Le Cetine di Cotorniano

Final report

Written by Teen's Voice

2021/2022

Index

Introduction

what would you answer if I ask what is the most important thing that you have learnt from pandemic? We would say cohesion! Little did we know 2 years ago that we would have faced such a tremendous time where death returned to be an everyday matter and fear dominated lonely hearts.

Living inside such an historical period made us realize that the only way to survive in this planet is teamwork, cooperation, trust in each other, in what we are and in where we live gaining awareness of being part of a huge ecosystem called Earth. In other words, we have learnt what cohesion means: trust, culture, social and economic welfare of a community.

Elaborated the concept, we were looking for an opportunity to make a hands-on experience. When our teacher proposed the project "*at school of open cohesion"*, we were looking forward to start working on it conscious that it would have enriched as both from the professional side and the human side. And we were not let down!

As you will read in this report, we have become real detectives and by working together we solved the mystery of Le Cetine an abandoned mine, whose process of decontamination is stuck due to bureaucracy! We felt really attached to this mine and soon we were dealing with laws, administration, experts and archives…

Le Cetine represents our redress against Covid that has taken away our Fun, conviviality and cooperation but as we have learnt ""Happiness can be found, even in the darkest of times, if one only remembers to turn on the light." (Albus Silent- Harry Potter)

Our choice

Choosing the topic of our work wasn't a piece of cake! We were looking for something that could have combined both our needing of developing technical skills, in the environmental management sector, and our needing of strengthen our bond with the territory. Therefore, when Le Cetine popped up, we seized the opportunity of fulfilling our aims! In fact, this project required us to deal with not only with the procedure aspect of the project but also with environmental restrictions and different laws regarding the decontamination. Plus, it helped us interact with the public administration and technical offices. It does not happen all days!

Presentation of the team

Our team composed by all the members of the 5A-enviromental and territorial management- of the agrarian school in Siena. There are 12 of us in this group, each of which has a specific role in the project:

- Head of the project: Tania Monti
- Social manager: Dario Giannini and Dario Arzilli
- Designer: Silvia Dominijanni and Mattia Piazzesi
- Blogger: Samuele Santoni
- Picturegrapher: Niccolò Campinoti and Libero Borgogni
- Writer: Giovanni Riforgiato, Matteo Zanzarella, Filippo Lavacca
- Coder: Giorgio Manganelli

Picture 1: teen's voice team

We have been helped by our professors: Gori Fabio, Mori Isabella, Chiello Alessandro, Guarnieri Valentina, Gazzarri Riccardo, Ricci Anna, Invidia Maria Paola.

We have chosen Teen's voice as our name to enlighten the teenager's role in the civic reality and the make the world understand that, also, our opinions, our "voice" counts. Our logo represents our idea of cohesion that starts with our roots, our tradition and ends with the future that will be made only by cooperating.

Picture 2: our logo

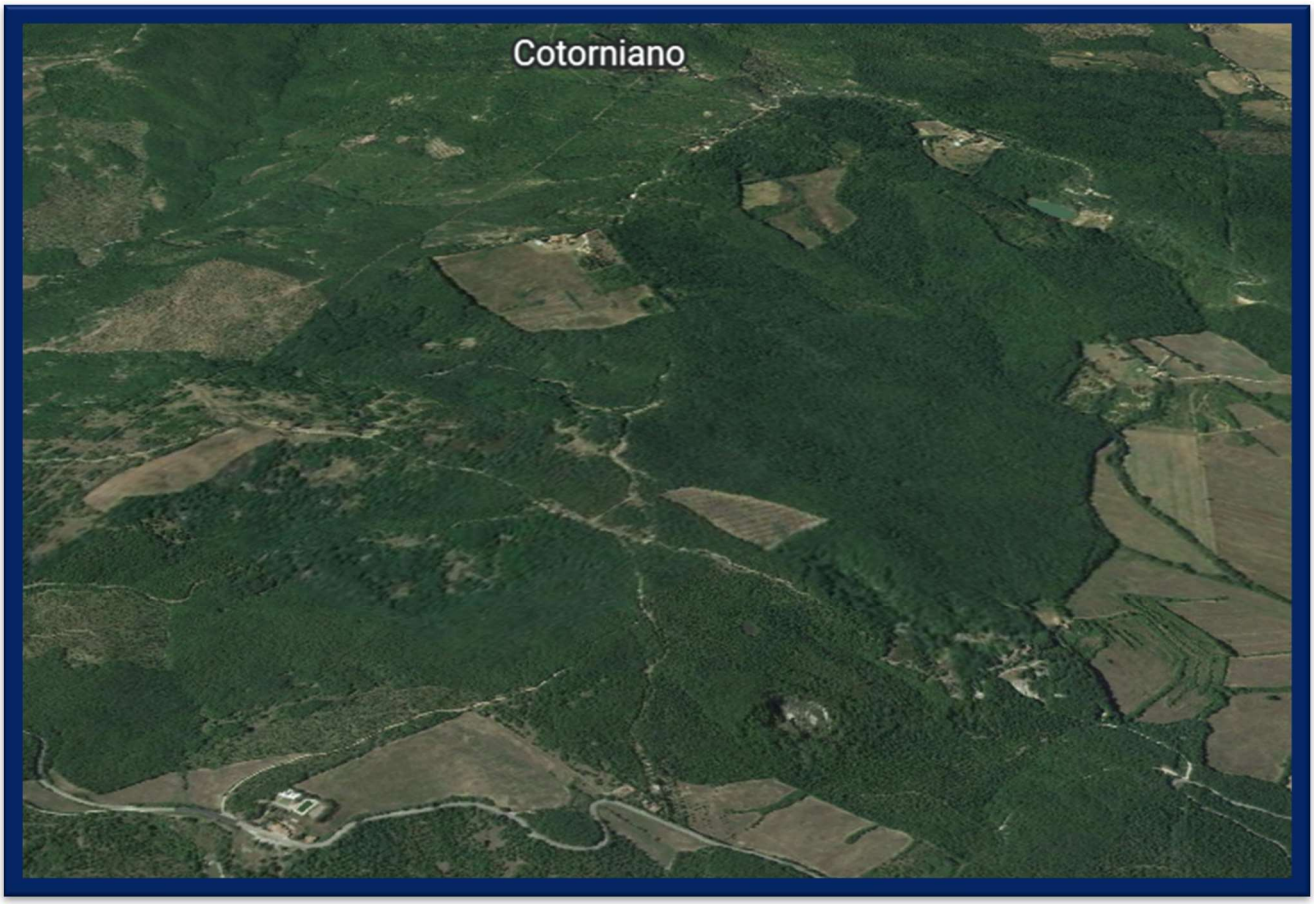
In order to simplify the work, we have splitted in 3 mini-groups, each of which developed a different matter of the project. Here they are:

- SMS. This group worked on the chemical interactions with the environment and the decontamination legislation and procedure
- DDT: This group worked on the environmental and territorial management. In other word, it studied the legislation that protects the area from an urbanistic and landscape point of view. It studied also the geological part of the mine.
- MRGP: this group works out the history of the mine.

We shared the information by debating in class and by posting them in our shared drive.

(Watch our video presentation. Click here)

Sources



Picture 3: 3d view of Le Cetine (for a better view click here)

In order to produce this researcher, we have consulted firstly the material given in OpenCeosione website. Then we have made interviews to experts and local administration. Here they are:

-Luciana Bartoletti, the major of Chiusdino;

- Giuseppe Protano, a geologist of the UNISI (Università di Siena);

- Maria Francesca Pia, the archivist of Archivio Storico Minerario di Vilasalto(Sardegna);

- Gaetano Zanchi, a freelancer mineral engineer;

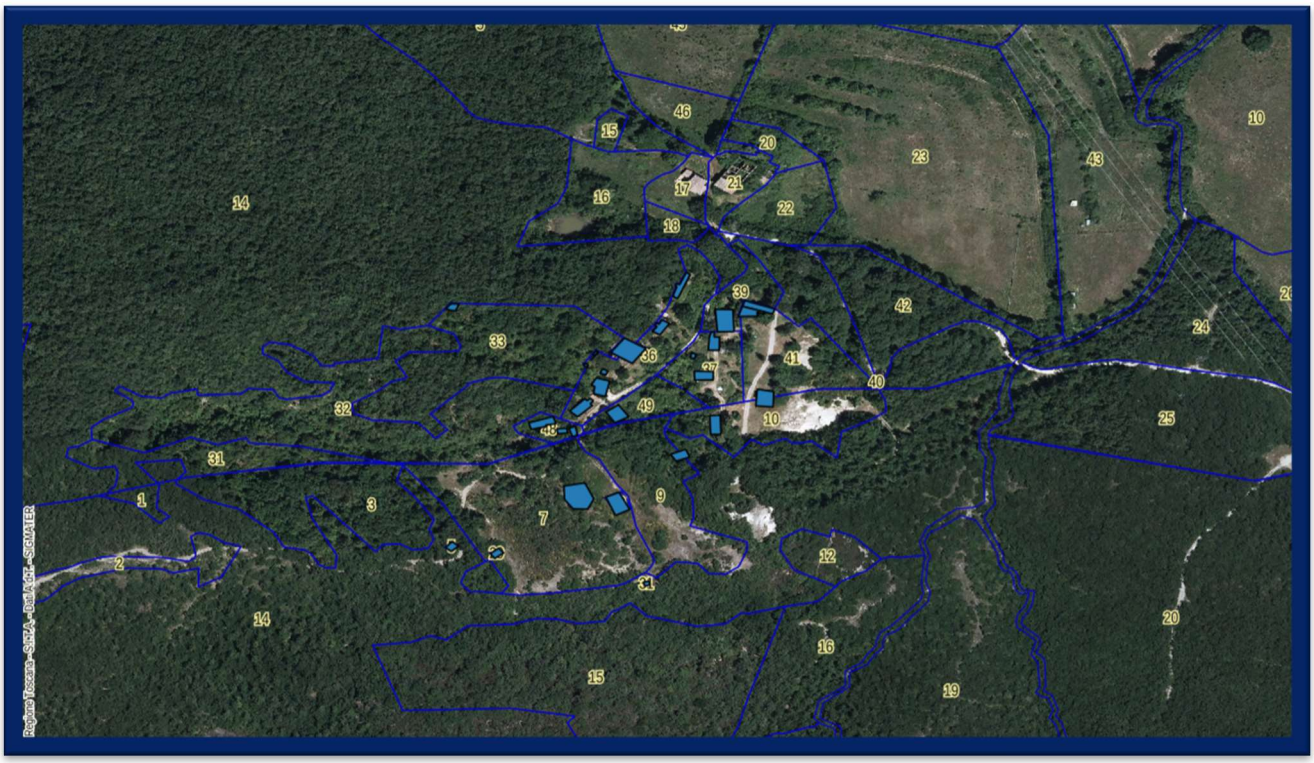
- Alessandro Masotti, the geologist in charge of the mineral park. He asked us not to spread the information that he has given;

- Grazia de Nittis, archivist of the National Archive in Siena;

- Guerranti Francesco, official of the regional pollution and decontamination office in Sienese Territorial Headquarter.

We have also visited the area gaining awareness of the current state of the mineral site. (watch the video report of our visit. Click here)

General Description of the site



Picture 4: air view of the contaminated site (the blue spots represent the buildings)

Le Cetine is an abandoned mine located in the Chiusdino' municipality, in the district of Siena, close to Colonna di Montarrenti, in the hidrographic basin of Rosia Steam in Colline Metallifere. It is around 325-405 m s.l.m and it covers a surface of 128.600 m^2 splitted in according to the operative project:

- 50.300m2 of landfills and mineral plant
- 17.400 m2 of ex mineral village
- 60.900 m2 of woods and quarries

There are a few buildings left of the mineral village, most of them are ruins, but some are actually inhabited by privates. The main ones are:

•administration building;

•accountant house;

•corporal's house;

• technical buildings: carpentry, storehouse, stable, electric cabin, selecting canopy.

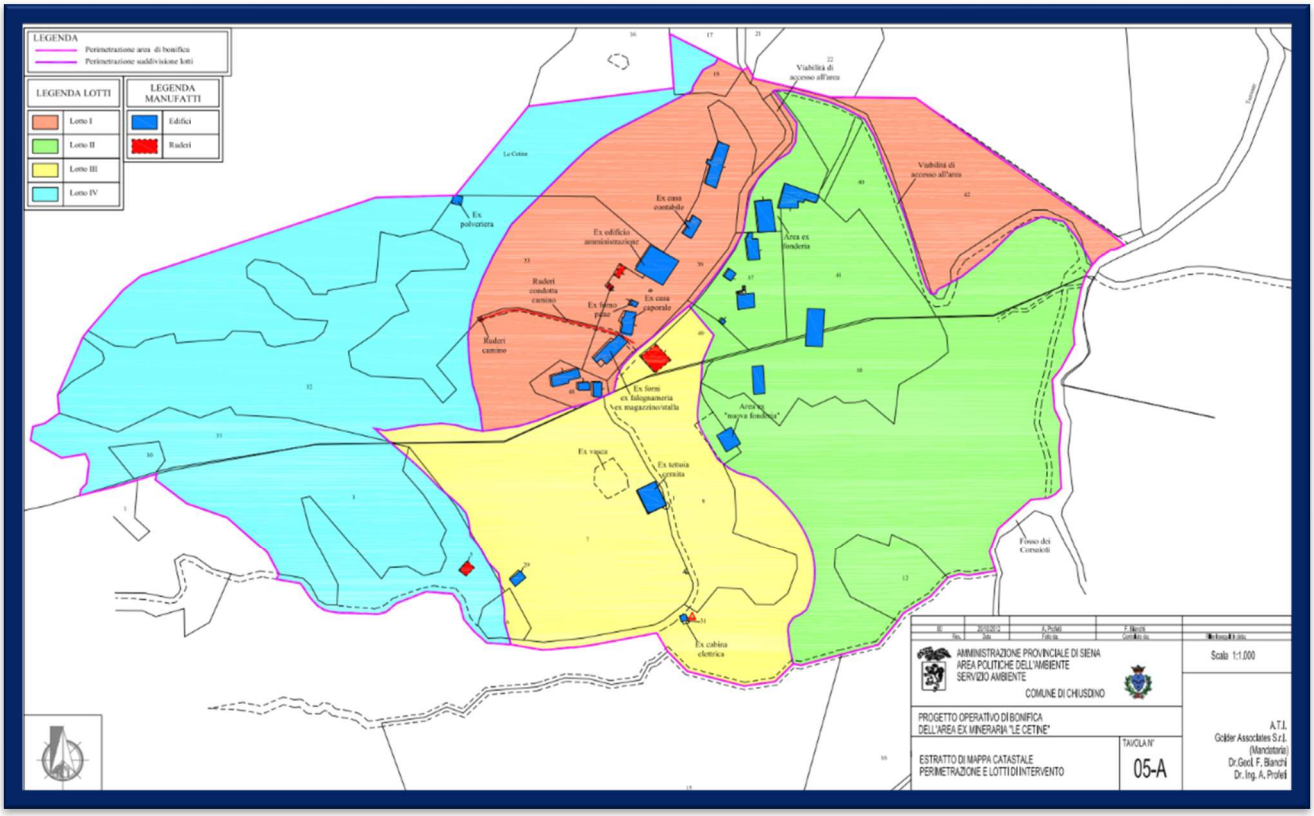
The abandoned mine was exploited for antimony and it had lots of galleries build up throughout its history that are:

- Level Bice, 394,5 m s.l.m., located in the western side of the mineral canal, it has 2 entrances
- Level Henfrey, 377 m s.l.m., contrary to other levels it isn't connected with the rest of the mine and it has a ventilation gallery
- Livello Intermedio Alto, 373 m s.l.m.;
- Livello Intermedio Basso, 365 m s.l.m.;
- Galleria Garibaldi, a quota 360 m s.l.m.

The levels were connected by little wells and they were reinforced with wood structures, that nowadays are damaged. Inside the mine there is landsliding risk.

The ownership of the site is partly regional (the north part) and partly district (the south part), and some areas are private property.

The project



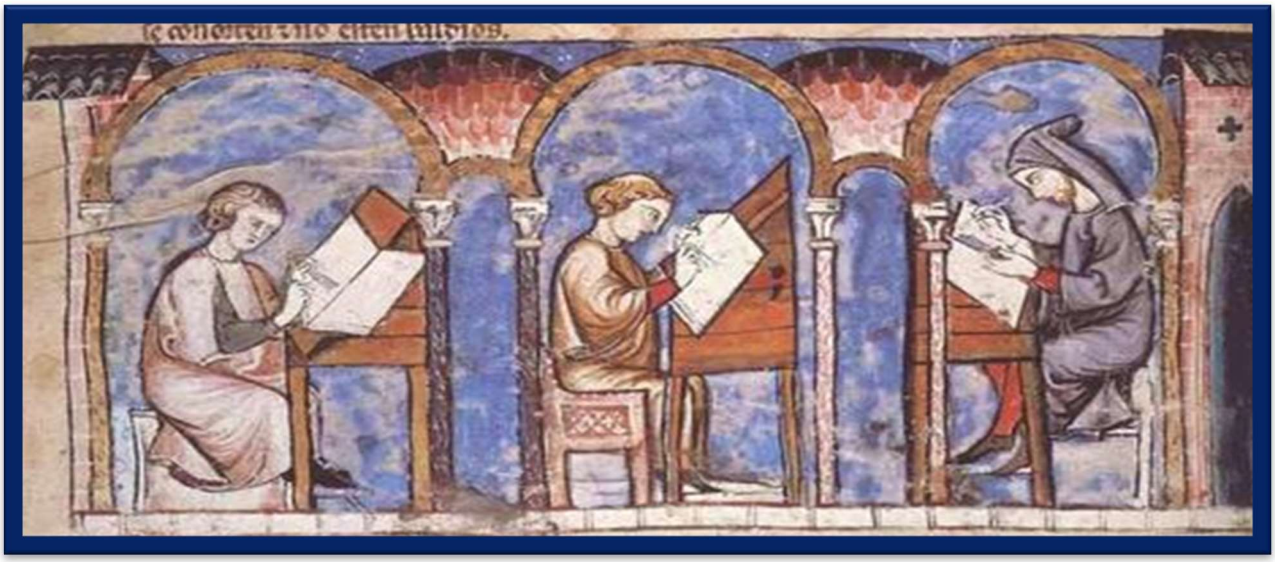
Picture 5: map of the project

The project consists in decontaminating and making a long-lasting security in the mineral site. In fact, there have been found high quantities of antimony beyond the legal limit in the soil for the residential areas which is 10 mg/kg according to D. Lgs 152/06. Antimony seems particularly high in the landfills. Specifically, the action consists in:

- Waterproofing the area by covering the interested area with geomembrane and soil in other to let the vegetation grow. Indirectly this leads to the creation of a drainage system for the rain waters to avoid as much as possible their contact with the continued soil. This system should and with a permeable interactive barrier that by electrostatic and chemical interaction shell eliminate antimony from the water.
- Around the buildings, the project establishes the replacement of 50 cm of ground surface, in order to allow gardening activities or small vegetable gardens, provided they are made with plant essences with low root penetration), replaced with 40 cm of low impermeability soils and 10 cm of soil vegetable.
- Securing the landfills from the risk of landsliding by reshaping it and creating terraces and compact them. On the landfills, after modeling, the distribution of 50 cm of soil is established, of which 40 with low permeability (which become 25 on the slopes, but surmounted by a refueling grid), and 10 cm of topsoil. There is no waterproof sheet, and the 10 cm of topsoil was judged insufficient during the approval of the Services Conference.
- Urbanizing construction as sewer and a fit depuration system (that use root absorption for cleaning sewer's water) in order to make the area residencial, therefore suitable for living.
- Pulling down some ruins.

It is provided also the improvement the accessibility for the operative means.

Antimony: a flower or a poison?



Picture 6: Monks

Tuscany is the second most mining region in Italy after Sardinia. And, in Tuscany, the mining areas the most important are two: Monte Amiata and the Colline Metallifere, especially in the Grosseto area. The Cetine di Cotorniano mine is located on the edge of the Metalliferous Hills, and here too it is formed a reservoir as a consequence of hydrothermal phenomena present throughout the area, as a residue of a previous intense volcanic activity. It was formed here because there were the right conditions: a small outcrop of cavernous limestone, rather fractured, where the endogenous fluids pushed by deep pressures could infiltrate, and an impermeable cover of clays, which forced the fluids to stop and cool, so as to form antimonite (antimony sulphide). Even today, a few kilometers from Cetine, three putizze that emit gases containing antimony, the subject of recent studies by the University of Siena.

In the area there were other antimony mines: a very small one in Vallerano, witnessed only by one cross on an old map, a small Tocchi, a larger one in Casal di Pari, and then in Pietratonda. Antimonite, due to its shiny gray color, has always fascinated.

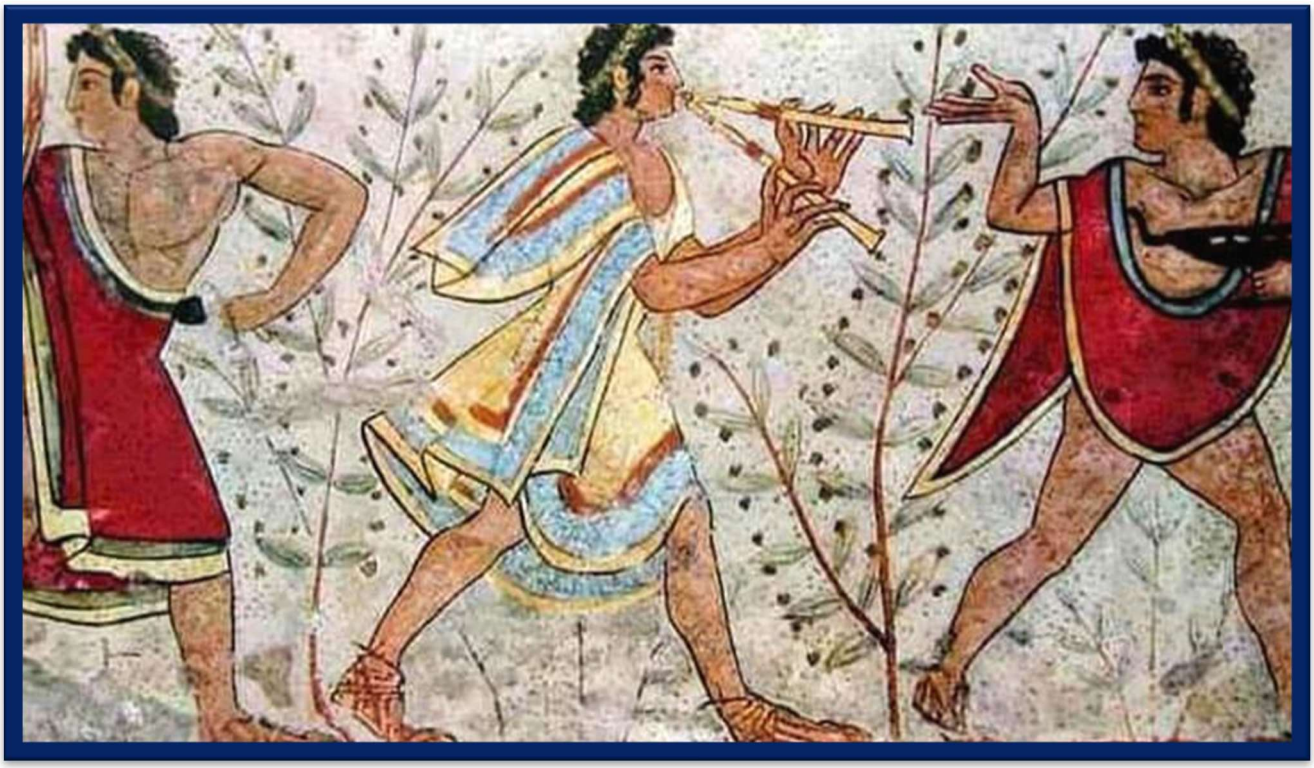
The origin of the name is uncertain. Some think that it derives from the literal meaning the Greek words *anti* and *monos* literally "opposite to loneliness" because it was thought that it could not have been found in his native status. Others think that it comes from the Arabian I *antos Ammon* literally "Ammon's flower. But the most curious theory is that it derives from the word's anti monks. In fact, in Transylvania during middle age it was used by monks as a drug for stomacache. But they took in excessive doses therefore they died poisoned. Nowadays it isn't proved that antimony alone can cause cancer but it is considered "*possibly carcinogenic to humans*" by IARC.

Excessive exposition can cause vomit, arrhythmia, lungs fibrous that could ultimately lead to cardiac arrest according to the regional chemical database.

In the Metalliferous Hills there were also mines of silver, lead, zinc, copper, pyrite: all minerals that have made the fortune of these lands, from the Etruscans to the Republic of Siena (its possessions they also included Grosseto), until the 1900s when the mining companies collected profits and generated jobs, leaving landfills as a legacy of the community. Some, such as the red and deeply engraved roste di Boccheggiano, are an attraction tourist and will be left intact for their beauty. Others, but not all, have been included in the Plan Regional Decontamination. Some mining areas have been acquired by the Tuscany Region, which is now the responsible party: in fact, "The burden of remediation lies with the person who caused it pollution, jointly with the owner "(art. 5 paragraph 1 DM 471/99). The Cetine project is therefore part of a larger project: some landfills, especially in the Grosseto area, have already been decontaminated, and also destined for a mining park. Now is the time for the Cetine di Cotorniano mine. It is 16 km away from Siena as the crow flies, but scattered among the mountains in a sparsely populated area, so only a few know it.

Etruscan, priests, royal family: first light of Le Cetine

Antimony seems to have been extracted in the area since VII b.C. when the Etruscan mined the superficial veins. They used it as a coloring substance for make-up or as a drug for healing illnesses. After the Romans conquest proved by the ruins of an ancient roman villa that have been found in the site, antimony started to be trade all over the roman empire. The Romans were the first to name the mineral as stibium (as written by Plinio il Vecchio) and from 800 a.C it was named antimuonium.



Picture 7: Etruscan

In Middle Ages, Colline Metallifere was pointed by noble local families like Aldobrandeschi, Gherardeschi and Piccolomini who granted the permission to mine by acting directly or with the permission of the religious institutions. As a result of this lots of mineral castles were built like Montarrenti and Miranduolo, vital for the trades and the organization of the mineral extractions. The mineral activity was economically important and it was aimed especially by the needing of material for the money production: silver and copper.

The main street of communication was Francigena a pilgrim's road. Pilgrims were often protected by templars and that is why nearby Le Cetine there is a templar fort. We think that the presence of Francigena derives from the presence of an important abbey called San Galgano (famous for the sword in the stone). Not only was this abbey important from a religious point of view but we have discovered that it was also extremely advanced, talking about the surveys of mineral techniques!

Picture 8: San Galgano's abbey

Many important mineral discoveries have been made in this period. For instance, Vannuccio Biringuccio a Sienese researcher discovered how to isolate metals and he explained it in a best seller book called De la Pirotecnia (1540), in which there is the testimony that antimony in Siena's nearby was known.

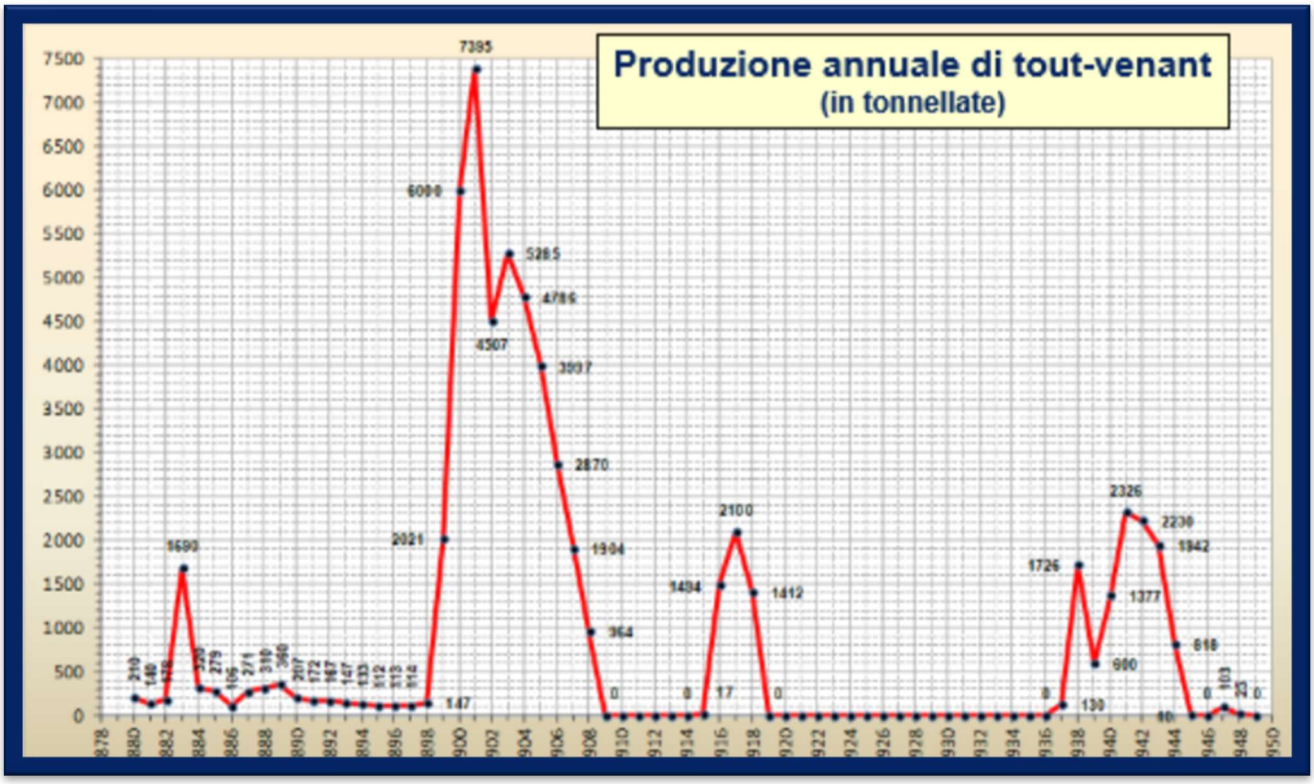
During renaissance Piccolomini, a relevant Sienese family, restored an ancient fort and created Cotorniano farm which they will owned since the interwar period.

The ownership of the current mine and the mineral village therefore was initially Piccolomini's. The area of the landfill and a few buildings more was instead of the Palazzo al Piano farm, owned by another important Sienese family: the owner was Fabio Chigi Luccherini Saracini since 1877, and afterwards in 1906 of his nephew Guido Carlo Chigi Saracini.

Picture 9-10: family emblems

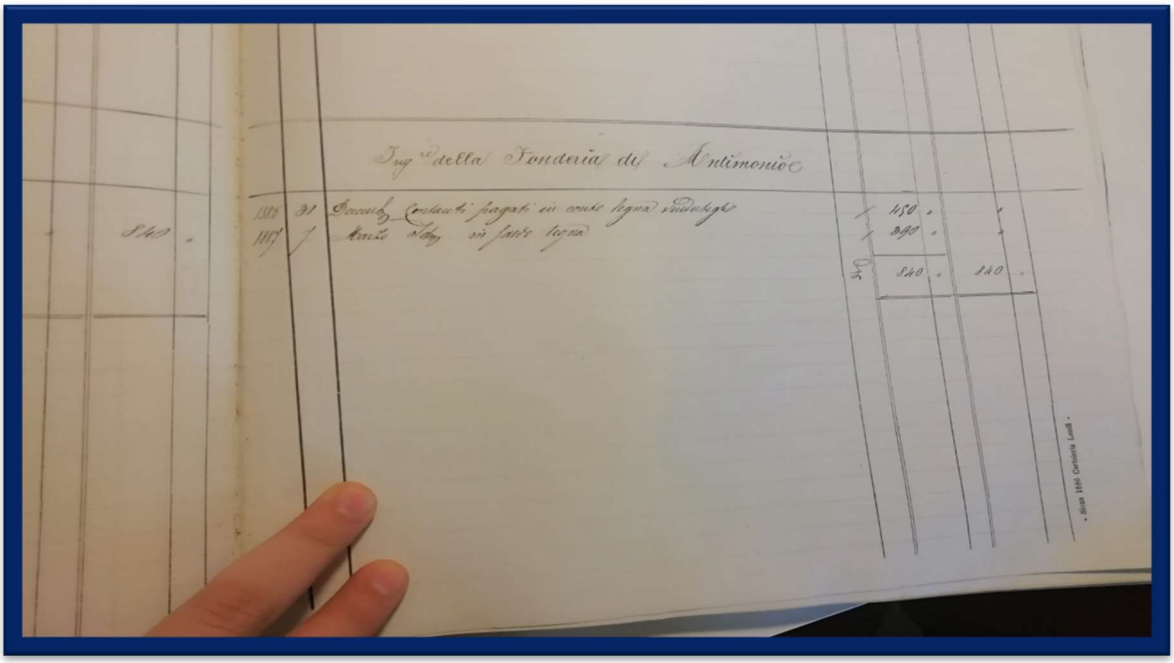
War and Le Cetine: the first exploitation in 1878-1898

This was the first period of serious exploitation of the mine. This was related to the expansions wars in Africa as we have discovered that antimony is used in the production of bullet at a harden material. Therefore, in this period in Italy it started research of the mineral deposits of this strategic mineral which was found as stibnite, a Sulphur of antimony. Le Cetine was perfect because it is a monomineralic mine. The downside was that when the needing of antimony was low the mine couldn't balance with other minerals and so it has lived many closes.



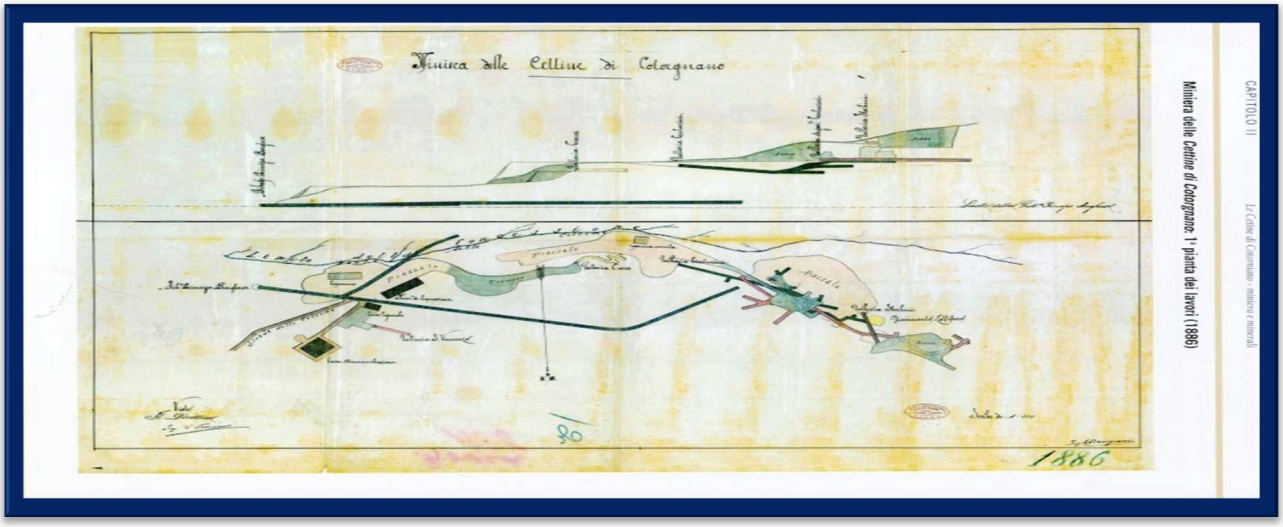
Picture 11: production of the *mine*

Initially the mine seems to have been used not for the antimony but for the Sulphur by Piccolomini, who owned it that used it as a pesticide in their farm. After in 1884 the mine was rented to *Società anonima miniere e fonderie di antimonio,* which held almost the European monopoly of antimony and already operated in Sardinia in the largest mine of Su Suergiu: it was here that the director of the mine of Cetine resided. In 1886 after ending the superficial vein that was mined whit the open-pit technique (just digging a hole and extracting the mineral) the society started to build galleries. They were armed by using chestnut-wood that seems to have been bought from the Cotorniano farm (it is proved by the farm 'economic registers that we read in the national archive).



Picture 12: economic register of the Cotorniano Farm: sale of wood in 1886 to Fonderia di Antimonio

The mineral extracted was sent to Ponte del Rosario foundry that refined also ore mined in Su Suergiu, in Sardinia. In 1888 it was clear that the vein was not regular but as the manpower was cheap it was not a problem. Throughout the history of the mine lots of underage children and women have worked in the mine mainly as selectors. Before1899 the ore mined which contained around 20% of antimony was enriched with fusion reaching 40%. This was necessary because otherwise the refining does not worth it! In 1899 blasted furnaces were built in order to reduce the fusion slug and refine the ore with low quantities of antimony. For this mineral plant the *Sociențà anonima minere e fonderie di antimonio* won a prize in the EXPO in 1900 as the oxide produced was pure and therefore used not only for bullets but also for colors (biacca di antimonio) and enameled iron. In this period the currently existing building presented were the administrative building, the caporal house, the storehouse. while of the original foundry there are only the underground and the ruins of the chemistry laboratory, as the rest of the building was transformed into a house.



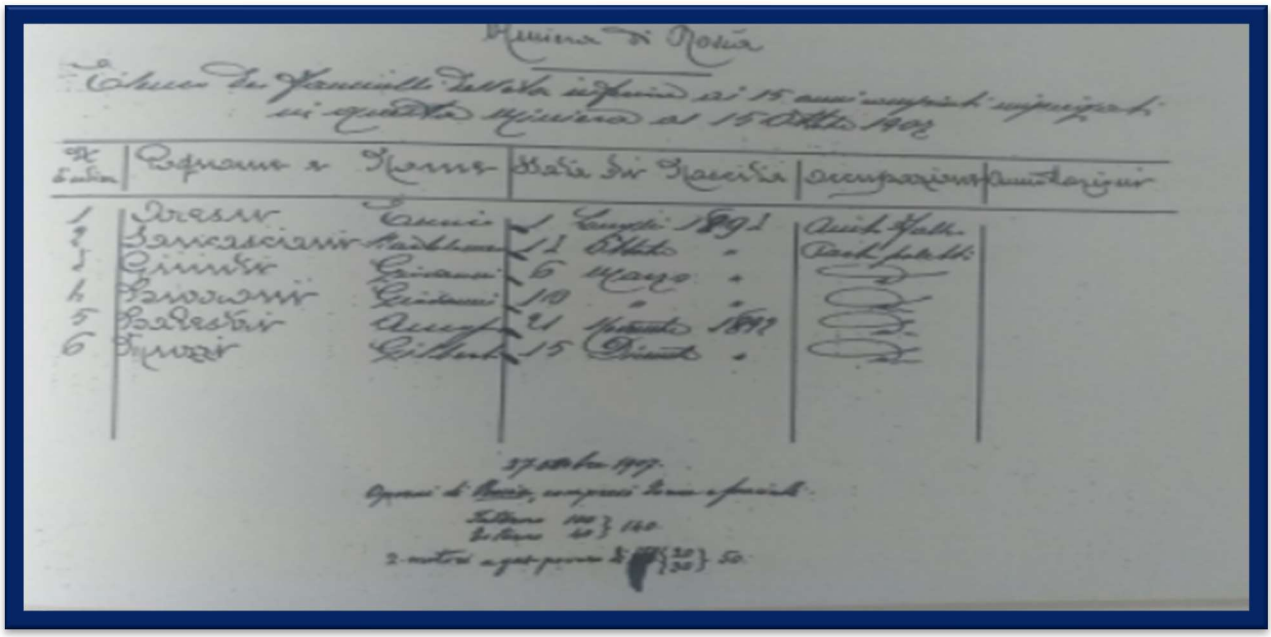
Picture 13: mine's *galleries* in 1890

From hero to zero: second period of exploitation in 1899-1908

Approaching XX century, the mine reached high levels of production. The mineral plat was improved by the construction of new furnaces "a Tino" (metal shaft furnace).

Picture 14: furnaces "a Tino"

The mine was thriving and the number of workers reached 300 with 16 underage children.



Picture 15: register of *workers*

Four new levels of the mine were dug. Bice, Borghese, Henfrey and Ribasso superiore. This means the This extracting method change from open-pit to underground.

Antimony in this period was expensive due to the new wars between Russia and Japan and the Boxer Revolution in China but in 1907 the price dropped due to a financial crisis, born in North America (from L.3000 to L. 700). As a result of it, combined with the trade of Japanese antimony far purer than the Italian, the mine was closed in 1909. New buildings were added: casa contabile, flue pipe a structure where the fumes were moved from the flounces to the chimney: it is extremely rare to find in present times as engineer Zanchi confirmed.

Le Cetine during the Great War…

The mine reopened in 1915 with the beginning of WW1 as the demand of antimony increased due to need of producing weapons. The workers in the mine were 70 and the ore extracted was enough to cover all the demand of Ponte di Rosario foundry. Lots of galleries were dug and connected by opening slots. The production reached the 1 500 tons of ore mainly with 10% of antimony- The mineral plant was improved by the construction of the third furnace. After the end of the great war the mine was

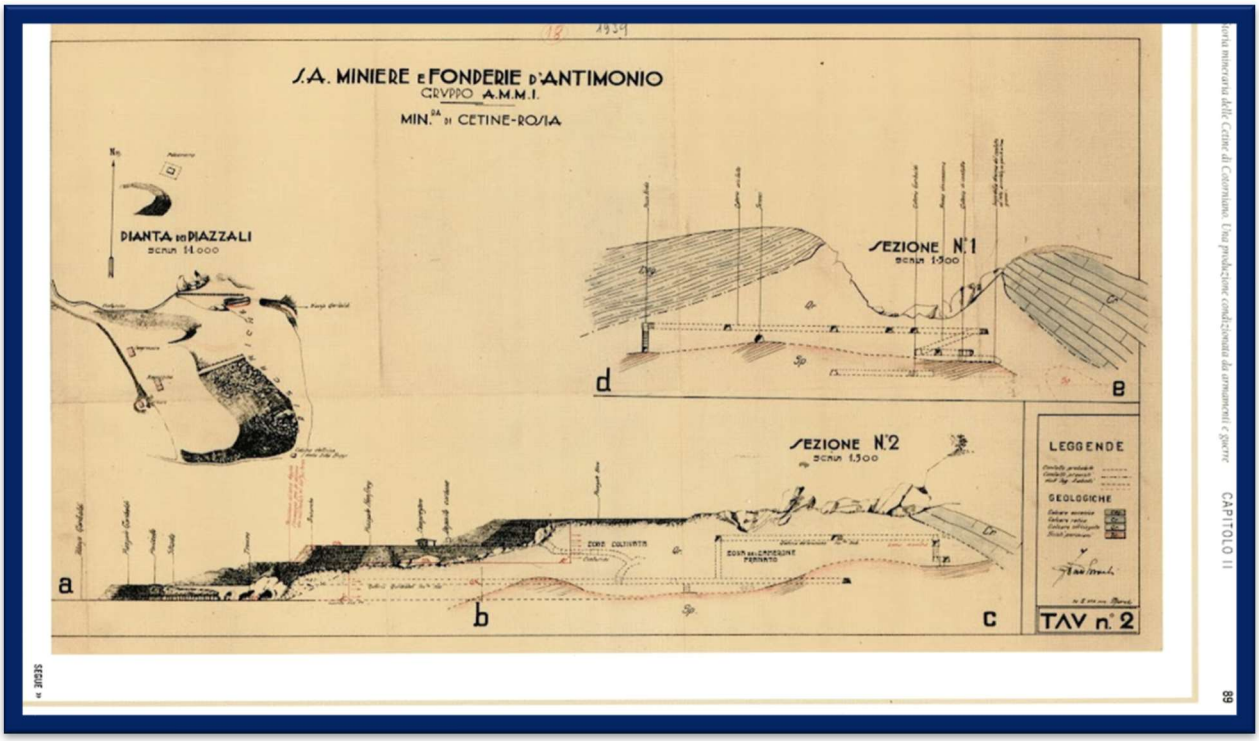
closed again in 1919 since the new trial resulted unsatisfactory. In 1918 Countess Agiola Piccolomini sold the mine to Società anonima miniere e fonderie di antimonio for L.100000. In 1916 there were new buildings: selecting canopy, basin for the rain water collection.

Picture 16: historical view *of* the mine (note the mistake "Cettine")

New ownership, new rules: Le Cetine in WW2

The ownership of the mine was now Sardinian. Therefore, we meet the mineral historical archive of Villasalto to gain information. They told us that in the archive are stored documents from 1939 to 1942. So, aimed by the will of reconstructing what happened after that period we asked the historical archive in Rome (headquarters of AMMI) but they answered us that they have no information about Le Cetine. Here is the information we gained! The new owners realized that there was a lack in the organization of the mining activities and that there wasn't a geological and structural map of the area. Therefore, they started their works with the beginning of WW2 by drawing new maps of the mine. Several Sardinian workers were sent to teach the locals the mining techniques and to build new structures as "coke deposit" in which the head of the mine Mr. Marchi died due to an accident during its construction, or a repair office, or the accident electric cabin. The ore extracted was shipped to Sardinia. In 1936 AMMI (Azienda Minerali E Metalli Italiani) following an autarchy law, frequently encouraged the extraction of pure material which was impossible as the mine had already been exploited. The communication between the two parts was

complicated since the only phone was in Rosia, 6,9 km far. In fact, when there was an emergency, for example the fire dated in 1941 the emergency services were always late. The presence of Nazi made difficult the movement of the ore from Livorno to Su Suergiu as there was the risk of attack. Le Cetine in WW2 supplied antimony for the Nazi till the freedom of the Arno line thanks to the Allies in 1944. Before the arrival of the Allies the Nazis undermined the foundry making it unusable. Due to the war lots of workers were called back to duty but the society succeeded in dismissing them as they were considered soldiers working in the mine. In 1949 The mine closed forever as the mining permission was not renewed by the society.



Picture 17: new *drawing* of the mine in 1939

Music, art and gold: Le Cetine from 1949 to 1990

After the mine closed, area of the landfills was acquired by Chigiana Musical Academy while the mine and the mineral village property were sold part to Ambron Emilio and part to Società Agricola Forestale (owned by Emilio Ambron). He had already bought Cotorniano Farm from Piccolomini, where he had created a cultural cenacle. Ambron was part of one of the four most important Jewish family in Italy: we contacted the Jewish Community of Florence (the Fondazione Ambron Castiglioni) and Siena, but they did not know this branch of the family, as they probably came directly from Rome. Emilio was a painter and he was asked by accademia Chigiana to paint its library. Looking at the painting it seems that the landscape of the Divina Commedia scenes resembles the rocky characteristics of the Le Cetine mine's entrances.

In 1973 the Accademia Musicale Chigiana sold its part to Siena's district administration and in 1972 Emilio Ambron sold his part to Aziende di Stato Foreste Demaniali, in particular to a close zootechnies enterprise called Cornocchia, then transferred to Tuscan Region in 1979.

Between 1985 and 1990 the Italian ministry of industry fostered new mineral trials for the gold, antimony and iron research. So, lots of mineral enterprises coming from America and Great Britain mineral society started researching in Le Cetine, but it was never mind because economically it did not worth it.

Throughout its history in the mine there have been found several unique minerals some of which still have never been found in any other part of the world. Its most unique mineral is onoratite. For this peculiarity lots of amateurs collectionists entered the mine to look for rare minerals. Some collectors have collaborated with the University, but many have carried out raids and vandalism, and it seems that they were able to enter even when the Municipality of Chiusdino put in the 2000s of the railings at the main entrances.

Picture 18: Chigiana Musical Academy's library

Mineral Park: genesis and dead from 1998 to 2003

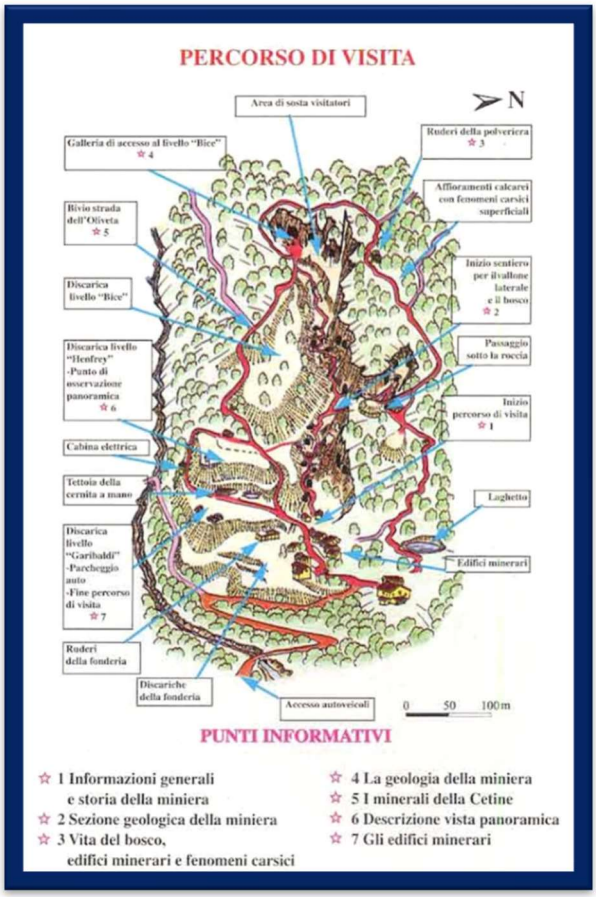
At the end of 1990 it was decided to turn le Cetine into a mineral park. The works were financed and started but they were immediately stopped due to the needing of decontamination expressed by the Tuscan Region. Between 2000 and 2009 the region and the district sold part pf the field and a few buildings to privates.

\

Picture 19: historical reconstruction of the owners

Watch the resume in the infographic: click here

Once upon a time…the mineral park project



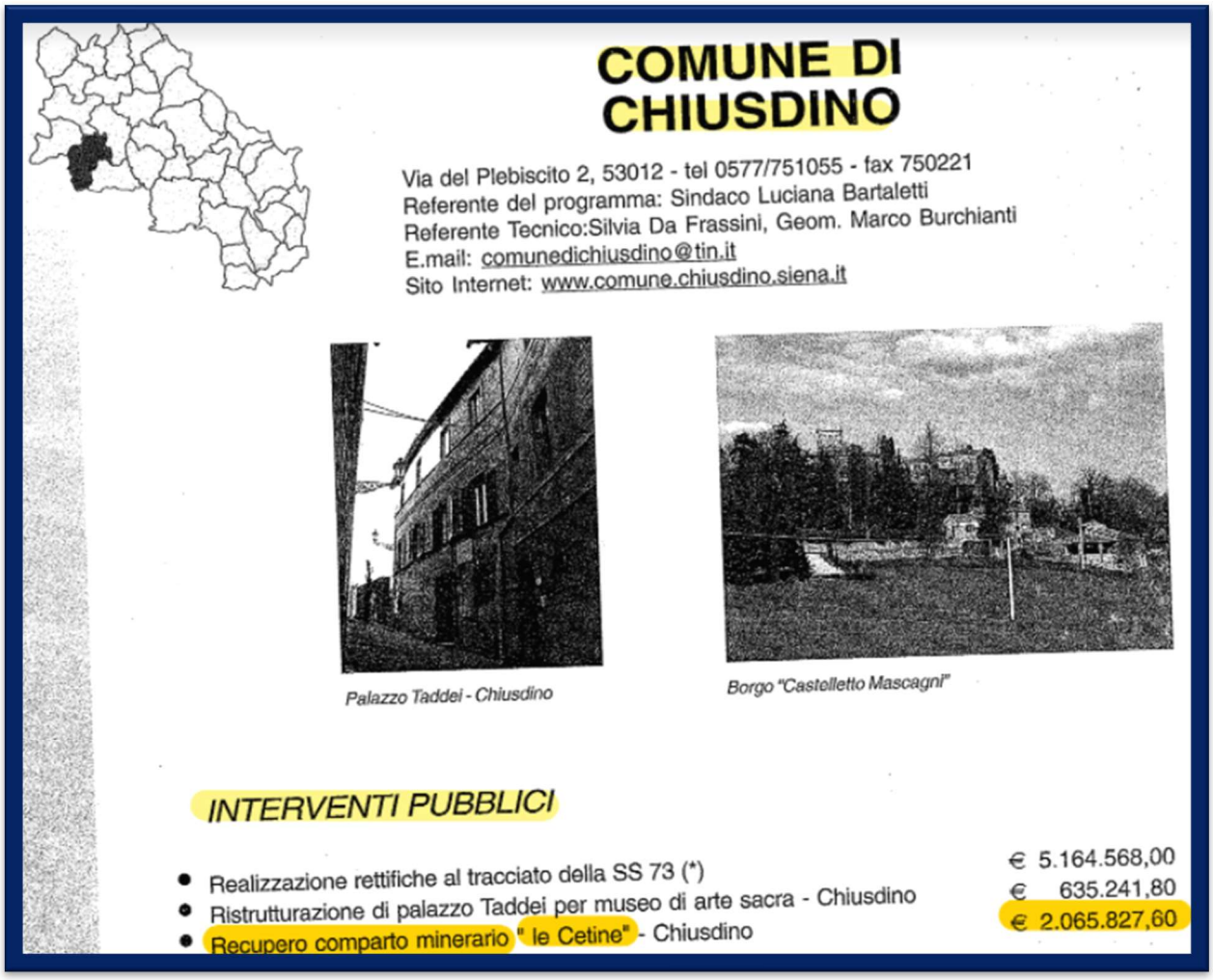
Picture 20: mineral park project

We were not allowed by the mayor of the Municipality of Chiusdino to see the park project, made by Eng. Carmelo Latino of 2003, the preliminary geological survey done by geol. Alessandro Masotti in 2000 (including the mapping of all the galleries) and the related administrative documents. Despite the formal access to the documents that we presented it seems that unfortunately it was not possible to access this important document.

Nor did we have any luck with the geologist Alessandro Masotti, whom we interviewed by videoconference. We were asked not to spread the information given even though he added little to the information already contained in an article he published in a local magazine.

We did not give up! From the information we collected, the intervention included works for 3 million euros (estimation indicated in the operational project of the decontamination) and benefited from a loan of 2,065,827.60 euros from the PRUSST "Terre Senesi" (amount of money indicated in a specific publication that we read in the municipal library of Siena). That's a lot of money!

The PRUSST is an "Urban Restructuring and Sustainable Development Plan" that the municipalities of the District of Siena and the district Administration have developed to finance a set of projects, chosen on the basis of the content of the Provincial Territorial Coordination Plan; the project was drawn up on the basis of the ministerial announcement D.M. LL.PP. of 8.10.1998 n. 1169 and approved by the same ministry with D.M. of 19.04.2000 n. 591.



Picture 21: PRUSST *reference* to Le Cetine

Some information on the mineral park project is contained in the operational decontamination project, which results in a coherent conservative approach concerning both the tunnels and the mining village: "the project proposes guidelines, choices of interventions and solutions operational, preserving the unity of the whole of the elements that constitute it, such as the underground environment, the foundry and the network of complementary and service works (connecting roads, yards, civil and industrial buildings). The project establishes that the urban plan of the Le Cetine mineral park is articulated in a network of ring routes, which connect the access area with the tunnel path and a series of equipped areas. For the underground areas, the

project establishes the construction of paths involving the Bice level and three different paths that from this level lead to the lower levels of the mine. "

The expense amounted to one million euros (amount indicated in the operational decontamination project) and concerned the external paths (some fences, today crumbling, are still visible), the safety of the small tunnel at the Bice level (which presented itself to visits than to two neighboring entrances and a circular route) and, perhaps, the permanent exhibition. By the way, in the cultural ministry website it is fostered an exhibition of le Cetine's minerals in Chiusdino that we have discovered nonexistent!

We wish that we could have seen them as we have discovered that in The website of the Ministry of Cultural Heritage it is indicated the presence in the town of Chiusdino, a *"permanent documentary exhibition of the Cetine mine".* However, from the answers received by the mayor of Chiusdino via videoconference, we came to know that the exhibition was set up in a room owned by the Municipality in the historic center and soon used as a health facility, so it has been closed a long time ago time and most of the exhibits have been returned to the owners who had lent it.

The work started and the municipality spent around a million euros but, then, it was stopped by sudden the needing of decontaminating the area! We must say that this impellent needing was not a surprise! Already in 1999, the Cetine mine had been included in the regional decontamination plan among the "sites to be verified" (and not among those "not to be decontaminated "), and in 2002 the Arpat (regional agency for environmental protection) communicated the need for a short-term decontamination. In fact, the ministerial approval of the PRUSST Terre Senesi is in 1998, the geological report is in 2001 and the park project is in 2003.

The question at this point is the following: are the works realized using the first loan tranche still usable today? From the meeting with the geol. Masotti it seems so, as the Bice level has been made safe, even if now, after twenty years, checks will certainly be needed.

One, two, three… sold: auction

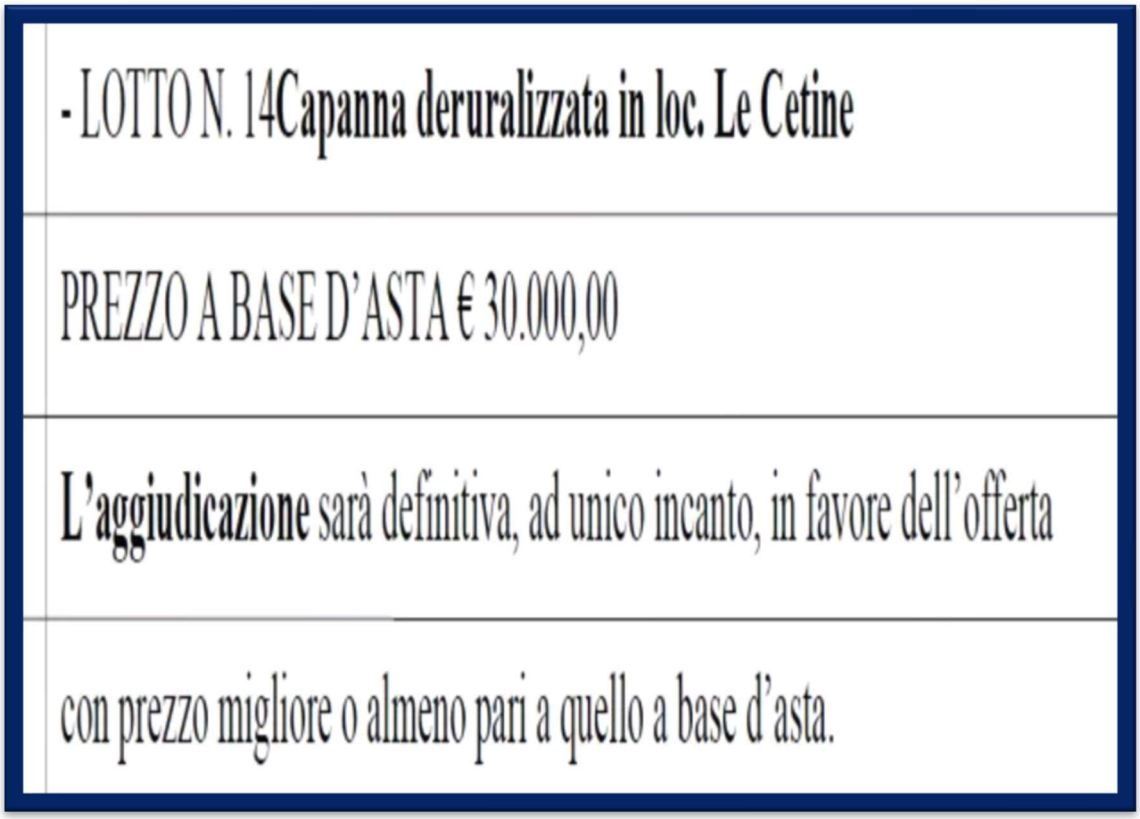
In 2000, when the PRUSST Terre Senesi financing was in progress, the Tuscany Region sold at auction a part of the "Podere Cetine" real complex which, although not part of the mining area, is the only pre-existing building already registered in the Leopoldine land registry, and subsequently included in the perimeter of the geosite.

In 2009, when the area was already proposed as a geosite of regional importance and the remediation plan procedure had already begun with the approval of the

characterization plan, the Provincial Administration of Siena sold at auction most of the buildings in the mining area and surrounding landfills owned by him.

Following this auction, against a collection of approximately 46,000 euros, approximately 2 hectares of inert landfills are no longer available to the public, including a storehouse of approximately 30 square meters and, with an adjustment made two weeks before the closing of the tender , also a shed of 120 square meters (referable to the metallurgical coke warehouse built in the 40s, necessary for the foundry below) and the remains of the "new foundry", which has an area of 20 square meters and a height of about 6 meters (built in 1939 by the retreating Germans). The electrical substation serving the mining area and the waste dumps remained the property of the Provincial Administration.

In the 2013 operational decontamination project, we read "a part of the areas must be acquired through acquisition / expropriation from different owners", but, in our survey at the land registry, we discovered that in the sale it is clearly indicated that the area sold at auction will be subject to a decontamination intervention with expenses paid by the public administration.



Picture 22: *auction*

The administration prospective for Le Cetine!

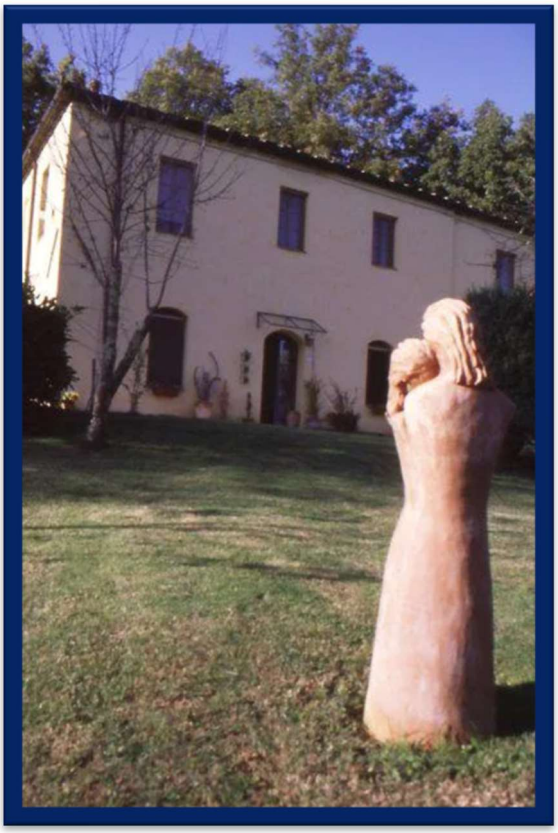
The Tuscany Region, in the Territorial Address Plan (2014), writes in the chapter of the Values of the area "a park of mineralogical interest is that of the Cetine of Cotorniano". However, the Municipality of Chiusdino, in the "San Galgano' abbey Enhancement Program" (2016), indicates the enhancement of the Cetine mine only as a "perspective".

At present, the destination as a mining park has not been incorporated by the urban planning instruments of the municipality of Chiusdino: in fact, the Structural Plan, which dates back to 2008 and its revision has just begun. Currently, the former mineral village is indicated as a tourist-accommodation area with the aim "of recovering also a part of the residents who in the past have abandoned the locality". Indeed, we have discovered that historically the local population rate was affected by the opening periods of the mine which attracted inhabitants which were mainly mineral workers.

Interviewing the mayor Luciana Bartaletti, in office almost continuously since 1999, she explained us that her primary objective is to repopulate the area, considering the demographic decline that has occurred in recent decades (from 5,000 in 1921 to 1,800 in 2021, ISTAT population census), and consequently the decontamination is set up in such a way as not to preclude any possibility, both that of the park and the sale to private individuals. She also expressed her frustration in failing creating the mineral park, and we agree with her!

We think that the main risk of this project is creating an area where buildings are sold to foreign people that will just inhabit them for a small period. This could possibly mean that there will be no population growth and that the area will be appreciated exclusively be few people. In fact, the mining village is an important part of a mineral park: it includes the administration building, the basements of the old foundry, the old bread oven, the old postal office and so on, and there are architectural details as a lintel of a window made with a mine rail track. If the mining village, owned by the Tuscany Region, is sold to private individuals, it will in fact become inaccessible to the public. Plus, if the mining park will not be made, the money spent in 2003 will be useless.

At the moment, the only result of the decontamination project that we have stated is the closure of the activities in the mining village, including alternative accommodation activities, also aimed at meditation and art. Today the village is abandoned, apart from two illegal occupations. This adds difficulty to the decontamination process!



Picture 23: Administration house, ex *"ecoturismo casa gialla"*

Cetine, a Geosite of Regional Importance

In 2007 the area was included in the list of Geosites of Regional Importance (GIR 18) regulated by Article 95 of Regional Law 30/2015 and considered structural invariants according to Article 5 of the Regional Law. 65/2014 so are subjected to specific protection in the context of territorial planning tools and in the acts of territorial governance. But in this regard, we are still awaiting the conservation regulations that was not written yet, despite that the protection of geosites is established by the environmental and cultural heritage code (Legislative Decree 22 January 2004, n. 42). What are they waiting for!?

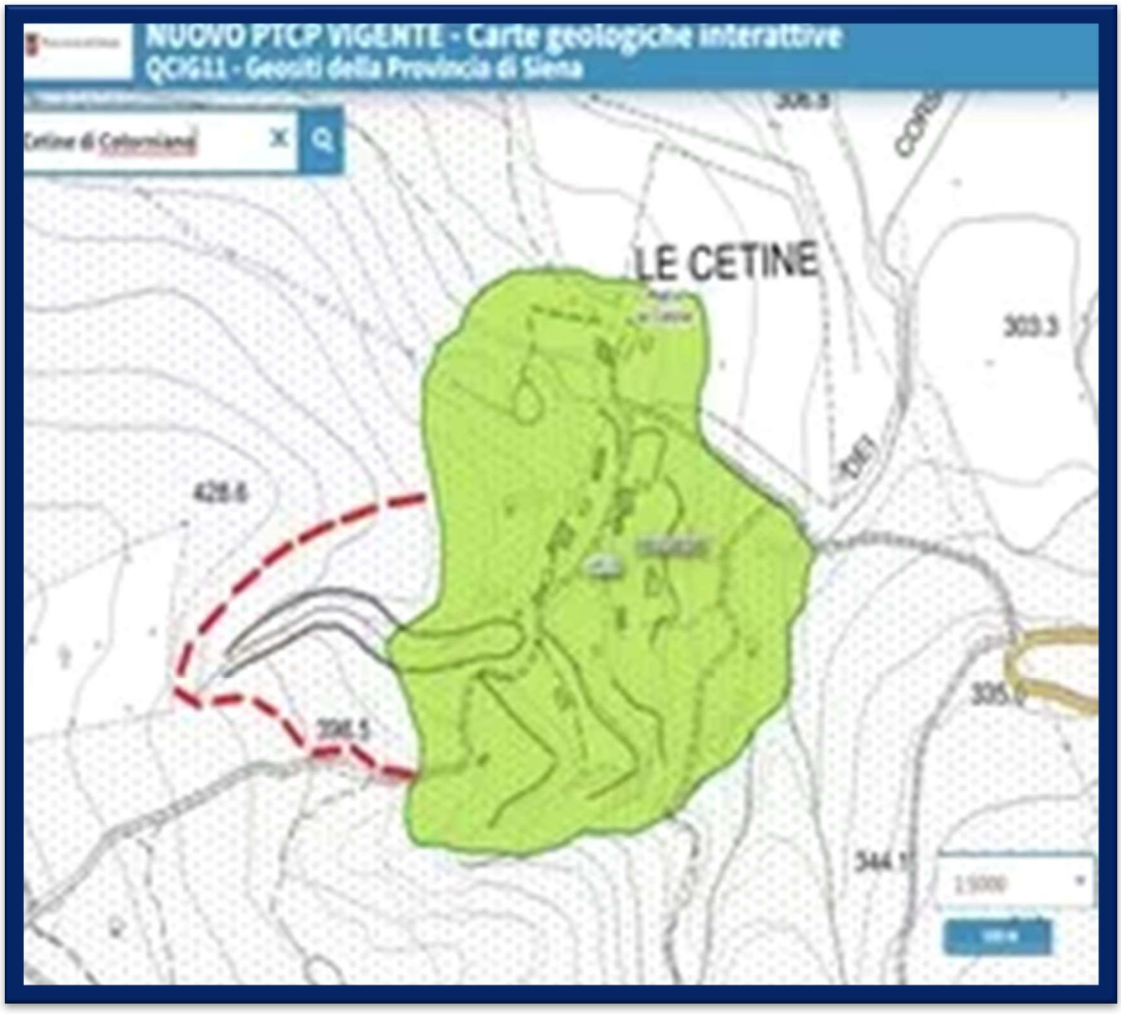
The reason for nomination of Le Cetine among the geosite lies in the fact that in the area there is a high concentration of minerals (about 80 species), some of which are very rare and found in this place for the first time in the world, and a mineral (onoratoite) represents today the only worldwide discovery.

We found the geosite map in PTCP! It is significant that the perimeter of the geosite includes the entire mining village, where are the blocked entrances of the first galleries built (who knows what they hide!) as well as all the landfills and almost all

the entrances to the tunnels. However, we found that the western part of the extraction area was not included in the perimeter of the geosite, right where there is the entrance to the Bice level, which twenty years ago was made safe for tourism purposes!

Already in 1999 the ARPAT (regional agency for the environmental and territorial protection) indicated in the personal data sheet attached to the PRB (regional plan of decontamination) that the decontamination works must be carried out *"limiting the removals to the strictly necessary, also taking into account the scientific and naturalistic value of the area, site of discovery of numerous rare minerals object of study by the scientific community, the full usability of the sites must be ensured in the event of the establishment of the archaeological mining park ".*

Unfortunately, the operational project does not mention the geosite, and the mining park is regarded as a historical event; only at the time of its approval of the operational project by the Services Conference, did the Superintendence subordinate the favorable opinion to the verification of the historical and cultural peculiarities of the former mining buildings.



Picture 24: PTCP map of Le Cetine

How far does the contaminated site go?

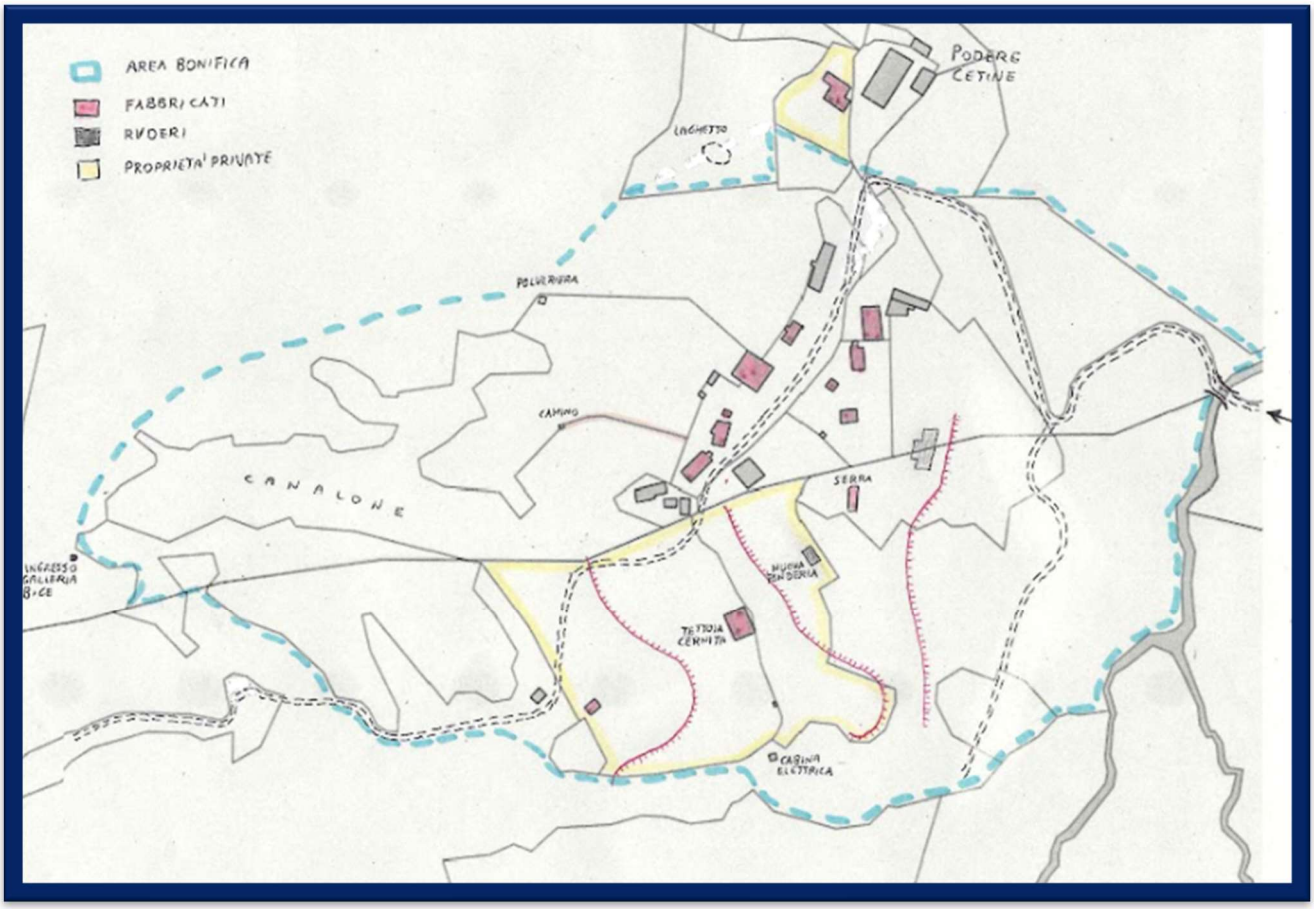
We believe that the decontamination of the former mineral site arises from the fact that the legislation provides for residential areas with a soil in which antimony content not exceeded 10 mg / kg over the natural polluting value, as prescribed by Annex 5 of decree no. 152 of 2006. But in Le Cetine the values are way higher!

So, it is necessary to proceed with decontamination or safety measures.

However, the area covered by the decontamination does not only concern the area surrounding the mineral village, where the ruins of the foundries and the landfills are located. It also concerns the wooded area of the inert landfill of the Bice level, which is located outside the perimeter of the UTOE dell Cetine, and therefore in the agricultural area.

It also regards the area of the inert material landfills of the Henfrey and Garibaldi levels, which in 2009 the Provincial Administration of Siena sold to a private individual, where there are some storehouses susceptible to a change of use in homes; however, the Municipality of Chiusdino approved the request for the transfer of the volumes outside the decontamination area, and so this area could be excluded from the perimeter of the UTOE.

So, perhaps the extension of the decontamination area or at least the intervention methods could be re-evaluated based on the different urban destination of the different portions of the former mineral area.



Picture 25: extension of the *decontamination* area

What about coherence with the urbanistic tools?

The legislation of the government of the territory establishes the importance of a coherence analysis of the municipal urban planning tools (the Structural Plan and the related Urban Planning Regulations) with those and district (PTCP District Territorial Coordinating Plan) and regional (PIT Territorial Address Plan), and among these also the PRB (Regional Decontamination Plan).

In this regard, on the website of the Municipality of Chiusdino we only found the Urban Planning Regulations approved in December 2012 and not the Structural Plan, as the link to TerreCablate does not work, as it seems that the convention has expired. By comparing the operative project with the urbanistic tools, we have discovered that:

- the Urban Planning Regulations, approved in 2012 and under review from 2019, don't' speak about Cetine mining park: it is prior to the 2014 PIT, which indicates the use for this urbanistic destination. But this is not the project's purpose!

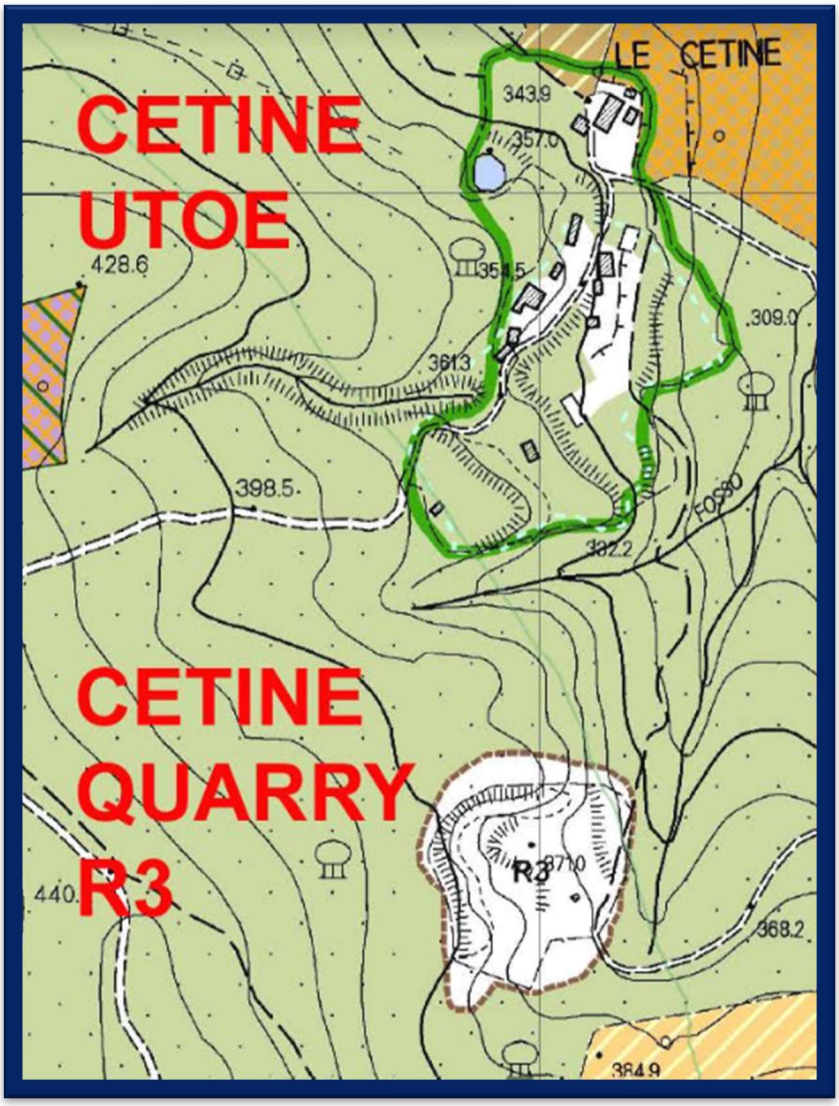
- the Urban Planning Regulations, in the maps, shows Cetine as Geosite, like PTCP 2010.

- the Urban Planning Regulations, about PRB (Regional Decontamination Plan), indicates and map the "Le Cetine' quarry" as the "R3" area, that is the one that *"must be decontaminated and made permanently safe according to the procedures and operational project of the District of Siena, in order to reduce the percentages of polluting factors found "*. But this is an abandoned quartzite quarry located about 300 meters south of the Cetine mine, outside the decontamination area, which has nothing to do with the mine.

This quarry is instead indicated among *the "Areas susceptible to environmental recovery"* in Annex 5 of PAERP, the Plan of Extractive Activities, Recovery of excavated areas and Reuse of recoverable residues, approved by the Provincial Administration with DCP 43 of 23 April 2009.

By the way, Entering the merits of the recovery of the Le Cetine's quarry, the intervention appears to be outdated today as the area is almost completely re-naturalized, and the legislation establishes that *"If, in fact, it is found that the former quarry, on which once the restoration work was carried out, it was affected over time by a spontaneous process of renaturalization, it is believed that more interventions could cause greater impacts on the site itself and its surroundings "* (annex. 1 PAERP).

Therefore, we think that more trials should be done to establish the effective needing of works.



Picture 26: UTOE Le Cetine *close* to le Cetine quarry in the Urbanistic regulation

The legal process of decontamination.

We have discovered that the characterization plan approved in 2009 and the operational project approved in April 2013 lack of some minimum contents required by the PRB, proposed in September 2013 and approved the following year: in particular, the description of the natural environment, the compatibility study environmental and cost-benefit analysis, important for calibrating a decontamination plan.

In fact, Annex 7 of the plan, paragraph 3.1.1., invites you to determine the cost-benefit ratio *"capable of observing all the aspects (not only economic) that come into play in the execution of a remediation work" through* " calculation tools capable of comparing the economic, environmental and social aspects associated with the various remediation technologies ". We think that this is essential to evaluate the

effective needing the decontamination both from the social and economic point of view.

The project must also be signed by a specific professional *"If they include interventions of bioremediation, environmental and landscape restoration of the area, or interventions of an agronomic or forestry nature, they must also be signed by professionals qualified in the related matters, such as: biology, agronomy, science and forestry, architecture, and the like (art .42 Implementation"* Regulation 32 / r 2001)

Moreover, the legislation establishes the determination of the risk analysis for distinct areas in the event of a different urban destination and the characteristics of the materials, while in the project a distinction has not been made between the UTOE area (where the foundry slag is, more polluting) and the surrounding forest area (where most of the excavated aggregates are found).

Annex 8 of the plan identifies the following minimum contents, which we did not find in the project documents:

Characterization plan (paragraph 2):

- description of the natural environments (lack of floristic and faunistic research),

- volume of waste (identified with a very high range),

- identification of the properties (passed due to an auction and expansion of the area)

- analysis of the distribution of the resident population and of other anthropogenic activities

Operational plan (paragraph 3):

- definition of the intended use of the site (reference to the mining park provided for by the ITP),

- study of environmental compatibility,

- definition of the criteria for acceptance of results, and monitoring of interventions,

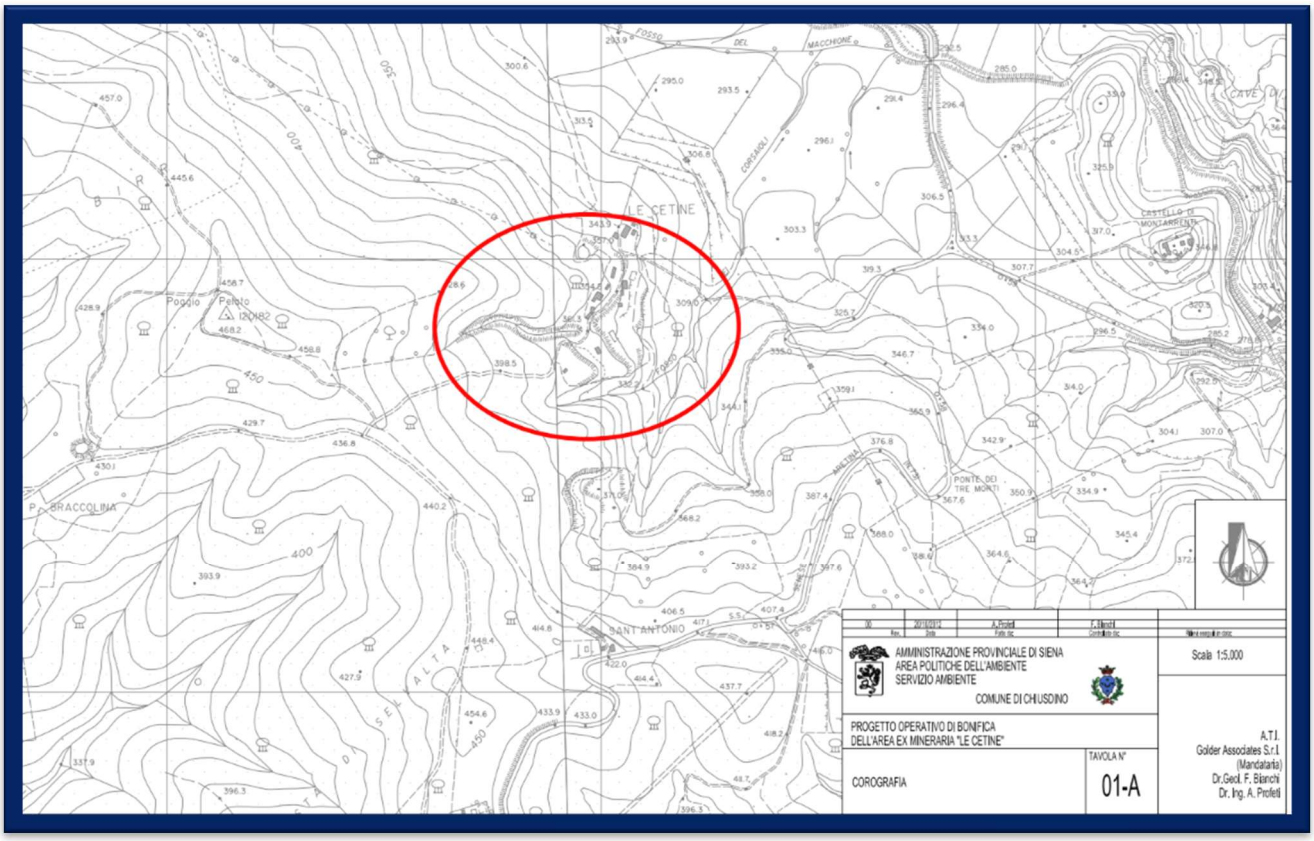
- definition of any limitations and requirements for the use of the site,

- detail on the safety measures during the construction phases,

- management plan of materials, soil, water, waste, produced during the remediation activities

- schedule of activities.

Incipit del piano



Picture 27: CTR Le *Cetine*

How far does the wood extend?

The report of the operational project states that the site is "*characterized by generalized degradation, in any case in the process of renaturalization due to the growth of brambles and other vegetation typical of the undergrowth: it should be noted that this growth is in any case null and void, especially in conjunction with the waste dumps of smelting and landfills of mine tailings"* (Current site status 2.3). It should be noted that the only species mentioned is the bramble, one of the few shrub species whose presence, according to the regional forest law, does not entail the classification of the area as a wood. A little further he reports that *"Currently the site is mostly covered by woods and low shrub-like vegetation" but the next step "Most of the areas affected by the landfills of mine tailings and melting slag are almost completely free of vegetation".*

The metric calculation indicates a generic work of *"deforestation and clearing"* for 4.78 hectares, but the forest no longer appears under the heading *" clearing operations".*

The form drawn up by ARPAT in 1999 of the sites to be reclaimed SI073, contains the following description: "*spontaneous vegetation, flourishing and without any evident signs of suffering, has developed on part of the piles of landfills and in the valley",* without specifying whether it deals with arboreal, shrubby or herbaceous vegetation.

The PS (structural plan) of the Municipality of Chiusdino for UTOE (elementary homogeny territorial units) Le Cetine *reports "there are some areas internally covered by vegetation; as part of the drafting of the R.U. particular attention must be paid in order to identify which are the wooded areas and which, on the other hand, are configured as gardens, courtyard areas or vegetable gardens that in recent years, as a result of prolonged abandonment, have been attacked by weeds. For areas recognized as woods, the discipline referred to in art. 19 of the N.T.A ".*

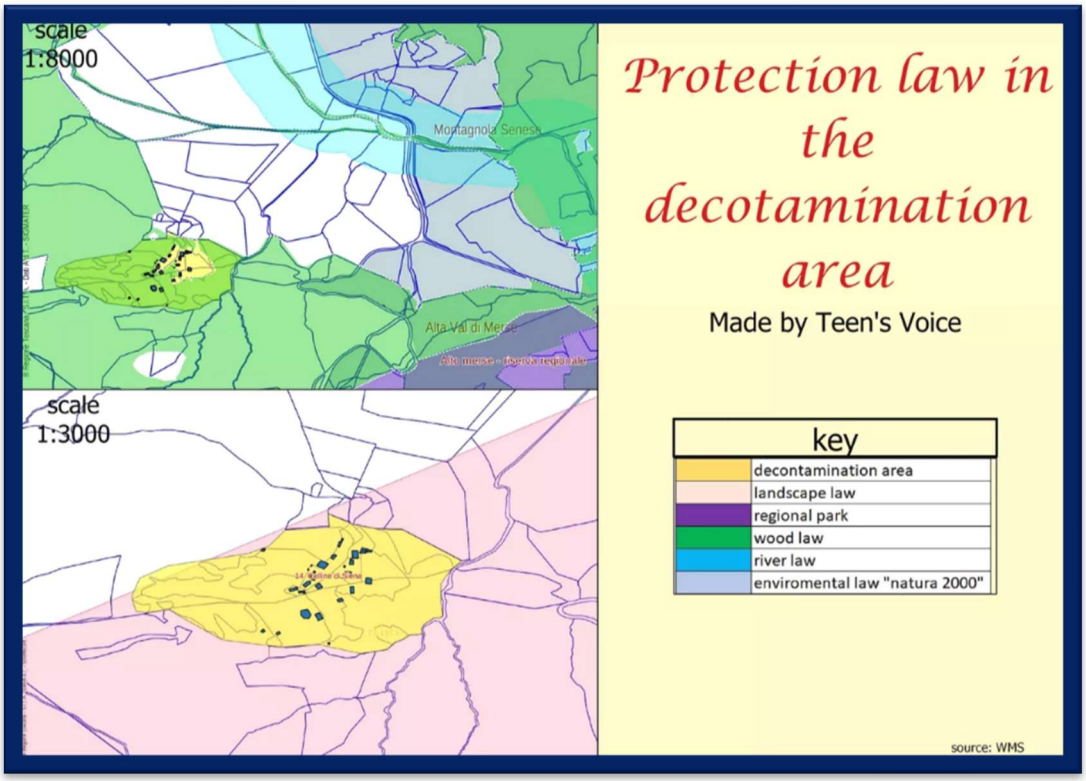
We then checked the state of affairs, noting that the mining area is almost completely covered by wood in its various types (coppice, mixed and tall trees), for a total of about 80,000 square meters, of which about 32,000 mq intended for deforestation (we calculated it based on aerial pictures). The wood is particularly luxuriant in the part occupied by the inert dump, with a prevalence of turkey oak, downy oak and black hornbeam, which in the lower altitudes facing the watercourse give way to chestnut trees. The average diameter of the trees varies from 23.7 cm in the wood around the chimney of the flue gas pipe, to 40.5 cm in the wood behind the mining village, with some plants around 70-80 cm in diameter. The undergrowth is made up of some juniper plants, occasionally holm oaks and strawberry tree, while heather prevails in the area facing the ditch.

Areas with other land uses are all affected by decontamination plan. Some areas are occupied by shrub species similar to "woods" according to the Forest Law: they are mainly occupied by broom, a lime pioneer species, accompanied by rose hips and juniper (about 4,000 square meters) and other bushes more settled and complex (about 4,000 square meters).

Some areas (about 2,000 square meters) are occupied almost exclusively by herbaceous species, with the presence of essences typical of arid calcicolous substrates.

The areas without vegetation concern four areas, the main ones include the landfills of the foundry slag (approximately 2,000 m2).

The remainder, about 10,000 m^2, is occupied by buildings and courtyards, of which about 5,000 m2 affected by the expansion of the forest.



Picture 28: *protecting* laws

Deforestation: Is it really necessary?

The safety of the landfills involves covering the area with a layer of waterproofing soil to prevent rainwater from going through the landfill and dragging heavy metals into the surrounding environment through, but these works involve the elimination of the wood!

Furthermore, the elimination of a portion of tall wood to create the tank for phytodepuration, in an area not affected by mineral activities.

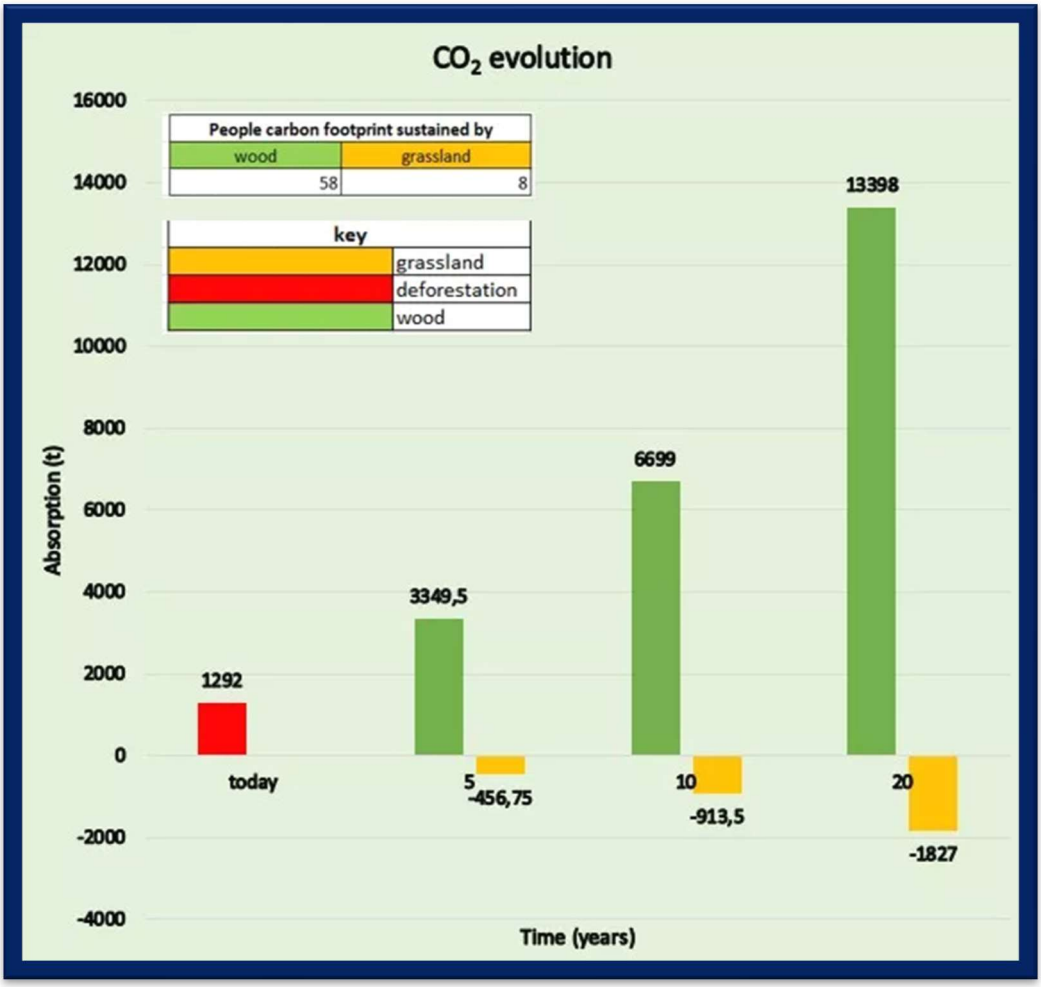
The Regional Forest Regulation provides for the possibility of eliminating the woods "in exceptional cases of an environmental nature", to be compensated for by reforestation of the same surface (art. 80 et seq. DPGR 48 / r of 8.8.2003).

Compensatory reforestation was in fact prescribed by the Union of Municipalities of the Val di Merse at the time of approval of the operational project, together with the requirement to quantify the wooded area: despite the progress of the project, not everyone knew the real extent of the forest and the regional forest legislation!

Based on what we have said before the wood in Le Cetine would be cut down forever and replaced with grasslands. As we are an agrarian school we are concerned about the emissions and the woods. By our surveys we have discovered that with the

decontamination works about 5 hectares of woods would be cut down and replaced with shrub and grassland with a considerable emission of co2, over 1300 tons. Think about it! In 20 years, a wood can absorb the carbon dioxide produced by 58 men while a grassland can absorb on the amount of co2 of 8 men. Plus, by cutting down the wood the local ecosystem would be damaged and it would be a problem as the site is extremely closed to several protected areas characterized by an endemic wildlife. The question is: is it worth?

However, the Ministerial Decree of 18 January 1973 and the PIT 2005-2010 perimeter the Cetine area as a landscape of excellence and therefore places it under particular landscape protection that we hope would save the wood from destruction.



Picture 29: carbon dioxide evolution

Destination of the biomass obtained from deforestation

The biomass resulting from deforestation, as stated in the metric calculation, is partly destined for reuse on site, and partly for composting.

We still do not understand how to use biomass will be used in the site. Talking about compost, the current legislation does not provide for maximum concentration limits of antimony, established instead for the other more common heavy metals: Cd, Cu, Cr, Ni, Hg, Pb, Zn (Annex 1C Law 748 / 84 and subsequent amendments, Decision EU 2015/2099 of 18.11.2015.

However, from the scientific literature it emerges that antimony is easily assimilated by plants without determining phytotoxicity, and that it is accumulated mainly in the roots but also translocated in the leaves, especially in some species. We did not find any studies carried out on the concentration of antimony in tree species, but the research carried out by prof. Protano of the University of Siena in southern Tuscany on various species of herbaceous plants present in the landfills of the Tafone antimony mine have found an average content in the leaves of 0.2 mg / kg, but in some species, it reaches 50 mg / kg. So, we think that the biomass derived from the deforestation will be contaminated!

Deforestation expense

The metric calculation provides for an expense of over 120,000 euros for *"deforestation and brushwood clearing"* and 11,000 euro for the "*loading and transport of biomass derived from (only) clearing to the composting plant*", the latter assessed "in bulk" and not quantified.

The project provides that, in the event that there is a high presence of plants with a trunk diameter greater than 15 cm: "*they are collected, stacked, deprived of branches, reduced into commercial length rods and transported where indicated by the Office of Management*". However, the proceeds from the sale are not quantified in the calculation!

Since, as we have seen, the vegetation consists mainly of arboreal plants, consistent salable woody assortments are retractable: in the cleaning operations of the waterways around Siena, commissioned a few years ago by the decontamination consortium, the company in charge has the job cleaning as pair.

Picture 30: *wood*

The mystery of natural polluting value: what does the law say?

The determination of the natural contaminating value is the biggest problem we had to face because it is the base to calculate the exceeding of the legal limits of pollution. The project itself indicates the difficulty of identifying the background contamination and we agree with it! In order to establish it, the geologist did the trials in the surroundings of Le Cetine.

It is obvious to find very low values of heavy metals compared to those of a mining landfill of aggregates, although a few kilometers from the Cetine there are three putizze whose gaseous emanations contain antimony, arsenic and mercury, residue of those hydrothermal phenomena that led to the formation of the Cetine reservoir. This means that in the area antimony is naturally present.

Other guidelines have recently been published (ISPRA snpa 8-2018), as the underlying value concept is evolving.

A new element to consider in order to identify the underlying value could be art. 37 of Legislative Decree 31 May 2021 n. 77 which, *"in order to accelerate the procedures for the remediation of contaminated sites. to be used for the implementation of*

projects for the PNRR" modifies important steps of Legislative Decree 3 April 1996 n. 152: *"for the purposes of defining the natural background values, the procedure provided for by Article 11 of the Presidential Decree of 13 June 2017 no. 20 "*, or the legislation on excavated earth and rocks, which establishes that" *If the construction of the work involves a site where, due to phenomena of natural origin, in the excavated earth and rocks, the concentrations of the parameters referred to in Annex 4, exceed the contamination limit concentrations referred to in columns A and B, Table 1, Annex 5, Title V, of Part IV, of decree no. 152 of 2006, without prejudice to the possibility that the concentrations of these parameters are assumed to be equal to the existing natural background value ".*

We think that determining the (natural) polluting value by taking as reference the surrounding soils, not affected by the mining activity, but derived from the same geological matrix (limestone), would allow to evaluate the real consequences of human activity on the environment.

Talking about inerts dumps, located at higher altitudes, human activity has crashed minerals and rocks, and have accumulated the less mineral-rich fragments in a more superficial position than the original one (the deposit was quite superficial: the difference in altitude between the level Garibaldi and the level Bice, is 34,5 meters).

Talking about foundry slug dumps, located at the lowest altitudes, which among other things were the only ones initially identified by ARPAT as to be subjected to decontamination, the human activity has determined not only a greater concentration of antimony, but also a transformation in more soluble forms and therefore dangerous for the environment!

To identify the values of the natural contamination of the rock, we already know some data: *"The most complete geochemical data, among those collected, are contained in the RIMIN report of '90. They show the presence in quartzites and dolomitic limestones of 5,000-10,000 ppm of Sb (with peaks of 20,000-30,000), as well as a significant concentration of as (50-100 ppm, sometimes 400-500 ppm) and Hg (1 -3 ppm, with peaks of 10 ppm)".*

Picture 31: geologist Protano

Decontamination of water: is the permeable barrier efficient?

The landfill decontamination project proposes interventions aimed at reducing the contributions of heavy metals to the watercourse that flows near the landfill, which seems to be conditioned above all by the source at the base of the landfill, that will be intercepted and purified together with those of the planned drainage trenches. The danger is mainly due to the antimony oxides, formed as a result of the oxidation of the primary mineral, the antimony sulphide (called stibina, stibnite or antimonite).

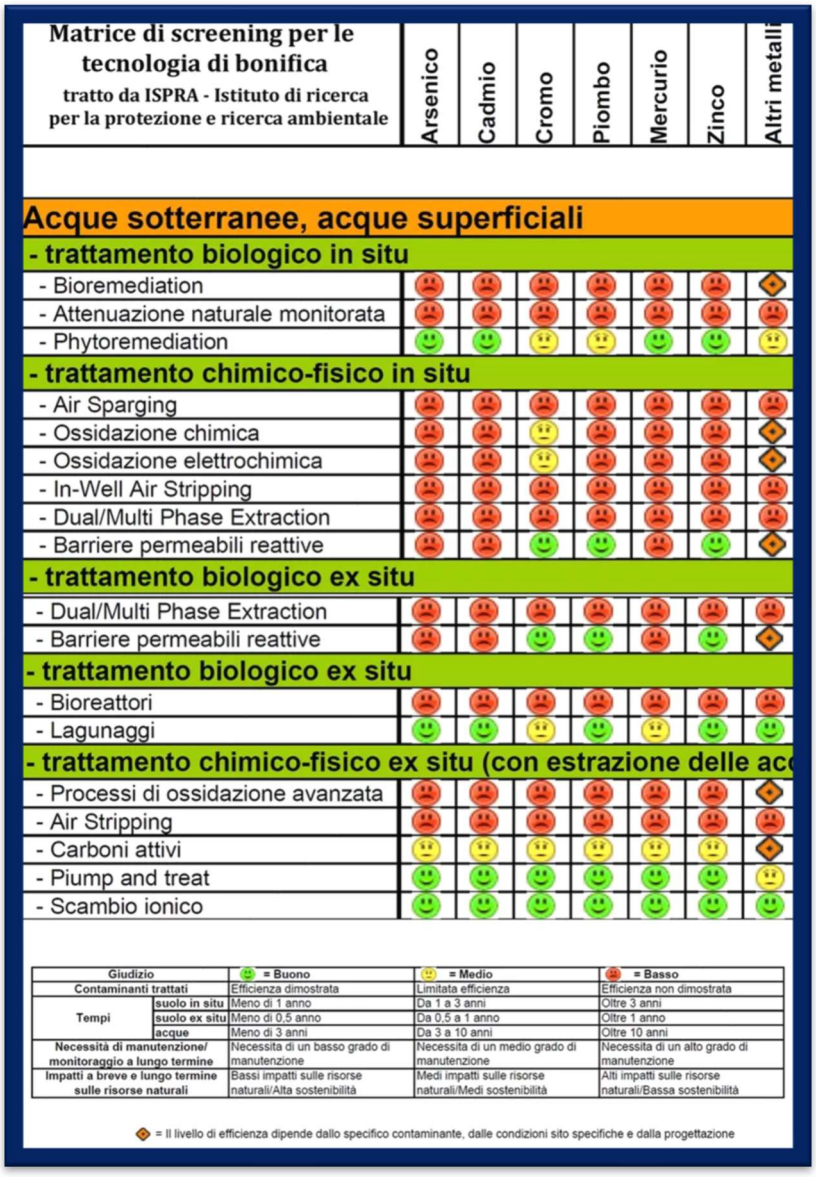
We have doubts about the validity of the reactive permeable barrier (BPR) proposed by the operational project to purify water. This treatment is based on creating a reducing environment, where the antimony should oxide, together with the sulfur present in the water, form again the antimony sulphide, which precipitates.

However, the ISPRA (Higher Institute for Environmental Protection and Research) in its guideline (Screening matrix of remediation technologies) indicates that this treatment is not indicated for mercury and arsenic (also these detected in the area of decontamination) which have a very similar behavior to antimony. In the scientific literature we have in fact found that the reactive impermeable barrier is capable of

decontaminating antimony only when it becomes part of complex molecules with a resulting negative charge. But they are extremely rare!

The same operational project, in justifying the BPR, explains that it is indicated above all for acid drainages, or from pyrite mines (where, according to geol. Prof. Protano, the outgoing waters also reach a pH of 3 or 4). Looking in the analysis we can say that Le Cetine is not the case: water is alkaline!

Instead, other treatments could be evaluated which seems to be more suitable according to ISPRA, such as ion exchange: these are ferrous substrates, enriched with harmless cations that are exchanged with those contained in water.



Matrice di screening per le tecnologia di bonifica tratto da ISPRA - Istituto di ricerca per la protezione e ricerca ambientale	Arsenico	Cadmio	Cromo	Piombo	Mercurio	Zinco	Altri metalli
Acque sotterranee, acque superficiali							
- trattamento biologico in situ							
- Bioremediation	☹	☹	☹	☹	☹	☹	◆
- Attenuazione naturale monitorata	☹	☹	☹	☹	☹	☹	☹
- Phytoremediation	☺	☺	😐	😐	☺	☺	😐
- trattamento chimico-fisico in situ							
- Air Sparging	☹	☹	☹	☹	☹	☹	☹
- Ossidazione chimica	☹	☹	😐	☹	☹	☹	◆
- Ossidazione elettrochimica	☹	☹	😐	☹	☹	☹	◆
- In-Well Air Stripping	☹	☹	☹	☹	☹	☹	☹
- Dual/Multi Phase Extraction	☹	☹	☹	☹	☹	☹	☹
- Barriere permeabili reattive	☹	☹	☺	☺	☹	☺	◆
- trattamento biologico ex situ							
- Dual/Multi Phase Extraction	☹	☹	☹	☹	☹	☹	☹
- Barriere permeabili reattive	☹	☹	☺	☺	☹	☺	◆
- trattamento biologico ex situ							
- Bioreattori	☹	☹	☹	☹	☹	☹	☹
- Lagunaggi	☺	☺	😐	☺	😐	☺	☺
- trattamento chimico-fisico ex situ (con estrazione delle ac							
- Processi di ossidazione avanzata	☹	☹	☹	☹	☹	☹	◆
- Air Stripping	☹	☹	☹	☹	☹	☹	☹
- Carboni attivi	😐	😐	😐	😐	😐	😐	◆
- Piump and treat	☺	☺	☺	☺	☺	☺	😐
- Scambio ionico	☺	☺	☺	☺	☺	☺	☺

Giudizio		☺ = Buono	😐 = Medio	☹ = Basso
Contaminanti trattati		Efficienza dimostrata	Limitata efficienza	Efficienza non dimostrata
Tempi	suolo in situ	Meno di 1 anno	Da 1 a 3 anni	Oltre 3 anni
	suolo ex situ	Meno di 0,5 anno	Da 0,5 a 1 anno	Oltre 1 anno
	acque	Meno di 3 anni	Da 3 a 10 anni	Oltre 10 anni
Necessità di manutenzione/ monitoraggio a lungo termine		Necessita di un basso grado di manutenzione	Necessita di un medio grado di manutenzione	Necessita di un alto grado di manutenzione
Impatti a breve e lungo termine sulle risorse naturali		Bassi impatti sulle risorse naturali/Alta sostenibilità	Medi impatti sulle risorse naturali/Medi sostenibilità	Alti impatti sulle risorse naturali/Bassa sostenibilità

◆ = Il livello di efficienza dipende dallo specifico contaminante, dalle condizioni sito specifiche e dalla progettazione

Picture 32: *ISPRA* analysis of decontamination methods 'efficiency

Urbanization works: sewer implant

The project involves the construction of urbanization works and the preparation of the connection to the sewer system and to the aqueduct of the buildings in the mining area, including those sold to a private individual by the Provincial Administration of Siena through a public auction in 2009.

These works arise from the need to avoid subsequent earth movements that could again diffuse heavy metals into the air, which would fall back into the surrounding area and would be inhaled by the people on the spot.

However, in the sales contract between the Province of Siena seller and private buyer, it is indicated that the public body will have to bear the costs of decontamination *("the owner must allow the decontamination works, which will be carried out at the expense of the provincial administration "*), but it is not indicated that if he will also have to take charge of the connections.

Furthermore, according to the legislation on remediation, "*For the purposes of the contribution for environmental remediation and restoration interventions, the charges relating to the construction of residential, commercial and industrial building works cannot be considered*" (Article 18 of Legislative Decree 471/99).

Moreover, the Municipality of Chiusdino, in the Urban Planning Regulations of 2012, approved the displacement of the volume to an area outside the decontamination area, following a request from the property: therefore, the need for septic tanks would disappear, and mining buildings would be destroyed.

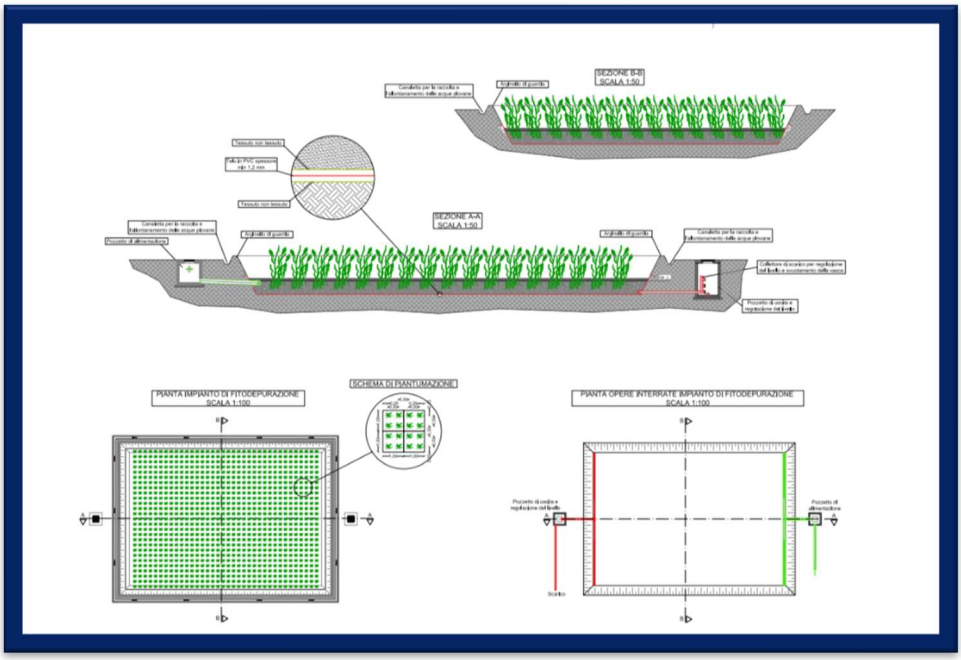
It is a storehouse of 30 square meters (part 29 sheet 6) for which the operational project provides for the construction of a septic tank for 4 equivalent inhabitants, to which other buildings should be added, as a requirement of the Union of Municipalities della Val di Merse has extended the need to equip all buildings with a septic tank as, it is obvious, the use for non-residential purposes could equally require the need for drinking water and sanitation: this is a roof of 120 square meters probably referable to a storehouse for metallurgical coke built in the 1940s (part.30 sheet 6) and the ruins of the new foundry built in 1939 and destroyed by the retreating Germans in 1942 (present in part.9 sheet 6, but not stacked) .

Picture 33: equivalent *inhabitants* per building

New ecologic depuring system: phytodepuration

This new method of depuration based on plant absorption is extremely ecologic as it bases its efficiency on the creation of a healthy ecosystem but it has its downsides: if the ecosystem loses its balance the whole depuration will stop. Compared with other depuring systems it is less efficient and needy of space. Moreover, periodically it needs maintenance and that the waste produced must be considered contaminated so disposed in special ways

The operative project establishes the realization of a phytodepuration implant. By the drawings it seems to be the "horizontal flow" type according to ARPAT regulation which is formed by a basin in which different gravel layers are displayed ending with an earth layer in which specific plant are cultivated. The plants absorbed the organic fraction left in the introduced sewer's water. After that water is canalized to the river. The only problem that we have found here is that the basin has been dimensioned by calculating the equivalent habitants (unit of measure) based on the cover surface (the physical surface occupied by the building) not taking into account that a building can have more than one floor! Plus, the basin should be placed in an area not covered by wood that consequently would be destroyed!



Picture 34: *phytodepuration* implant of Le Cetine

Slopes: is there really the risk of landsliding?

The operational project proposes a remodeling of the slopes due to the apparent risk of landsliding.

Unfortunately, we were unable to see the report on the stability of the slopes presented by the designers at the Services Conference, despite our request to the territorial office of the Tuscany Region: it seems that it has been lost and in any case is considered outdated, considering that the executive project is already been contracted.

By the way, from our analysis, after consulting Eng. mining Zanchi, it emerged that the danger does not appear higher than that of other places accessible to the public such as cliffs or historical monuments and in that place, there is not the need of reshape. Only the foot of the lowest landfill, as it was excavated relatively recently to draw materials, in our opinion could be worthy of an intervention.

The reason for the reshaping indicated in the operational project lies in the fact that *"The landfills of mining residues present stability problems due to the considerable slope of the slopes, the absence or scarcity of vegetation, and the inconsistent nature of the materials ... hinged without constipation and reinforcement / support elements, are arranged naturally according to the angle of rest of the discharged material* ", but here the arboreal vegetation covers almost the entire area, and we wonder if after 80

years from the closure of the mine, and in the absence of any sign of landslide, landfills are still to be considered inconsistent.

To ensure water management, the creation of upstream dimples could be evaluated in order to reduce the water supply to the site, which seems not to appear in the operational project: in the decontamination of the Su Suergiu antimony mine, such arrangement has reduced by 40% the supply of water to the site. This means less polluted water and safer environment!

The documents of the project say that *"Given the extension of cultivation in the subsoil and the presence of surface tunnels, it has been highlighted that subsidence could develop due to internal collapses. (Feasibility study 2.2.4)"* In the area there are some small and localized depressions, about 20 cm deep, related to landslides of superficial tunnels, but this should be considerated to the solid geological nature of the quarryrnous limestone (so much so that most of the tunnels were not reinforced) and that any collapses of more superficial tunnels would cause only small depress. Ing. Zanchi also explained to us that during a mining activity a lot of attention is given to safety, so much so that the most unstable tunnels, after exploitation, are closed with the aggregates coming from the new excavations, and galleries excessively excavated in width reinforced by retaining walls; the book on Cetine by Menchetti shows 3 pictures in which are highlighted walls of stuffing, one of which defined colossal. So, we think that experts should do more analysis.

Picture 35: dump

The project solution

The remodeling of the 5 hectares surfaces means constructing regular steps: the declared objective is to make them more usable by residents ("*redevelop the entire area currently degraded, making it usable and suitable for residential use",* in 3.*1 Reason for the chosen solution and purpose*s). In this perspective, it is not planned to remodel the forest immediately behind the mining village, where the slope is very high and therefore difficult to use: here too there seem to be inerts dumps, certainly there are containment dry stone walls.

However, the current trend of environmental recovery is to restore the site giving it an aspect that is as natural as possible, thus saving a large part of the costs of earthmoving and canceling the landscape impact of an evident human intervention, also in consideration of the fact that this area is under particular landscape protection (Ministerial Decree 18 January 1973, PIT 2005-2010).

The same legislation on the decontamination of polluted sites indicates that "the environmental remediation and restoration of a polluted site must prefer the use of techniques that favor the reduction of handling" (art. 5, Ministerial Decree 471/99). This means that the project should consider both a reduction of cost and reduction of deforestation.

The new regional decontamination Plan, proposed 5 months after the approval of the operational project of the Cetine, establish the need for a vegetation analysis drawn up by a specific professional in other to preserve the natural environment.

Demolition of historical valuable monuments

The operational project states the demolition of the smokes pipe of the foundry and the ruins of the chemistry laboratory, and the filling of the water tank and the foundry basements to be carried out with waste materials; in addition, the demolition of the most recent greenhouse is planned, in good condition, connected to the agritourism activity that took place here several years ago.

In this regard, during the approval of the project, some prescriptions were made at the Conference of Services: the Arpat asked to "*detail the operating procedures regarding the interventions to be carried out on the structures and the ruins relating to the metallurgical plants (chimneys , smoke line, ovens) analyzing the various operational hypotheses (demolition and / or safety)* "and the Superintendency has prescribed that" *publicly owned buildings over seventy years old must be objects of cultural interest* " and therefore, in fact, of all those existing, given that the mining activity ceased in 1945, excluding however from the analysis the three buildings now

private, as they were sold at auction by the Provincial Administration of Siena, built in the 40s. Some of these buildings could however be destroyed as the Municipality of Chiusdino has approved a transfer of volumes. So, in the first months of 2022, the drafting of the executive project was suspended as the evaluation of the Superintendency is underway.

Very interesting is the smoke pipe of the foundry (indicated in the project as the "chimney", which was located at its end and no longer exists). We have in fact verified that the stone pipeline, built in 1899, is a rare element in the panorama of industrial archeology and represents an open book for possible studies aimed at identifying the characteristics of the extracted material and the metallurgical techniques used. The demolition is motivated in the project with the high contamination of heavy metals but, precisely for this reason, perhaps the resulting material should be properly disposed of. The ARPAT, in fact, during the approval of the operational project, the ARPAT asked to give details of "the methods for managing the resulting materials in the event of demolition"; alternatively, it is possible to evaluate the safety with a painting encapsulating with resin, as was done in the mining park of the Su Suergiu mine in Sardinia with which we were confronted: the metric calculation, of 2014, indicates that this operation has a cost of 6.14 eur / m2.

The demolition of the ruins of the chemistry laboratory is also planned, motivated by the danger of collapse, and subsequent recovery of the volume for residential purposes (in fact, the project includes an Imhoff pit); it is a perimeter wall with large arched openings dating back to 1899, adjacent to the ruins of the 1939 post office; here too an alternative safety measure could be advised; the laboratory was in fact essential to establish the richness in antimony of the extracted material and of the processed product that came out of the foundry.

The water tank, serving the foundry, appears for the first time in a map of 1916 and was fed by a small reservoir just upstream, already indicated in the maps of 1909; therefore, we think it represents the testimony of how one of the numerous difficulties encountered in running the mine was faced, given the geological nature of the area is devoid of water. The same drinking water comes from Cotorniano, more than 2.5 km away as the crow flies: the connection was made in the 40s with great difficulty, as shown by the correspondence kept in the mining archive of Villasalto that we were able to consult not only that: the valuable wrought iron railing that delimits the tank at its upper level, together with the excellent workmanship of the straight wall, testify the importance that was attributed to this mine, as engineer Zanchi pointed out during the site inspection.

It is also foreseen the filling of the basement of the foundry, dating back to 1899: these are evocative rooms with arched vaults, where the slag accumulated, located near the house once rented by the Tuscan region and used as a farmhouse.

The buildings sold to private individuals by the Provincial Administration of Siena also have a historical value: a storehouse, a shed and the ruins of the foundry. The 120 square meter shed, which the book on the Cetine mine indicates as a shed where women and children sorted out the material just extracted, to be destined for the landfill or the foundry, could also be the shed-deposit for the metallurgical coke necessary for the foundry below: in fact, the map of 1939 does not indicate any sorting canopy at that level, and in January 1940 a correspondence kept by the mining archive of Villasalto (Sardinia) indicates the need to build a coke deposit.

Another ruin is the new foundry, built in 1939 by skilled workers from the much larger antimony mine in Villasalto (Sardinia), and destroyed in 1942 by the retreating Germans: only a tower of 20 square meters high about 6 meters remained. However, the property has requested and obtained the transfer of volumes: will these buildings then be demolished?

The analysis of the buildings could also reveal particular aspects to be protected, such as the lintel of a window made with a railroad track of the mine, which an unsuspecting person would immediately replace. (see the annex called "Buildings" for a complete list of the interesting buildings)

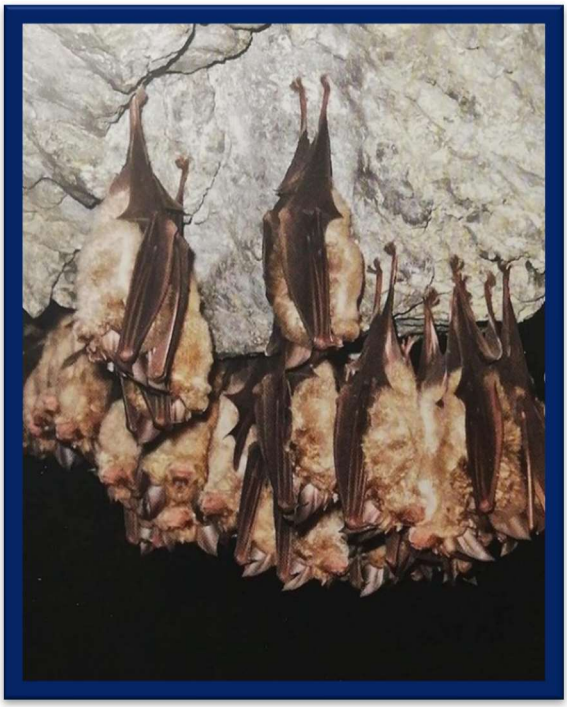
Picture 36: fumes pipe

Filling the galleries: what about bats?

The decontamination project envisages the filling of the superficial tunnels with the excavation waste materials, but perhaps it is necessary to evaluate the opportunity to maintain access for scientific purposes (the area has been proposed as a geosite of regional importance, due to its richness and the rarity of the minerals found) and, last but not least, the legislation on the protection of bats should be respected that use these tunnels as a winter refuge: in fact, the presence of different species of Chiroptera is known, for which any disturbance is prohibited as they belong to the "Strictly protected fauna" by EUROBATS, the agreement on the protection of European bats which entered into force in 2004, implemented in Italy by Law 104/2005, but previously protected by Presidential Decree 357/1999 and subsequent amendments.

In particular, the book on Menchetti's Cetine mine indicates that there is the greater Rhinolophus (also called greater horseshoe), in addition to the lesser Rhinolophus, the greater Vespertilio and species belonging to the genus Pipistrellus.

Talking about the result materials, according to PRB, they should be quantified and it the final process of disposing should be determinate, especially for those that are contaminated and toxic.



Picture 37: bats

The decontamination expense: does it worth the cost?

The bill of quantities was drawn up in 2003, therefore the executive project will update it both in monetary terms and on the basis of the additional works prescribed at the time of approval by the Services Conference, which concern among other things:

- the implementation of compensatory afforestation,

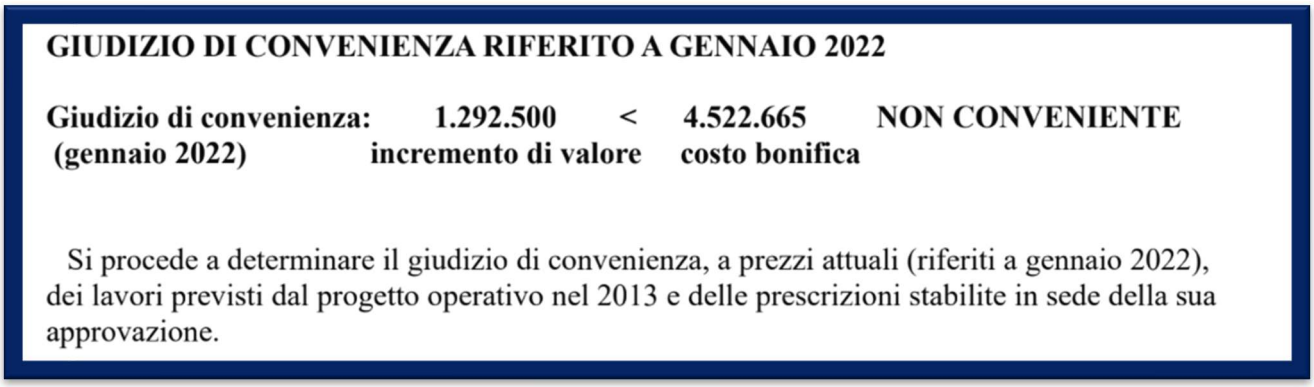
- the management of waste materials,

- the increase in the thickness of the uncontaminated soil of external origin,

- the increase in the number of septic tanks.

We did not find any indication on the price list used for its drafting but, using the regional price list for public works and the regional price list for forestry works, we estimated that the final cost of the intervention could go up to 4.5 million euros compared to 3 million euros indicated in the operational project. That's a lot of money! Presuming that most buildings will be sold to privates we do not's think that the decontamination is worthy, as the prices the buildings won't balance the costs.

Since among the disciplines that we study there is also the estimation, we made a judgment of convenience of the planned works, referred both to 2013 (at the time of writing the project) that to date. We have estimated that, in order to recover the costs of the decontamination, the average cost of sale of the buildings would have to be three and a half times that of market.



GIUDIZIO DI CONVENIENZA RIFERITO A GENNAIO 2022

Giudizio di convenienza: 1.292.500 < 4.522.665 NON CONVENIENTE
(gennaio 2022) incremento di valore costo bonifica

Si procede a determinare il giudizio di convenienza, a prezzi attuali (riferiti a gennaio 2022), dei lavori previsti dal progetto operativo nel 2013 e delle prescrizioni stabilite in sede della sua approvazione.

Picture 38: results of our studies on the convenience of the project

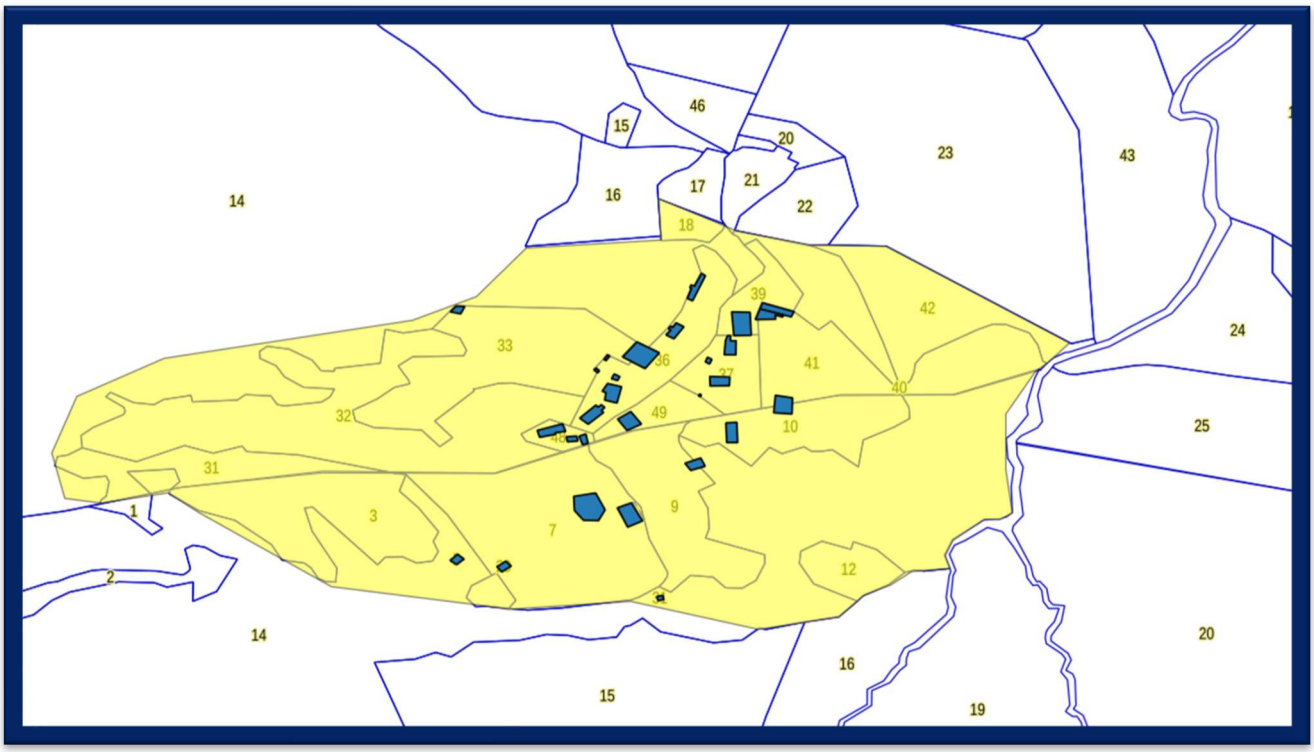
Catastal differences

We wonder if all public bodies know the real situation of the real estate assets of the former mineral village.

Some buildings are not stacked. Others are collaborating but registered as homes or warehouses. Still others are registered in the land register and therefore not transferred to the buildings register.

Also, the list of properties owned by the region published at seems not complete, as there are no parcels 37, 38 and 39 of sheet 5, occupied from five buildings.

Nor is the project document *"E2.3 exhaustive - Sheets of the building heritage of historical and architectural value",* which illustrates the buildings in the decontamination area.



Picture 39: catastal view of the decontamination site

Conclusion

Here is the end of our report (click here to see o! So, it is the time to draw our conclusion! In general, the decontamination project, due to deforestation, remodeling, demolition of elements of the former mining village, establishes irreversible interventions, which we think that can be replaced with reversible and less invasive interventions, for the benefit of future generations.

Plus, the construction of a mineral park could be positive in the future as part of a project to further enhance the area, which boasts the presence in the vicinity of important sites such as the castles of Montarrenti, Frosini, Miranduolo and the Abbey of San Galgano without considering that recent archaeological investigations have ensured the presence of Etruscans and Romans in the area, and that the area was crossed by a via Francigena as evidenced by the presence of a mansion of the Knights Templar near Frosini!

In conclusion we are extremely puzzled by the administration decisions and times which seems to be endless and we cannot explain ourselves how it is possible that such evident damages and mistakes were not spotted by the experts. We believe that especially in such tremendous times that we are living in, it is important to preserve the cultural heritage and the environment. According to the new-modified article 9 of the constitution both environment and culture are protected by our state, therefore whenever the human being wants to do something he must ponder its action in order not to interrupt the harmony in the world-wide ecosystem… do you think it has been done planning this decontamination?