

Multidisciplinary research on two ancient mining sites in Western Liguria (Italy)

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Abstract

The article deals with some historical, material, and geo-mineralogical aspects related to the multidisciplinary exploration of two ancient mining cavities in West Liguria (*Ponente Ligure*) carried out in the most recent years by a joint team involving specialists from two speleological associations: Gruppo Grotte Borgio Verezzi sez. CAI Finale Ligure and Gruppo Speleologico Ligure Arturo Issel. Coupling bibliography reviews with field activity, it was possible to focus attention on two sites briefly described here. Aside from a novel full 3D survey, an environmentally friendly campaign of observations was carried out, trying to sort out elements in agreement or in contrast with the available historical information. The first case-history deals with the ancient Bric Gettina galena deposit (Rialto, Savona, Italy) also known as Melogno, Rocche or *Purin*, now included in a popular hiking trail. Ruins are still visible as well as a few adits with a few tens of meters of tunnels. The second site is the Cà dei Bassi iron deposit (Orco Feglino, Savona, Italy), less known than the previous one, even though the most recent activity dates back to the XX Century (AA.VV., 1927), when the autarchy policy made attractive even deposits as small as this. In spite of an apparently short history, the site seems to be quite interesting because of its diversity in biological and geological terms.

Keywords: West Liguria, Ponente Ligure, mining, Bric Gettina, Cà dei Bassi, galena, pyrite.

Introduction

Materials and methods

The joint team involved two associations (Gruppo Grotte Borgio Verezzi sez. CAI Finale Ligure and Gruppo Speleologico Ligure A. Issel) and covers skills and areas of knowledge including, among others, anatomy, archaeology, biology, chemistry, geology, history, mineralogy, mining, speleology. The work dealt with some historical, and scientific aspects related to the exploration of some ancient mining-related cavities in West Liguria (*Ponente Ligure*) carried out in the most recent years. Aside from the more traditional cave exploration, the work team paid attention to a number of lesser-known cavities, whose origin is artificial and that were dug for mining purposes. Surveying has been carried out with the LiDAR sensor mounted on an iPhone 13 PRO device using the application Scaniverse: physical visual target has been positioned in critical points to be detected and then used to facilitate data editing. Data has then been processed with Cloud Compare (graphical work) and then QGIS (geo-referencing) (fig. 1).

Ore and minerals were checked using Raman spectra-

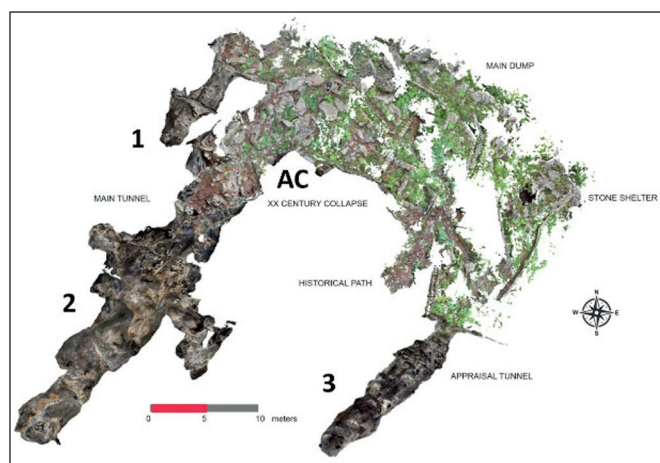


Fig. 1 – The most recent Bric Gettina complete survey (embedding LiDAR data) that mimics the previous (2014) numbering and survey relevant to tunnels 1, 2 and 3 as well as to a secondary appraisal cavity (AC). Original rendering by GGBV and GSL.

based techniques in collaboration with Bicocca Milan University (DISAT).

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Case histories and results

Bric Gettina mines

Small lead ore occurrences are a common encounter in Western Liguria (Jervis, 1884; Issel, 1881; Issel, 1892; Bracco *et al.*, 1999; Del Lucchese & Delfino, 2008) in many Bric Gettina galena deposit (Rialto, Savona, Italy) also known as Melogno or *Purin*, has been an important mining site in the past centuries (Nesti, 2011). Ruins are still visible as well as a few adits and tunnels dug into the Palaeozoic rock (Melogno Porphyroids Fm.: Palenzona, 1980). The ore mainly consists of veinlets and pods of galena embedded in a quartz vein extending for some tens of meters, showing a significant thickness variability (at centimetric to decimetric scale). Despite the presence of relic ore (Amoretti, 1980) and some recent geological and mineralogical re-investigation efforts (Pipino, 2016), mining was already over by Napoleonic times (Barelli, 1835; Jervis 1884).

History and legends about the mine seem to have been running since much more than two centuries (Caldera *et al.*, 2020). With the exception of some mining investigation carried out in the second half of the XX Century (Pipino, 1976, 2003, 2008, 2016), from the economic geology standpoint, the deposit got neglected or forgotten for a long time (Mojon, 1805; Jervis 1884). Further scientific investigations are planned according to recent literature (Bayley, 2008) for a better assessment of the actual consistency of the materiality of the deposit.

The field campaign allowed to identify five cavities, in agreement with the previous speleological works.

Significant part of the mine tailings can be seen downhill the main adit (galleria 2).

Part of the material is dispersed along the very steep slope underneath (main dump).

Traces of pre-industrial works are still visible both outside and underground, even if significant rock removal has been done by air compressed drilling while investigating for possible mining ventures in the XX Century (fig. 2).



Fig. 2 – Denting left by pre-industrial rock splitting techniques (photo GGBV and GSL).

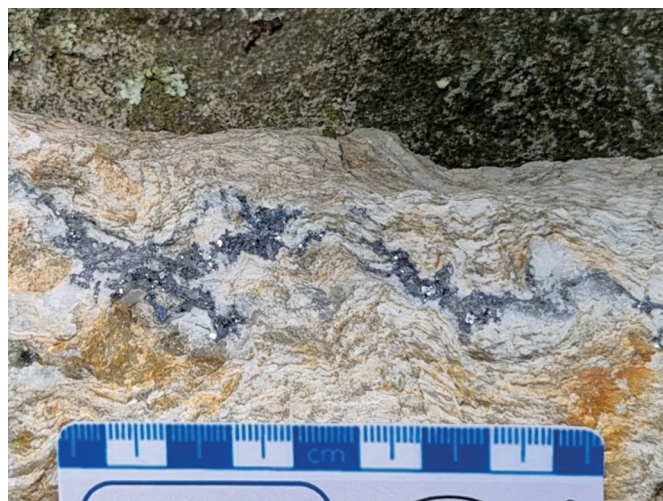


Fig. 3 – Bric Gettina gray-blackish galena ore stands out against the whitish quartz gangue (photo GGBV and GSL).

The area is now a protected site and hosts floral and vertebrate peculiarities (Nesti, 2011).

The area yielded in the past interesting minerals species (Amoretti, 1980; Antofilli *et al.*, 1983), including wulfenite and cerussite (Castellaro, 2005 & 2008), (fig. 3).

Being the mineralogy state of the art quite mature, the site still offers archaeological and historical investigation opportunities.

Case Bassi mine

The Case Bassi iron deposit (Orco Feglino, Savona, Italy), is poorly known to the general public, despite the recent age of the last works, dating to the first half of the XX Century, while autarchy policy made attractive metal deposits as small as this (Castello & Castello, 2021).

The area is characterised by the contact between the metamorphic schists (Permo-Carboniferous) and the dolostone carbonates (Triassic). Along the irregular and tectonized contact there is a sheared pyrite layer with subordinate barite reaching a maximum thickness of about 1 m. The pyrite is often weathered and replaced by gossan rock and locally by yellow and red ochre. This assemblage is topped by the younger karstified Miocene carbonates (Pietra del Finale).

The on-site observation allowed to recognize an accessible adit and a drainage secondary excavation, with diggings extending up to about 100 meters into the slope, following the irregular shape of the ore bearing layer. Distribution of pH appears variable, the site ranging from decomposing pyrite to calcite deposition conditions. Within the acidic portion of the mine there is plenty of sulphates, including crusts of secondary gypsum, very good crystals of melanterite and local rozenite patches (here reported for the first time) and other mineral phases still under investigation (fig. 4).



Fig. 4 – The ephemeral sulphate melanterite from Case Bassi (picture by M. Marchesini).

Fragmentary information about iron prospecting and metallurgy in the Finale area might make a base for further investigation comparing historical and material multiscale evidence.

Interesting populations, including *Speleomantes stri-natii*, isopoda and bats are present in the main cavity, making the site interesting for its geological and biological diversity. Due to the importance of the site

for the local water balance and its potential fragility, visits of the site by a general public should be discouraged.

Discussion

Further work is planned to include additional data into the surveys (such pH, T, and fauna distribution) to be integrated into further hydro/geological and/or historical studies.

Bric Gettina site is already well known to the public, but little effort has been spent in protecting the mines causing damage from mineral gathering. We have no notice of previous extensive archaeological studies of the site that could have therefore a significant potential for future campaigns.

We acknowledge that Case Basse mines haven't been studied in the past because both cavities are located in plots of land difficult to access on logistical and practical ground. Up to now, access has been granted to the drainage tunnel, allowing us to survey the cavity and 1) gathering a few mineralogical samples to be analysed and, to a lesser extent, 2) acquiring some early biological data. Most mineralogical data from the mine comes from samples gathered in the 1990s that we were able to get in early 2023. Considering no collapse has been documented in these 20 years, a new visit to gather fresh data and survey the mine is obviously considered as an interesting further step in the research.

Conclusion

The early phase of the studies already allowed to make significant observations and to draw some preliminary conclusions:

- The Gettina remaining artefacts exhibit interesting mining features on one of the richest lead occurrences in western Liguria / southern Piedmont areas.
- The Gettina site still offers opportunities for more future in-depth geological, mining, and archaeological investigations to be coordinated with the institutional entities.
- The Case Bassi site has an outstanding geological variability concentrated in a very small area, reflected in lithological, pH, watering variation within a very small distance. This is reasonably reflected in environmental and biological diversity whose investigation requires further efforts.
- The involvement of different professionals with different areas of knowledge, affiliations and groups proved to be very efficient in understanding the scientific and cultural potential of the cavities of the area.
- Further efforts are planned to carry on exploring these and other cavities in an integrated, scientific, and environmentally friendly manner.

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