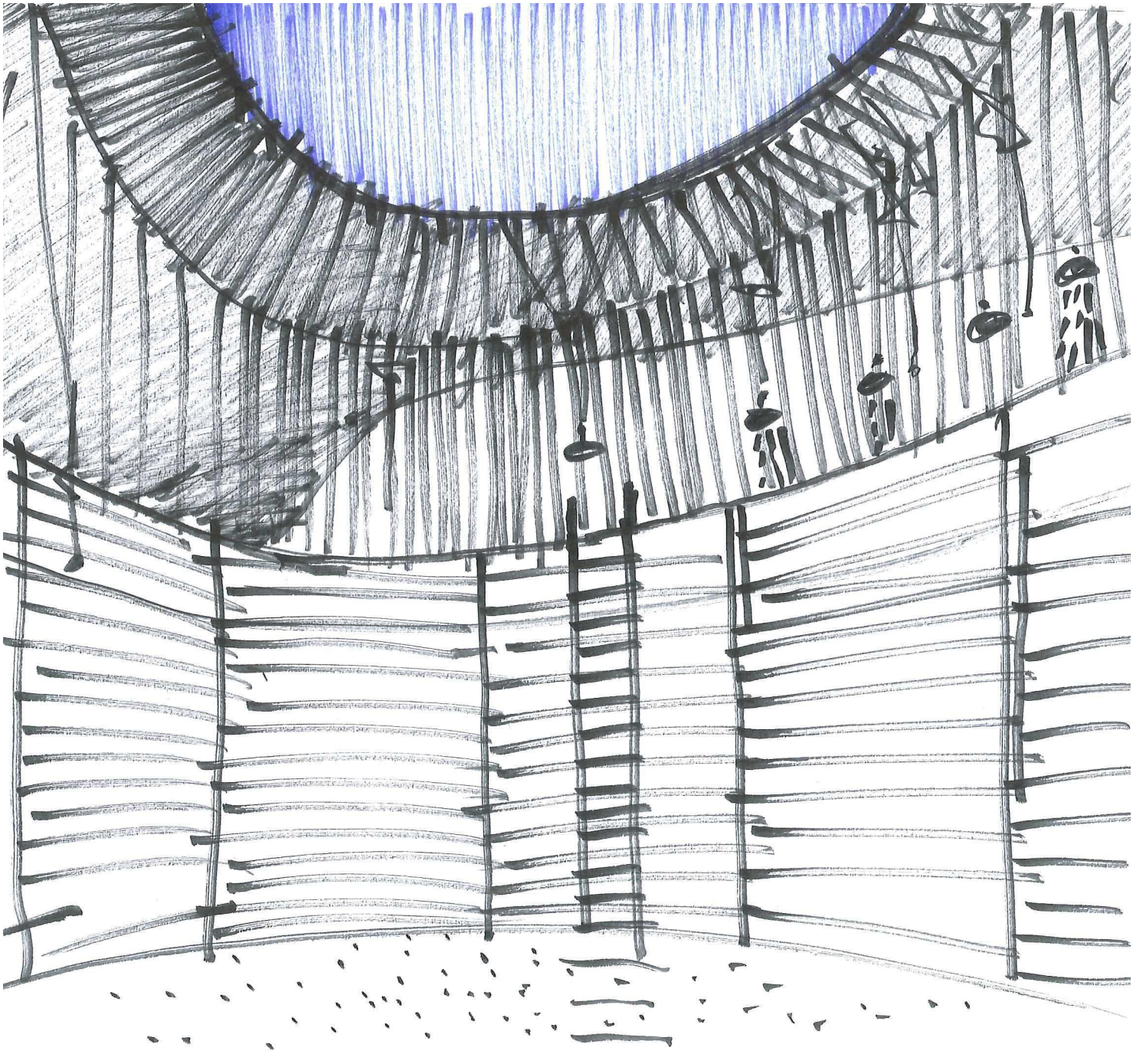


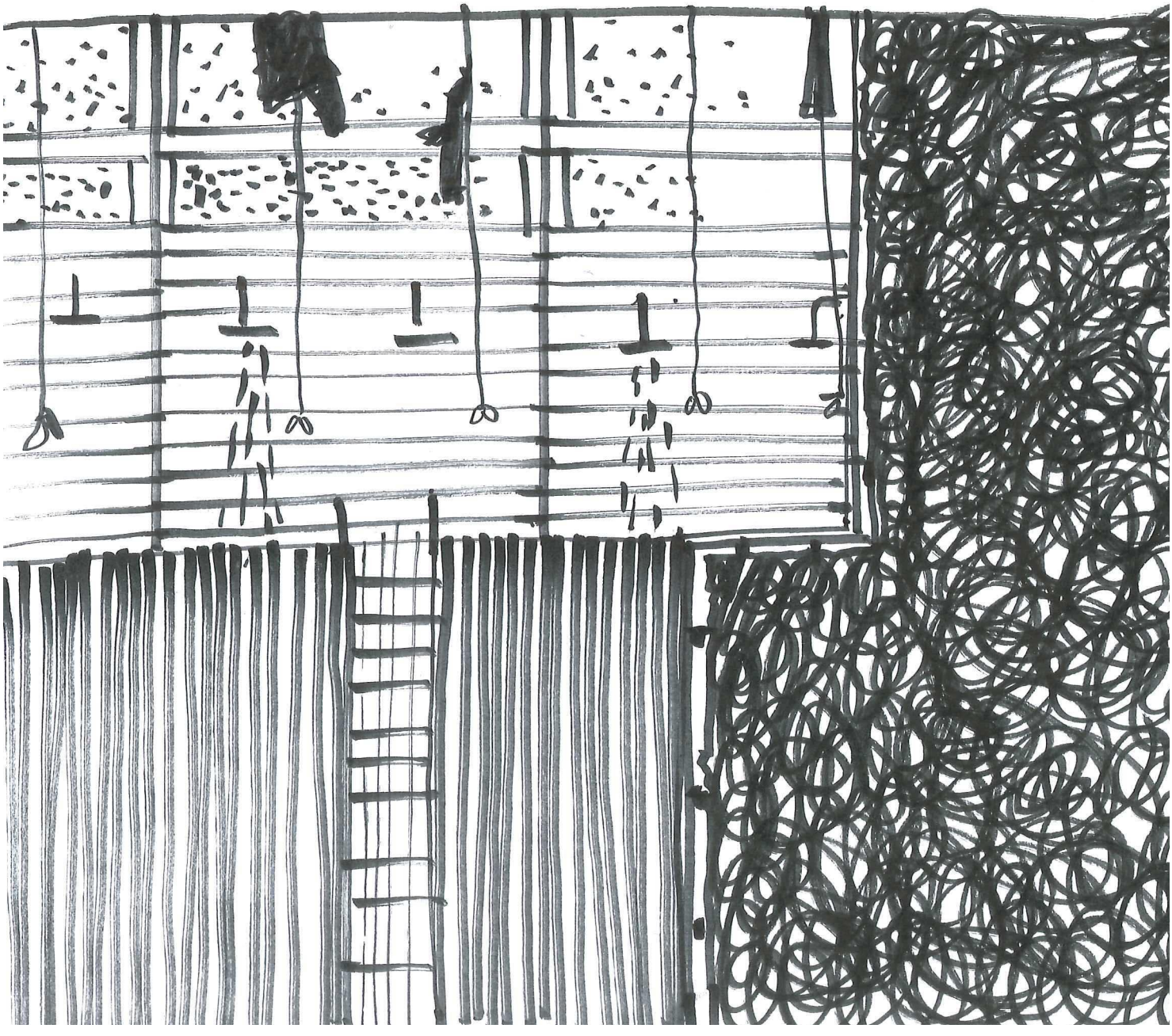












Athanasius Kircher’s Mundus Subterraneus, ca.1664.

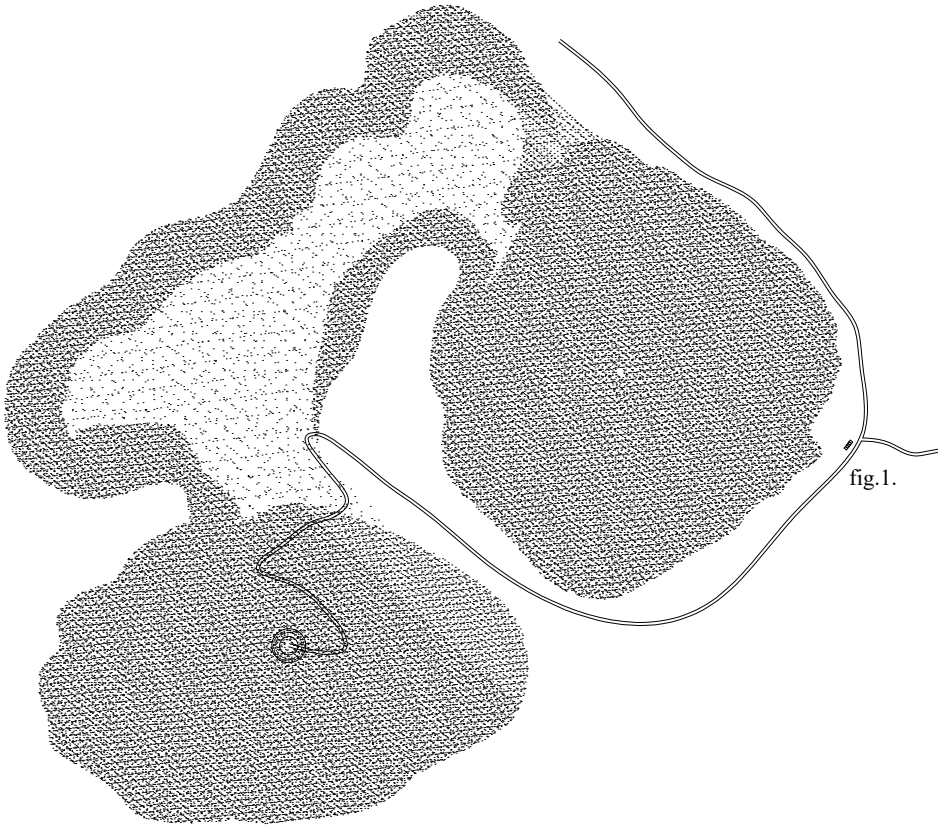
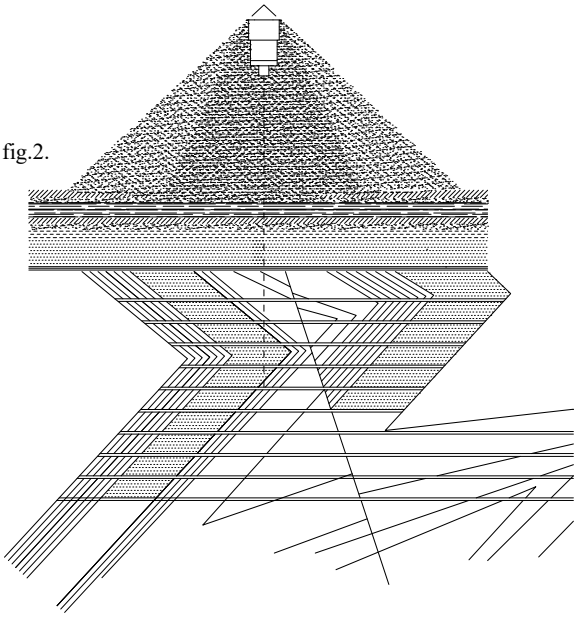


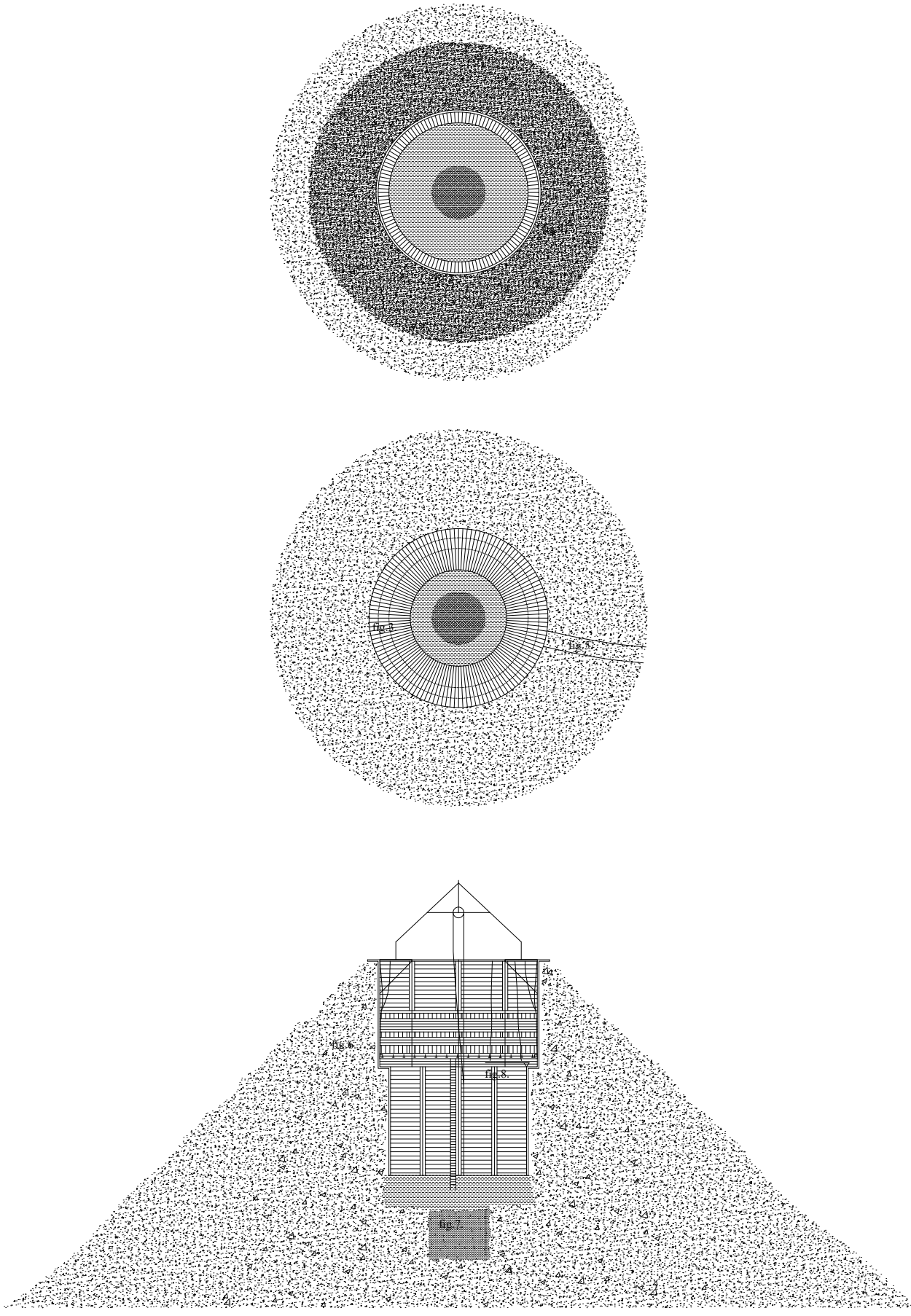
fig.1.

fig.2.



Plan and section of swimming pool in
Loos-en Gohelle slag heap.

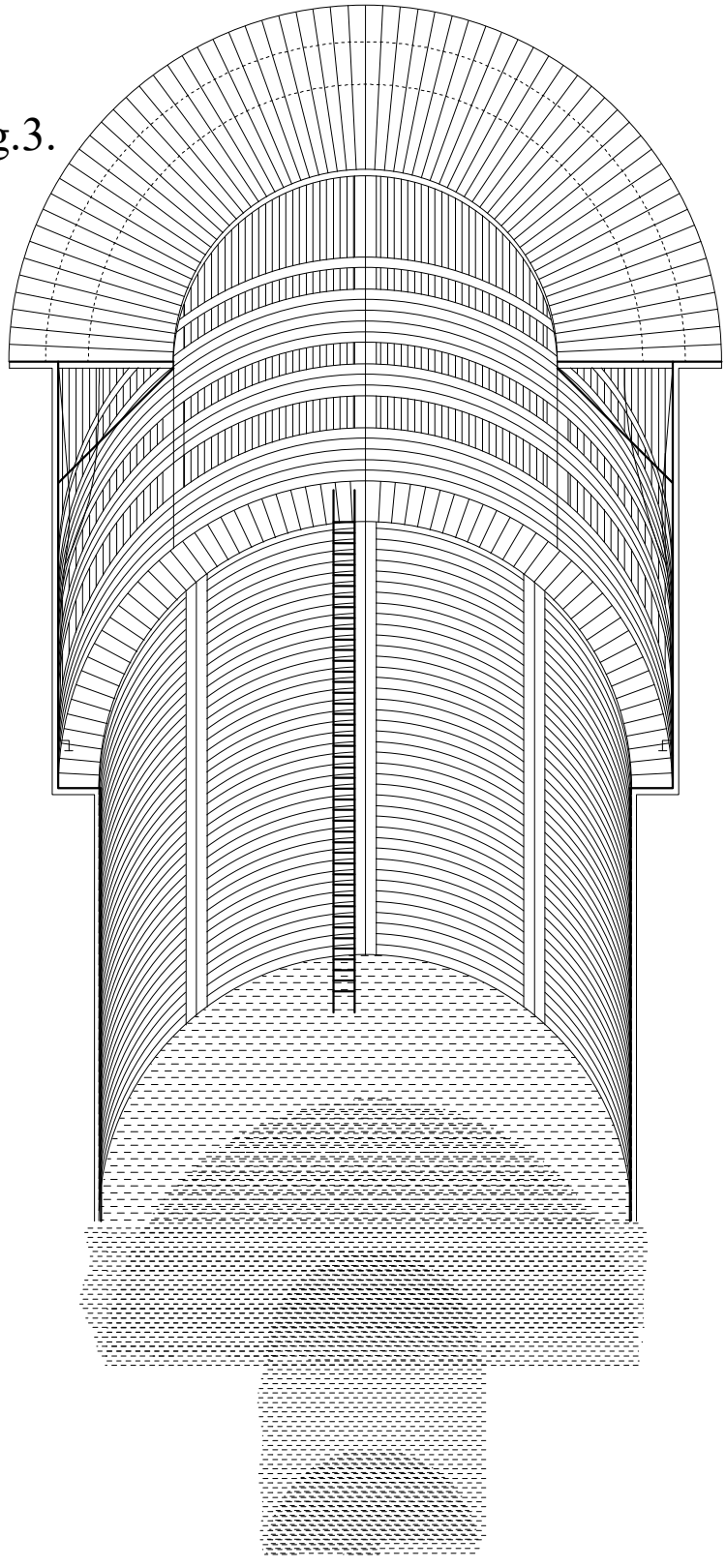
Student's drawing



Plan and section of swimming pool in
Loos-en Gohelle slag heap.

Student's drawing

fig.3.



axonometry of swimming pool in
Loos-en Gohelle slag heap.

Student's drawing

The Hydrophil directly and uncompromisingly longes for the wet. Surrounded by water, the wet body, in its element; only when resting does it seek the comfort of the dry. The Hydro-opportunist prefers a life on land with occasional excrusions into the wet as necessary. The Hydrophob is defined as the melancholic condition of a dry body, affected by strong reservations about water.

These three types can be metaphorically illustrated by three animals: the frog who lives in, the swan on, and the penguin next to, the water. For instance the family of two Hydro-opportunists and one Hydrophob cook out on Sundays, fully dressed sunbathing and uninspired swimming in shorts, floating on rubber mattresses, playing volleyball in pool that become shallower every day-developed not so much in but around the pool.

van Leeuwen, Thomas A.P. *The Springboard in the Pond, An Intimate History of the Swimming Pool,* Cambridge: The MIT Press, 1998.

The first 'floating' swimming school was funded in 1786 by a swimming instructor called Barthélemy Turquin on bathing barge on the Seine river, near the Pont de la Tournelle in the 5th district of Paris(...).

Around a central rectangle, left open for the water of the river, four wooden pontoons were interconnected and covered with decks(...).

By the mid-nineteenth century, bathing and swimming barges had become a familiar sight along the Seine river. Amongs barbershops, first aid posts with beds, changing rooms and cafés, they were accomodating instruction rooms where swimming was taught even dry.

van Leeuwen, Thomas A.P. *The Springboard in the Pond, An Intimate History of the Swimming Pool,* Cambridge: The MIT Press, 1998.

Being a pool-trained I used to seeing 4 sides and the bottom. When the clarity is removed I got nervous. (…) If it is dark it is worse. Thrilling and dreadful.

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A Conversation with an Expert: Rémi Chimot

The Berlage Thesis Project Proposal

A Conversation with an Expert: Rémi Chimot

Submitted by on August 24, 2017

Agnieszka Dąbek

Salomon Frausto
Head of Education

Table of Contents

Name
Rémi Chimot

Title
Environment / Heritage Manager of CPIE Chaîne des Terrils

Date of conversation
16th August 2017

Biography
2007 - 2008
BASE DES EEDF MORBECQUE LE PARC - ANIMATEUR NATURE - Morbecque

2008-2010
EEDF SAINT PIERRE DELS FORCATS - ANIMATEUR NATURE - Saint Pierre Dels Forcats

2010-now
ENVIRONMENT/HERITAGE MANAGER of CPIE Chaîne des Terrils - Loos en Gohelle

Relevance
The CPIE Chaîne des Terrils is an association created in 1989 which operates throughout the Nord-Pas-de-Calais mining area, where it protects, enhances and animates the remnants of the coal industry.

Le parc des Iles de Drocourt.

1.What are the components of Terrils Loos-en-Gohelle? What are the slag heaps made of?

These slag heaps are built only out of rocks from the mine and remains of materials used in the mines: wood. They consist in 20% of sandstone which is a silicate. The extraction of it generates lot of dust that was harmful for miners' lungs, causing an illness called silicosis.

The slag constitutes a type of soil, not native to this region, so plants typical for sea and mountains regions that grow on sand and rocks are present here.

2.Are there any components that could be harmful or toxic?

The material of slag heaps is not harmful because the dust harmful for miners is no longer generated by mining machines. The slag heaps are now used for sport activities such as cycling, walking and climbing.

3.What is the structural stability of them?

The surface of slag heaps is susceptible to erosion caused by wind and rain water. That's why the surface is gradually covered by plants, which roots stabilize and protect its outer layer. We designated walking paths on the slag heaps in order to enable plants grow and reduce the erosion. Trees were also planted on its perimeter to protect the nearby highway from slipping material. Inside the slag due to the process of subsidence the material is more stable. Underground there are still empty galleries that are filled with water.

4.Is the water somehow pumped from the galleries?

The water is pumped from galleries but in this area there are no pumps, there is no water to pump. Water is pumped not in every town. There are some pumps in Avion. The water is stored in the canals located on the surface but I don't know what is the relation between pumps and the canals.

-is there any slag heap?

There is one slag heap but covered with plants so hard to see.
There are some canals in this region but not for all mines. The canals were used for transportation of coal by boat as well.

-are there any underground water canals like for example in mining region in Poland?

There are no underground canals. The coal was transported mainly by trains and belt conveyors. Earlier by animals.
The pumping systems in general is quite expensive. There was a subsidence because of the water in mines.

5.How they were constructed? How are they located in relation to other elements of mine infrastructure?

The cabs, the conveyor belt or trolleys were transporting rocks on the slope, The railway was constructed on the slope, now only concrete slippers exist, and machine turning the cabs on the top.

There were 4 slag heaps on this site. 2 of them were of old type, manually picked. And the existing ones are constructed by machines. So it was 15-20% of coal in the old ones and 1-2% in the existing ones. De difference is caused by development of sorting system. The old ones burnt inside because of high percentage of coal and were exploited after because the red shales that were generated by this process. They are still exploiting the back part which will be finished in a few years.

-and the pattern on its surface?

They were created by distributors that were used to add more rock on the heap.

6.Do the slag heaps generate heat?

Yes, there are lots of slag heaps that generate heat because of the coal that burns inside as a result of chemical reactions. It depends of the composition of the slag heaps actually. Terrils Loos-en Gohelle don't burn but there is an area where it burns a little bit. Some of the burning slag heaps were exploited because during the burning process the black shales are transformed into red shales that are more hard as a rock and can be used for walls and highway construction and sport surfaces: athletic and for tennis.

7.Is there a washing plant in this mine?

There was one but it does not exist anymore.

8.What is your organization doing?

Le Chaîne des Terrils is a committee that is

Loisinord in Noeux-les-Mines

Base des Argales in Rieulay.

transforming the slag heaps into leisure activities spots. We acquaint people with the slag heaps as they are now and in the past, during the time mines were operating. We were created in 1998 to protect the slag heaps from exploitation and because the French government wanted to destroy all the mines in France. This part of country had bad reputation, black picture, regarded as polluted area. Some volunteers, naturalist, realized that some plants and animals in this area should be preserved and they started showing other image of slag heaps to people.

9.Do you cooperate with similar organizations abroad?

We are connected with 2 committees in Belgium, historical and naturalists. In Belgium private people are the owners of slag heaps.

With UNESCO and spot events we are valorizing the site on bigger scale, however it is mostly known in the region. Lots of people are coming here. We researched the people that came here. We know that they come from the area between Lille and Loos-en-Gohelle and Nantes. The is an île de Nantes which has a little bit the same history as slag heaps. There was a big plant that was to be deconstructed. Artist saved the site and used it for cultural activities.

10.Some of the slag heaps in the region are protected by UNESCO. What were the criteria for selection/valuability of slag heaps?

51 are inscribed on UNESCO list together with mining cities and 78 on Sitte de France. The ones that were selected are representative, are big in size, we can see it easily and are part of history of the mines.

11.What did happen/what will happen with not protected slag heaps? Is the material of slag heaps being reused in the region?

There was approximately 300 stag heaps in this region. Now there are 200. Some part of them were exploited because factories wanted to reuse their material, rocks. We will keep 100-150 finally. Lots of them can be used. For instance as ski slopes, for highways construction, tennis and athletic surfaces, layer of pavement structure.

12.Have the slag heaps been catalogued somehow?

There is a guy that made a historical research and photo documentation of every slag heap, Jérémy-Günther-Heinz Jähnick. The organization Bassin Minier has some documents as well related to UNESCO inscription.

13.Are there any examples of slag heap in Nord-Pas-De-Calais region already adopted to new function?

Yes, we have a few examples which could help you even if very few slag heaps have been utterly transformed into projects:
a case of slag heap converted into a skiing track (LOISINOR in Noeux-les-Mines), some into urban parks; a slag heap and subsidence lake transformed into a leisure facility (Base des Argales in Rieulay), a former coking plant into an urban park with 7 “islands” (Parc des îles à Drocourt), the land was extremely destructed here.

Terril des Argales,a Rieulay near Douai-a pond in which it is possible to swim. There was a marsh before the mines. The rocks were put into the marsh and dried it. Lots of marshes were destroyed in this way. After that the material was taken from that site because it contained 20% of coal that was recovered and the site was transformed into leisure activities. It is possible to swim, to fish there and there is an ornithology spot. The water contains lots of black mud but there is no problem to swim there. There are lots of sulfates in the rocks of slag heaps so maybe there are also sulfates in the water.

-and what are the buildings of mine infrastructure used for?

There is a site converted for media, one for history, for sustainable development, for music There are 4 big sites in general dedicated to musem (Lewarde), numerics (Wallers Arenberg), sustainable development (subsidence lake), and for concers (La Metaphone).11/11 is the number of the last pit. It is the site where we discovered the coal in Pas-de-Calais region in 1850 (in Nord region in 1720).

A Conversation with an Expert: Wout Broere

The Berlage Thesis Project Proposal

A Conversation with an Expert: Wout Broere

Submitted by on October 13, 2017

Agnieszka Dąbek

Salomon Frausto
Head of Education

Table of Contents

Name
Wout Broere

Title
assistant professor of Underground Space Technology at Delft University of Technology

Date of conversation
16th October 2017.

Biography
1996
Msc at Delft University of Technology

2001
PhD at Delft University of Technology

2001-2006
independent geotechnical consultant and head of courses and support at Plaxis BV

2006-now
full-time position at TU Delft

Relevance
Wout Broere's research interests include Trenchless technologies, Underground construction in soft soils, Use of underground space, Foundation engineering, Physical modelling & centrifuge testing, Site investigation & laboratory testing. He provided geotechnical expertise for several large tunnelling projects in the Netherlands and abroad, including Groene Hart and Liefkenshoek, as well as on foundation engineering aspects for onshore and offshore foundations.

1.structural stability of slag heaps/analogy to other materials?

The slag is the most dangerous material to dig in. If you look at it, you can see that it has a slope with an angle around 15-20 degrees. It means that it has a very low internat fix of material, simillar to the mount of soft sand or clay for example. That means that the material would fall even if you dig inside.

2.methods of construction in an unstable ground as slag/methods allowing high spatial precision?

Concrete tunneling techniques, Japanese method of injecting concrete-round small sections forming a closed perimeter of space, then taking out the material from the inside. More freedom in section formation. Concrete structure wisible from inside.

Artificial ground freezing process.

Cement injection/ chemical grouting.

Check the projects such as Antwerp central train station, TGV new track constructed under existing building.

3.testing structures/incidental spaces?

If you look on drawing explaining the first mining structures in England, especially those used for testing the ground, you would notice how difficult it was to construct in unstable surface layers (first 50-100m). That's why they invented the technique of freezing the ground.

4.size of internal hollow space/volume of slag?

5.efficiency/costs of various methods?

Tremendously expensive. There was a project of underground dome located in Tokyo, very deep in unstable ground. Not realised because of the budget.

6.structures resistant to movements/earth quaques etc., not anchored to the ground/'submarines like structures submerged in the slag'?

If you want to construct submarine you should remember that its internal structure, supporting the 'shell' is very dense. You would not have a huge open spaces, like in swimming pools, using this kind of structure.

7.timber as structural element?

Forget all mining timber structures. The slag is totally instable, you can not dig/carve in it. It means that every space you construct inside has to support the slag mass that is above it.

8.sections resistant to compression?

All the tunnel structures are characterised by circular section, and the spaces are more or less linear.

9.methods of stabilising the slag and then curving spaces?

What you could do is to construct a concrete tunneland then reinforce the slag that is inside (with cement, glue or whatever binding material) the tunnel before taking it out. Then could curve the material and have this quality of roughness-material visible in your spaces.

10.methods of the slag heaps surface stabilization?

You should also consider stabilization of the surface of the slag heaps, especially if you want people to walk on it,close to the entrance for instance. Even if it does not fall at that moment it could fall after heavy rains.

11.reaction between water, wood, slag?

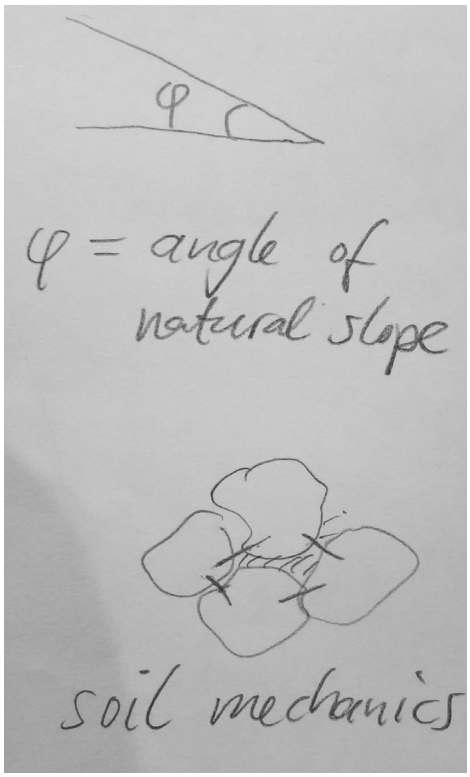
12.underground umbrellas like structures/ceiling stabilization only?

Impossible because the material will fall, At least you would have walls with a slope of 20 degres, whats more it is very possible that the material would fill the entire space. You need to construct a closed concrete box inside.

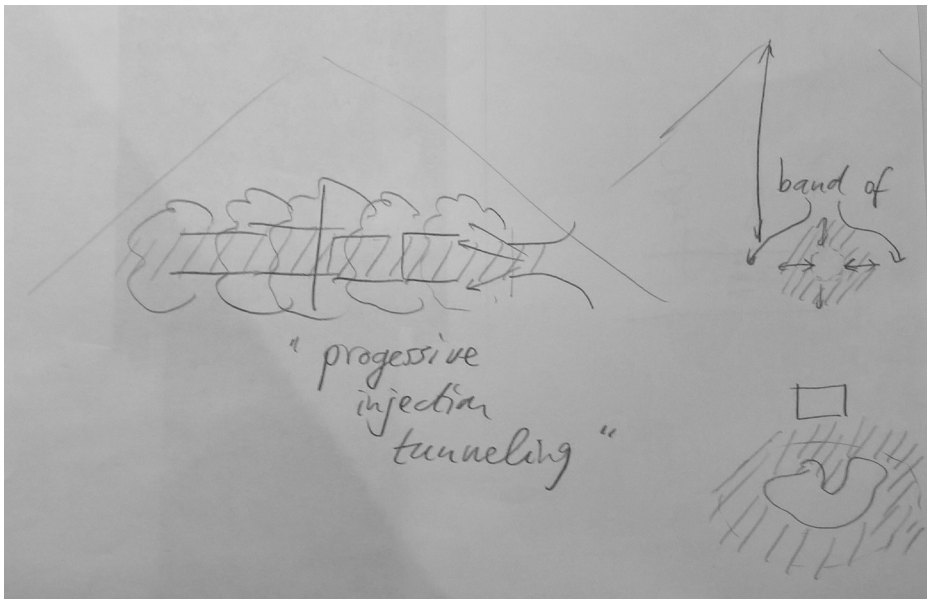
13.methods of stabilization by compression of unstable slag from inside/creation of spaces at the same time?

14.ventilation/termal insulation?

15.graphic symbols of geological layers-section?



picture 1.



picture 2.

Dr.ir. H.R. (Roel) Schipper

What is the.structural stability of slag heaps/analogy to other materials?

Digging in a slag is like digging in a soil so every space you would digged out would collapse, that's why I would reccomend supporting systems, that would keep the soil in place, you could digout parallel with tunneling I think. When the tunnels are constructed they dig inside sth and put away the soil from the inside and meanwhile they are constructing these rings of concrete. And then when the tunnel is ready the pressure keeps things in place, the ring is compressed by all the forces. But in sediments I am not sure... What is the height?

145m

But in general, I am not sure what are the grain sizes but what you can see from the slope, each granular material has a natural slope, it depends on the roughness of the grain. Round grains would have probably more flat slope, while angular agregates would make a more steep slope. In general when you put material on the top of each other you can see this slope, this says about the internal friction (tarcie) of the material. If you think about the water you can not make a slope of water, with fresh concrete you can make a little slope, it is a kind of fluid but after some time it would stuck, you can make a heap of sand but not too steep, but on the beach with wet sand you can make almost vertical walls at a certain point but as soon as it becomes more wet it would collapse due to the fact that the working pressure outside, the grains that would give reaction force to each others, but as soon as the water inside has a higher pressure to push the grains aside then these forces will reduce and the structure will colapse. So there is lots of theory about this kind of things. ...if you need more informations you should contact someone dealling with soil mechanics beacuse it is all based on calculations. (picture 1.)

The question then is what more properities you need to know about the slag. I think this is the most important one beacause this will also determine the horizontal pressure on the shafts. You can imagine if you have a very steep slope of the slag then the horizontal pressure is not very big to the concrete shafts. But if you think about material that is fluid then it will be like pushing the shaft. So let's say the heigher is the angle of the natural slope, the less horizontal pressure it will give to your shaft.

But what I am wondering is whether it makes sense to build in such a structure, what is the purpose, what function you would like to give it?

A swimming pool.

Okay. So let's say a recreational function. So where the water level would be?

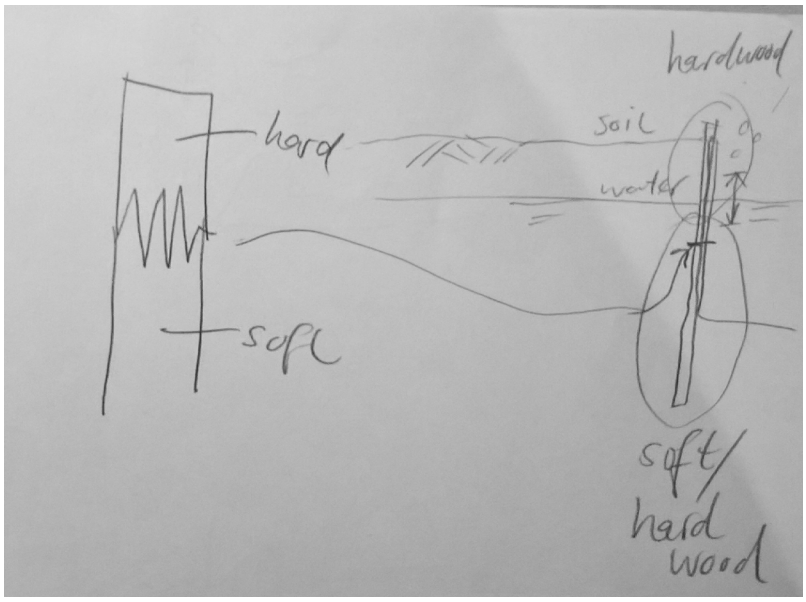
Is the slag heap a really loose material? it is almost 70 year old. Could I construct the spaces inside using traditional mining structures?

With mining activities you dig in a rock, stone, it is not composed of loose particles. Maybe the difference is that there is no cohesion and when you dig the material starts sliding in slag heaps in contrast to rock. In that sense it is comparable to tunnels, you always need a structure around it preventing from collapsing. The most natural way is I think a room.

I think it is a totally loose material. There is a difference between being stable and being let's say... For example if this is your swimming pool, a cross section here, you always need a sort of concrete ring around it. This is a sort of scaffolding system which keeps the grains outside. Because if you compare it to sand, even it is 100 year old, if you start digging in it it would fall appart.

What about reinforcing the slag with a concrete and then carving?

That is possible but sometimes it is done with tunnels. Well, yes, I think it is possible because, it would be sometimes also done with... ok let's take another example. if you need a... as soon as you are making a parking garage under a building with timber pile fundation, in a soil for example like sand, one of the methods is strenghtening the soil with a concrete injection or junjection of other material. So what you do is an injection of mortar that is a a mixture of sand and water with a little bit of fine sands. It is a very fluid mixture that is injected via injection needle that is a tube with a certain diameter. You can also call it grout, which is a cement with a water with a bit of sand, a very fluid mixture, and then what happens is that in this skeleton, if you zoom in to this, if you have sufficient pressure then let's say all these holes are filled with this grout, and that works as a glue. This is let's say a glue and it gives you cohesion. So that means indeed that after it has hardened you could carv a little bit through it. When you are actually building a



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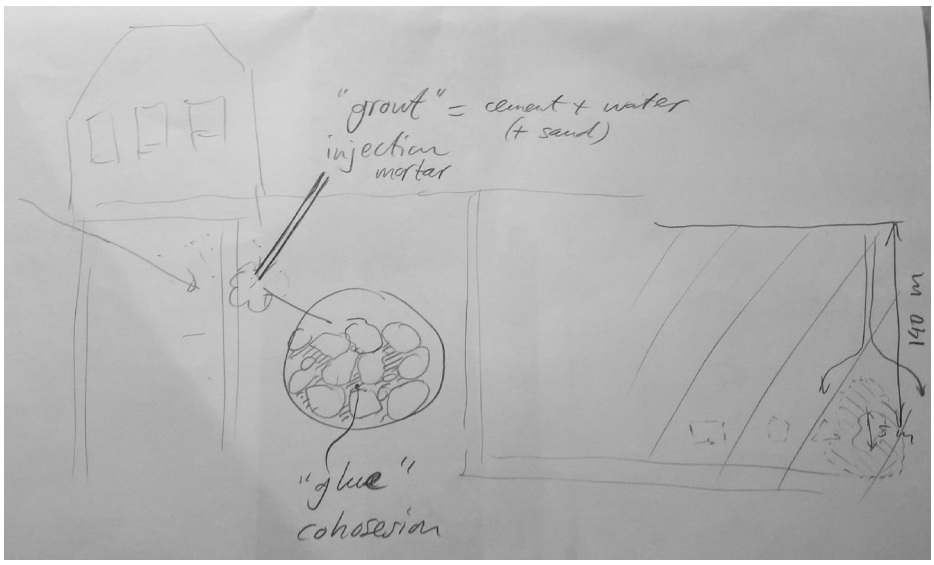

picture 3.

sort of...this is actually your thing, you should think about let's say maybe first injecting in that direction, if you look at it from the cross section and it is your intended shape you may need, you need to inject a bit around it and not everywhere. This is the top of the heap. Maybe you need a certain bend aroud your intended section. (picture 3.)

What is the proportion between the hardened material and the hollow space within it?

Well thereis some kindof proportion, I am not sure which one for example is trasferring the pressure. Because what happens if the whole weight of the hill needs to go around. It depends on I think it is a bit difficult to predict this and I am not completely sure... at a certain poin you start here and you can do the injection, than you can continue from this and another injection and continue and another injection ... so it is a sort of progressive system in which you dig in yourselves in a heap and then inject everything that is around you and then dig into the hardened material untill the end of the hardened material and then dig again.So some sort of progressive injection tunnel. I am not sure it exists, but... (picture 2.)

I would like to have more freedom in creating spaces within this material. What shape of section could I dig in?

Of course the circular section is in terms of The circular section gives you an easy flow ofthe material around it. But I think it is feasible to do sth like sqare, triangular... As long as the layer of the material that is hardened is big enough. I am not sure if you need to do that also here. What you can do is the calculation what happens with different shapes, or maybe something more freeform. You can start with a layer of simillar height as the maximum section, so maybe you could start with a layer of 5 m that is hardened. This is a high technical problem that could be solved with analitical methods. In reality people are using softwears to asses how thick should be the layer to hardened it.

For the vertical shafts you could think of a method that is called *dipwandgrijpen,*which is a method which is...

I think I might be smart to contact a geotechnical department. This is sth that could help you. This for example, they made piles for sort of mixed sand and grout mixture, they did it before excavating, a sort of vertical drill which makes a sort of mixture of the cement and grains that were already there. After hardening they can dig it. So these piles are actually the initial soil mixed with sand and mixed with cement. It is a drilled piled wall. This is also sth, a project in Netherlands based on injecting a sand from the dunes with cement and after after hardening excavated a sort of oppening in. If you search for drills piled walls things like that or a grout injection that could also be a good structural method.

For subway tunnels in Netherlands we use quite often system which they dig a one 1 m wide oppening in the ground and fill it directly after with sort of heavy suspension that prevents collapsing and once digging is ready they cast concrete inside and the fluid is again taken out, but it also works in soils like clay that are water resistant. It is a sort of structure that is useed in Netherlands to dig quite deep. Metro stations are made in this systems (diepwandgrijper). You can also put the reinforcement before casting the concrete. So actually creating a concrete wall inside. So first you are pouring the fuid in directly so it doesn't collapse. After you lower the reinforcement system in it and after you cast the concrete and the fuild is pushed away. This is for many Dutch metro stations, for example in Amsterdam. So if you put fluid inside and them from the bottom up you cast concrete untill the concrete level arises then you might take away the fluid that can be reused in another wall. It is a sort of a continous system. While diggin a pit you can make some sort of a rectangular/circular system. Last thing is that with this system you can go quite deep, 40-50m is not a big issue.

Submarine?

The most important thing is that the structure that you dig in is strong enough to resist the weight of the slag. So it's would be quite strong. But at a certain level I think it does not really metter how deep you are in the slag because...at certain point the loads go around it because the granulat lacks some kind of interconnections. ...I think it would be possible to dig a tunnel without any support...I think that the granular material in general is able to withstand such local interruption. But for the safety of people I will never allow people to go there without stabilisation. Its like on the beach, you can make sth that stands for a short time but is quite vurnelable to changes so you always need to fix it with a shell aroud it of concrete, sth that you just cover inside.

Thermal insulation of that material?

Well, I do not expect it would be necessary. In general what you can see is that if you go in a basement of a building the temperature is standing at the same degrees. It does not make sense to put an isulation aroud the basement because at certain point you will see that, a sort of stationary situation, which will not change that much because it is really heavy surrounding which is not changing easily. Are you planning to heat the spaces? Any energy lose expected? You can imagine if you have no heat maybe there is also natural flow of heat comming from the earth.

I was thinking about using a mine water, that has a quite heigh temperature.

So what are the needs for insulation: thermal comfort for people, that could be a reason but if you have a circumstance that is a sort of stationary, stable situation, energy savings? I think that the material is a sort of a natural isolator already because it is a good insulator in terms of heat as it is very thick, it will not experience any weather changes. So as soon as you start heat it with the mine water maybe at the begining the whole surrounding will get warmer, btw 40-50 degrees is not very pleasant for human beings. It should be a warm temperture, a bit higher, let's say about 25 degrees. So that is something you should be carefull with. For sure you need the ventilation for hyghenic reasons and the safety because I am not sure what kind of gases will emite this material. Maybe it would be unhealthy for human beings.

Could I fill the slag hardened with concrete structure directly with the water?

I think you should be able to make a water tight system. Sometimes they leak a little bit so you should assume that there would be a certain percentage of water that would come through. But it should be sort of water tight, not perfect. but with this cement system it should be able to make a water tight environment.

Timber as a cladding system.

Where are you going to use it, I thought you wouldexpose the natural aggregates (kruszywo), the slag? Timber on the ceiling?

I am not sure, for the structure you could use a tropical hard wood. Theya are quite resistant. You could use the European soft wood unless it is not exposed to oxygen because if you have sth exposed to oxygen and and heigh temperature it would start deforming. Under water it is not a big problem I think, above the water is not a big problem, what is the most critical thing is having water sometimes and sometimes not. That's why you need probably a hard wood. This is the soil, this is the water level and this is the most vurneable part because it will be sometimes dry somtimes wet, a lot of oxygen can come here...so hard wood for these parts, you could do the soft wood and hard wood. I know systems that are made by IKEA of hard wood with soft wood that are glued together. This kind of wood could be used on this level. I am not sure which type of soft/hard wood exactly to use but there are specialists. (picture 4.)