



Buried Treasures and Ancient Forges: A Historical Analysis of Mines and Ironworks in the Stilaro Valley

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Abstract

This study aims to examine in detail the mines and ironworks in the Stilaro valley and the ancient ironworking process that took place there. Until the end of the 19th century, the area comprising the municipalities of Bivongi, Pazzano, Stilo, Fabrizia, Mongiana, and Guardavalle, represented one of the most significant iron and mining centers in southern Italy. This study is based on archaeological, historical, and archival sources to deepen the understanding of such economic and industrial activities that characterized the region. The historical and geological framework of the Stilaro valley provides an overview of the mineral riches and the complex mining and ironworking activities that have taken place over the centuries. Historical evidence, supported by significant findings, suggests an ancient presence of metalworking in the region, with an influence extending to Magna Graecia. The analysis of mines and ironworks reveals a complex dynamic of adaptation and interaction among ancient peoples, whose migration and settlement were influenced by the natural resources and economic opportunities offered by the region. The role of mines and ironworks not only contributed to local economic and industrial development but also shaped the cultural and social landscape of ancient and medieval Calabria. The implementation of conservation and enhancement projects, such as the Ecomuseum of the Ironworks and Foundries of Calabria, underscores the importance of preserving this historical and industrial heritage for future generations.

Keywords: Iron and steel history of Southern Italy, Mines, Ironworks and Foundries, Economic history, History of Industry

Introduction:

Until the end of the 19th century, the Calabrian territory, comprising the municipalities of Bivongi, Pazzano, Stilo, Fabrizia, Mongiana, and Guardavalle, represented one of the most significant iron and mining centers in southern Italy. At different times, three weapon factories, thirty ironworks, and two foundries were active in this area. These establishments processed limonite extracted from deposits located in the mountains of Stella, Mammicomito, Petracca, and Consolino.

Currently, thanks to new knowledge acquired through the study of archival documents and modern research, we can further deepen our understanding of this ancient ironworking process and related mining activities. These new sources and methodologies allow us to shed light on previously obscure or little-known aspects of this important economic and industrial activity that characterized the region.

The hypothesis is supported by several significant archaeological findings. In the site of the 9th-century B.C. necropolis at Sant'Onofrio (Nenci, G., 1988), near Roccella Ionica, iron objects have been found, indicating an ancient presence of metalworking in this region. Furthermore, discoveries dating back to the Bronze Age in the Stilaro area and others from the Greek-Roman period (Franco, D., 2003), in the surroundings of Pazzano and Stilo, provide further evidence of ironworking and metallurgical activity in the area (Fiorenza, E., 2022; Fiorenza E., 2023).

The presence of a "culture" of ironworking in Calabria is clearly of importation, indicating a flow of knowledge and metallurgical practice from other regions. The mineral wealth of the valley, spanning the Aspromonte and the Calabrian Serre, has always attracted diverse populations that settled in mineral-rich areas to exploit their resources.

The earliest populations to take interest in the mineral resources of the Calabrian territory likely came from neighboring Iapygia. These populations, having abandoned the Salento Peninsula at the end of the Bronze Age, settled in Calabria, drawn by pastures and iron deposits, which they began to exploit more intensively than the indigenous populations.

This archaeological and historical evidence supports the idea that the mineral resources of Calabria played a significant role in the development of ancient communities and in the settlement of populations from other territories, contributing to the formation of a complex cultural and industrial landscape in the area.

The hypothesis of a sudden immigration of populations from neighboring Puglia is supported by the presence of significant archaeological

findings related to the Bronze Age, which testify to a civilization strongly linked to metallurgy. Conversely, findings attributable to the Iron Age are extremely rare in this area. This contrasts with the situation in Calabria, where the opposite is observed: few artifacts dating back to the Bronze Age, but numerous artifacts from the Iron Age.

It is hypothesized that the scarcity of raw materials, especially iron minerals, forced these populations to seek new lands rich in iron deposits. These deposits would have allowed to produce technologically more advanced weapons and artifacts. This migratory movement would have led them to Calabria, where there was already some mining exploitation and where indigenous populations had long been producing iron artifacts. This phenomenon reflects a complex dynamic of adaptation and interaction among ancient peoples, whose migrations were influenced by the natural resources and economic opportunities offered by different regions.

The Geography of the Stilaro Valley

The territory adjacent to the municipality of Stilo, located on the Ionian slope of the Calabrian Serre, can be identified, for its history, as the richest mining area of the Kingdom of Naples. It is known for its extensive deposits of iron minerals and for the presence of lead, silver, and gold. In addition to the natural richness of the subsoil, the region benefits from the typical geomorphological conformation of the countryside, characterized by vast forests and numerous seasonal watercourses, which facilitate the processing of minerals on-site. These elements provide both the necessary fuel and essential hydraulic energy for the operation of the early rudimentary smelting plants.

The mines of Stilo, presumably active since the 7th-8th century BC by the indigenous population (Orsi, P., 1926), are mentioned for the first time in 1094, in a charter granted by Count Roger II of Sicily to the community of Carthusian monks of Santo Stefano del Bosco (Tromby, D.B., 1773). Subsequently, in 1313, these mines are cited in an edict by Robert of Anjou, who, in confirming the ancient donation, orders that the monks not be disturbed in the extraction process of the "iron vein" by state officials present at the port (Orsi, P., 1926).

The geological conformation of the Stilaro area (Bova, D., 2008), although partly known, has not yet received a thorough and detailed study. This area includes the territory of Stilo and Pazzano, along with the Consolino and Stella mountains, which extend to the Ionian Sea.

The organization of the geological layers, highlighted through normal terrain cuts, particularly those carried out at the Campanaro locality, where the Monasterace-Pizzo national road turned westward, shows the following arrangement: the Quaternary or Neozoic group extends mainly downstream,

from the roots of Mount Consolino to the sea; the Tertiary or Cenozoic group includes the Pliocene, Miocene, and Eocene systems; the Secondary or Mesozoic group presents Cretaceous, Jurassic, and Triassic systems; finally, the Primary or Paleozoic group hosts limestone, limonite, arkose, phyllites, graphitic schists, mica schists, phyllitic gneisses, and gneisses, with granite forming the central backbone of the Apennines (Cunsolo, L., 1965).

The ironworking region can also be divided into two mountain masses with approximately identical geological structure: the Stella and Consolino mountains. The latter of these, located to the east and north of the Stilaro Valley, extends normally with respect to the former towards the southwest; however, it is separated from Mount Stella by a narrow gorge, just over a hundred meters deep, closed to the north by a terrace formed by grayish phyllitic rocks tending towards turquoise, with variations of yellow and brown due to the presence of limonite, derived from iron and its compounds under the influence of humidity.

This terrace rises from the roots of the Stella and Consolino mountains and extends northward into a short plain, upon which the town of Pazzano stands, which unfortunately continues to lose population steadily. Subsequently, the plain slopes down and descends into other terraces, characterized by olive groves and vineyards, until reaching the bed of the Stilaro stream, where, on the western slope of Consolino, lies the town of Bivongi.

Near the municipality of Bivongi, whose name seems to indicate the place where iron was tempered, and "Bingi" (Bova, D., 2008), an ancient hamlet now disappeared, believed to have been indigenous centers dedicated to mining exploitation or possibly founded specifically in Greek times for the same purpose, there is still a locality called "Argentera" today. Opposite it is the locality "Argalia," where on the same site in 1274, the Cistercian monks built a facility, a "mulin de fer," used not to grind wheat but to crush the ore, in this case galena, extracted from the adjacent mine called "argentera" (Franco, D., 2008). Currently, on the site, there are the remains of a tannery built in the early 20th century over a pre-existing ironworks.

The ruins of the latter were probably visible and substantial before the construction of the tannery, as reported by the priest Giuseppe Raspa in one of his works:

«As for the silver lead, there is, however, in the vicinity of Bivongi, a locality called Argentiera because of the mines that in the past were exploited for the extraction of the mixed metal. A short distance away, in a short distance, there are also the ruins of the furnaces used for the processing of the raw ore and the refinement of the individual segregated metals» (Raspa, G., 1911).

Along the Assi stream, previously known as "the river of silver," there is a locality called "argentina" (Bova, D., 2008). On the middle-upper stretch of the Stilaro, there persists a region identified as "angra do Furnu." Along the course of the "Melodare" stream, the locality "Argastili" is identified, suggesting the operation of a workshop during the Greek or Byzantine era (Rohlf, G., 1974; Franco, D., 2003; Rubino, G. E., 1978).

The area shows traces of ancient iron workings in the localities of "Pietra," in the municipality of Placanica, and "forno" near Camini. This municipality, originally known as Kaminion, which derives from Greek and means chimney or furnace, takes its name from the ancient furnaces used to produce ceramic artifacts. This village developed as a hamlet of Stilo around the 7th century, a period of prosperity for the area. In Contrada Jeritano, near the coast, a pit grave dating back to the 6th century BC has been discovered, attributable to a Bruzian farmstead (Mollo, F., 2018).

The national road that passes through Pazzano connects significant inland centers, including Stilo, Mongiana, and Serra San Bruno, stretching from the Ionian Sea coast at Monasterace to the Tyrrhenian Sea at Pizzo Calabro. This main artery follows the slopes of the Consolino and Stella mountains, gradually ascending, while the limestone of the Stilo massif gives way to the granite of the mountain. Beyond a thousand meters, the vegetation transforms into a dense forest of elms, beeches, and firs, but the deforestation activity of forestry companies continues to negatively impact the hydrometric conditions of the underlying region.

The road presents the same schistose rock formation as Pazzano. In some sections, the limestone present on the slopes and peaks of Mount Stella has caused landslides and accumulations that cover the schist.

In ancient times, Stefano Czyskoswki conducted an analysis on some mineral samples found along the road from Stilo to Pazzano, obtaining the following results: iron 0.90%; manganese 6.10%; zinc 0.80%; phosphorus 0.028%; silicon 1.50%; calcium 46.50%; aluminum 1.10%; magnesium (traces); iron loss 36.60% (Cunsolo, L., 1965).

Mines in the Stilaro Valley: analysis between ancient and contemporary times.

Regarding the mines in the Stilaro area, now completely abandoned and inaccessible, Cunsolo, citing Crea, states:

«It is said that in past centuries, on the hills beyond the Stilaro exposed to the south, there was an ancient silver mine, as still suggested today by the name preserved in the locality, called the Argentiera. It is said that on the slopes of a limestone mountain overlooking Stilo, precisely in the place indicated as S. Giorgio, another gold mine was discovered and explored in the past. However, beyond the uncertain traditions, there are neither traces nor

documents of either, or it is concluded that no benefit, apart from the expenses incurred, justified their abandonment. A more recent event, dating back about nine years ago, in 1832, testifies that after abundant rains significant landslides occurred in the territory of Pazzano, from which important veins of silver lead emerged, collected by many inhabitants of the surrounding municipalities. In several points of the indicated territories, this mineral manifested itself, but in the mentioned localities, it was more abundant and purer» (Cunsolo, L., 1965).

Cunsolo provides a detailed account of the ancient mines in the Stilaro area, outlining the traditions and legends related to the extraction of silver and gold in the region. However, the author denounces the lack of tangible evidence of these mining activities in the past, warning that many of them are legendary or poorly documented. Additionally, reference is made to more recent events, such as the landslides of 1832, which brought to light veins of silver lead, demonstrating the importance and unpredictability of mining resources in the area.

In the hinterland of the valley, on the slopes of the Stella, Consolino, and Mammicomito mountains, until the last century, there were about thirty mine shafts, of which unfortunately only a few are still visible. This significant number attests to the crucial importance of this mining basin for the entire southern Italy. Activities related to resource exploitation date back to ancient times. Metalworking, which spread in Calabria around 1000 BC, presumably thanks to the work of Mycenaean navigators, was further perfected by the Enotri, who began to exploit the surface deposits of materials such as copper, silver, and iron found in the territory.

In addition to the well-known mine in Pazzano, located along the Mines Road at the entrance of the town, there is the Grande mine in the municipal area of Bivongi, situated on the western slopes of Mount Consolino. Nevertheless, many other mines have disappeared over time, mainly due to lack of protection and changes in the territory, often caused by landslides and widespread collapses throughout the area. Recently, along the road leading to Ferdinandea, during some redevelopment work on the national road leading to Serra San Bruno, the municipal administration chose to wall up a mine shaft, commemorating it with the installation of a metal plaque on the closing wall. Even today, along the Mines Road, fragments of smelting slag can occasionally be found, silent witnesses to the mining activities that have characterized the area.

The historical reconstruction of the mining and metallurgical activity in the upper Locride is extremely complex due to the scarcity of available data. In antiquity, the area was renowned for the production and processing

of metals, particularly bronze. Paolo Orsi, a prominent archaeologist in Southern Italy at the beginning of the 20th century, is known for discovering the oldest ironworking site in the Stilaro Valley. During archaeological excavations in the Magna Graecia city of Kaulonia, the scholar discovered the remains of a processing environment, presumably a workshop, along with artifacts such as iron spearheads and arrows, as well as numerous smelting residues.

These findings, particularly the slag, now housed in the storage of the State Antiquarium of Monasterace (RC), are of particular interest as they confirm the hypothesis that Greek settlers in Kaulonia may not have imported iron from other regions but rather worked it locally, using the raw material from the inland mines.

These mines, presumably cultivated by local indigenous people, would have constituted an essential source of raw material, exchanged with the Greeks to produce utensils and artifacts.

The foundation of the polis of Kaulonia, starting from the 8th century BC, marked the beginning of systematic mining activities and intense commercial exchange between the indigenous populations of the hinterland, engaged in mineral extraction, and the new coastal colonizers equipped with the technological skills to produce high-quality artifacts.

Metallurgical activity, particularly the production of iron and silver, played a significant role in generating economic surplus that allowed the allied polis of Kroton to achieve a remarkable degree of development. This progress was also reflected in the issuance of silver coins depicting figures such as Apollo and the deer.

Testimonies of the cult of Apollo are numerous in Magna Graecia, with examples such as the Delphic tripod at Croton, attributable to the period of the colony's foundation under the aegis of Apollo. However, interpretative ambiguities persist among scholars, awaiting new discoveries that may clarify these aspects.

The bronze emissions of Caulonia present interpretative challenges, with hypotheses suggesting the beginning of coinage shortly before the city's destruction by Dionysius and a possible reinstatement during the Hannibalic period. The presence of a male head, interpreted as that of a river deity like the River Sagra, suggests a dating prior to 389 BC. Archaeological and numismatic evidence cited by various authors supports this hypothesis. (Gorini, G., 1975; Gagliardi, V., 2007; Gargini, M., 2004).

The coinage of Caulonia is a highly debated aspect in the history of Greek numismatics, but its understanding remains subject to ongoing interpretations and analyses. Currently, there is no definitive sequence of dies nor an unequivocal identification of the coin types.

The earliest emissions of Caulonia include incuse staters, weighing about 8 grams, following the standard of the Achaean colonies of southern Italy. These emissions are divided into three series, with the first dating back to around 525 BC. They feature a nude statuary god in profile, with a laurel branch in the raised right hand and the left arm outstretched, upon which a backward-facing male figure is depicted. Next to the god is a stag, also with its head turned toward the deity.

The scene on the coins of Caulonia is debated. Apollo is identified on the obverse, but the running figure has had different interpretations over time. The deer, also present on later coins, evokes Artemis. The name Kaulonía could derive from "aulon," valley or ravine. (Lepore, L., Luberto, M. R., & Turi, P., 2013). Moreover, in the area between the monastery of San Giovanni Therista and the Grancia dei SS. Apostoli, in the municipality of Bivongi, quarries of green and pink marble have been discovered. These varieties of marble were used to decorate the altars of the churches in Stilo. Grimaldi, in his "Record of the mines of Stilo that under the glorious government of S. M. Cattolica from the year 1748 to the year 1756 were worked, discovered, or at least revealed," provides important historical documentation on the marble mining in the region during the period between 1748 and 1756. This document reveals the economic and cultural significance of marble extraction and processing in the Stilo area during that historical period. (Cunsolo, L., 1965).

The text also provides a detailed list of the mineral resources present in the «*Territory of Stilo*:

1. *A silver mine, located in the Assi del Notare district, producing 10 ounces of silver and a cantajo;*
2. *An antimony mine, nearly massive, also in the Assi district, which is abundant in revenue;*
3. *A mine of sulfur, vitriol, and alum, in the said district, consisting of marcasite, which also yields little copper;*
4. *A stone salt mine, in the Gangia di S. Leonte district, revealed but not fully uncovered;*
5. *A very rich silver mine in the Stilo mountain, revealed but not fully uncovered;*
6. *A mine of precious marbles of all kinds and colors under the Stilo mountain». (Grimaldi, F.A., 1781; Cunsolo L, 1965).*

The list of mining resources in Stilo reveals significant economic potential, with some mines identified but not yet fully explored or exploited. The actual yield of the mentioned mines, as reported by Grimaldi and transmitted by Cunsolo, remains uncertain as we do not have reliable quantitative data. However, the presence of ironworks in Stilo has been

known since the Norman times. In the document of William, King of Sicily, dated 1173, the ironworks are mentioned along with other concessions, indicating the importance of mining activity in the region with the words «*et libertatibus minerae aeris et ferri*» (Cunsolo, L., 1965).

During the Byzantine-Norman era, the economy of the Stilaro Valley was primarily based on agriculture, sheep farming, and silk farming. The documented centers of industrial production were limited, including numerous mills (as many as 16) along the streams and some facilities for the processing of lime, bricks, and iron. (Franco, D., 2006).

This description of the local economy reflects a complex picture in which mines represented a significant but not exclusive component of the economic activity in the Stilaro region. The presence of ironworks and other industrial activities indicates economic diversification; however, mining activity likely had a significant impact on the economy and development of the area.

In 1523, several ironworks were active in various locations in Calabria, including Campoli, Caulonia (Castelvetero), Stilo, Spadola, Trentatarì, Furno, and others. These ironworks were granted by Emperor Charles V to Cesare Fieramosca, brother of the more famous Ettore Fieramosca. The Stilo ironworks was already operational in 1526, as indicated by the visit of the Bolognese friar Leandro Alberti to Calabria in that year (Alberti, L., 1550).

History highlights the importance of ironworking activity in the region during the Renaissance, with ironworks being essential to produce iron and other metallic materials. The granting of ironworks to Cesare Fieramosca underscores the connection between local economic activities and prominent figures of the time, while the presence of the Stilo ironworks in 1526 confirms the continuity of such activity in the Calabrian region.

In December 1527, the Stilo ironworks became part of the royal demesne for reasons of public utility, while the other ironworks were leased to Jacopo de Russis by King Ferdinand I of Aragon. In 1601, the descendants of Fieramosca leased the ironworks to a member of the Ravaschieri family, but about twenty years later, they decided to regain possession of them, and since then there are no more documents attesting to their history.

However, in 1642, the Princess of Scilla, owner of a third part of these ironworks, received some fiscal properties from the government in the tenure of Atti in Abruzzo, in compensation for her third part that the government subsequently acquired (Falcone, N., 1846).

Mining activities in the Stilaro area experienced an interruption at some point, but the reason or the exact period of this pause is not clear. However, in 1754, they were resumed, and structures for the smelting of the extracted material were built. During the seventeenth and eighteenth

centuries, the steel complex of Mongiana developed, which included all phases of ore processing, including smelting in blast furnaces.

The return to mining and smelting activities likely responded to a growing demand for metallic materials and the increase in resources and technologies available to exploit local mines. The steel complex of Mongiana, recently restored, attests to the historical and industrial importance of the area, which played a significant role in the economic and industrial development of the region during that period. (Fiorenza, E., 2024) Mongiana represented an important industrial hub where both civilian goods, such as railway tracks, and military goods, such as the famous Mongiana rifle and cannons, were produced, with a specialized factory in the territory of Pazzano. The limonite ore, extracted along the north-western slopes of Mount Stella, had already been exploited by the Campoli ironworks since the early 16th century.

Campoli, presumed to be near the areas of Campoli Cerasara, Campoli Sambucato, and San Todaro in the municipal territory of Caulonia, was an important center for processing limonite ore (National Library of Naples).

This industrial context highlights the complexity and diversification of mining and ore processing activities in the region, with production destined for both civilian and military markets, thus contributing to the economic growth and industrial development of the area.

In 1768, the ironworks were relocated to the areas of Mongiana and Ferdinandea, presumably due to the greater availability of wood necessary for the furnaces nearby. However, material extraction continued in Pazzano until the early decades of the second half of the 19th century, when the Bourbon dynasty fell, and the new government, applying Piedmontese laws to the entire kingdom, ended all industrial activities in Southern Italy (Fiorenza, E., 2023).

The Ecomuseum of Ironworks and Foundries of Calabria, established in 1982 by the Calabrian Association of Industrial Archaeology (ACAI) led by Danilo Franco, a pioneer in the industrial archaeology of the region, was created to protect and promote this vast heritage. One of its main attractions is the mining basin of Pazzano, which meets the need to safeguard and enhance all the forest, mineral, hydrogeological, infrastructural, landscape, and monumental resources of the territory.

Within the Ecomuseum, there is a project for an Archaeo-Geo-Mining Park of Mammicomito, along with planned interventions to create trails and make the Regina, Regina Ribasso, Italia, Piave, Melichicchi, and Umberto I mine accessible.

Evidence of mining activity manifests in various ways, highlighted by the remains of ancient furnaces and mines dating back to the classical

period, medieval material dumps, and the imposing ruins of modern mines. These artifacts represent extraordinarily significant traces of the history of extraction techniques, material processing, and the events of the local communities involved.

The imprint left by mining activity is so significant that it is also evidenced by the Naturalistic Mining Park of Gavorrano, which serves as a tangible monument to the mining and industrial tradition. This park not only preserves the remnants of the past but also provides an educational and informational context that illustrates the crucial role that mining has played in the history and development of local communities.

The visit to the park offers a complete immersion into the cultural roots related to mining activity, providing a detailed environmental and human overview of life during the exploitation of underground resources. Despite efforts, the historical reconstruction of the mining and metallurgical production of the area is still ongoing and far from being completed.

The earliest phases of mining activity are still partly undocumented, although numerous indicators of intense and continuous metallurgical production are evident. While knowledge of deposits and mines is well-defined for the post-medieval period, especially for the period between the mid-18th century and the first half of the 19th century, many details remain to be explored and understood regarding earlier phases. Research and continuous study are essential to fill these gaps and gain a more complete and accurate understanding of the mining history of the region (Clemente, G., 2013).

Steel Complex on the Assi River

The steel complex of Assi is located between the provinces of Reggio Calabria and Catanzaro. This center of metallurgical processing, closely linked to the nearby Stilo, played a significant role in steel production throughout the 18th century.

It takes its name from the Assi river (Bova, D., 2008), a crucial hydrographic feature around which the main buildings of the site were erected. The choice of location for the steel complex is not random but responds to precise technical and logistical needs inherent to the steel industry. The area exploited local natural resources, especially the water from the Assi, for metalworking operations. This water not only generated hydraulic energy to power machinery such as hammers and anvils but was also vital for the cooling and processing of metals. The proximity to the river facilitated the transport of raw materials and finished products, a crucial aspect considering the limited transportation systems of the time.

The steel complex represents a significant example of early development in Calabria from a historical and industrial perspective. In the

18th century, it played a key role in the local and regional economy, promoting industrialization in a predominantly agricultural and rural area. Its presence highlights technological advancement and the application of engineering in metalworking at a time when such practices were still in development.

The overall structure and its components, including mining extraction sites and various ironworks, present a picture of historical-economic interest.

Components of the complex:

- The Ironworks: Francese, Zessi, San Carlo, Ropalà, Maglietto (Fiorenza, E., 2019);
- The Old Ironworks of Stilo, consisting of Arcà, Acciarera, Armi, Murata, Nuova, Molinelle di Sotto, and Molinelle di Sopra (Fiorenza, E., 2023).

It is a diversified and geographically extensive production network, whose mention of both civil and military use underscores the dual function of the complex: providing tools and materials for daily life and supporting the war industry, crucial in that historical period.

Additionally, there were some additional structures:

- The Lamberti Arms Factory.
- The Royal Furnace of Pazzano (Franco, D. 2019).

Reports of new silver and argentiferous lead mines, as documented by Grimaldi (Grimaldi, L., 1845), along with the discovery of the Antimony mine, testify not only to the abundance of resources on the surface but also to the progress made in the geology and mining exploration of the time (Falcone, V., 2007; De Stefano Manno, B., 2008).

The arrival of workers from Germany and Hungary led by experts such as Professor Hermann and engineer Bruno Maria Schott led to a significant exchange of knowledge and skills at the European level in the field of mining and metallurgy. Schott, with his detailed work on mines and mineral veins, introduced a scientific and systematic approach to the mining industry. The loss of his documents, as highlighted by Carminantonio Lippi, represents a gap in the mining and industrial history of the region.

The Assi steel complex represents an emblematic example of industrial development during an era of technological transformations and interaction between productive sectors and European regions. It had a significant impact on the economy and society of Calabria, contributing to the evolution of mining and metallurgical technology in Europe. During the 1760s, the Stilo Ironworks recorded a considerable production of iron, totaling 1,034 tons over six years. In 1776, the overall iron production peaked at 308,451 kilograms, highlighting the productive efficiency of the

Stilo ironworks and their significant role in the steel industry of the time. (Franco, D., 2003).

Iron Production at the Stilo Ironworks:

Ironworks	Iron Production in kilograms
Arcà	56782
Acciarera	45123
Armi	36846
Maglietto	29900
Murataa	44500
Nuova	51000
Molinelle di sopra	23500
Molinelle di sotto	20800

Lamberti Arms Factory

The "Regia Fonderia Cannonum Civitatis Stili" (Franco, D., 2019), more commonly known as the Lamberti Arms Factory, was an important industrial institution established in 1746 (Franco, D., 2019). Situated along the Assi stream within the boundaries of Stilo, it was initially conceived under the direction of Giuseppe Lamberti. A landmark in the production landscape of the time, it stood out as the second armaments factory of the Bourbon Kingdom, indicating the strategic importance and technological advancement achieved in this sector during that historical period. Intended to produce artillery, it was designed to annually manufacture a total of 70 large-caliber iron artillery pieces (cannons) and 45 small-caliber ones. However, due to technical complexities and management issues, this ambitious production target was never effectively met. The situation culminated in 1752 when the Lamberti factory faced economic failure (Franco, D., 2019).

The Lamberti family, once influential in Calabria, experienced a failure that appears to have been orchestrated by more powerful entities closely aligned with the center of power in Naples. Bonaventura De Marco, an entrepreneur who later became a naturalized citizen of Bivongi, emerged as a central figure in this scenario. His rise began with the Lamberti's downfall, after which he took control of the Assi ironworks in 1753. De Marco's ability to navigate the political and economic landscape of the time, along with his understanding of government industrial plans, were crucial in this process.

De Marco, based in Naples, was aware of significant government investments earmarked for industrial development, particularly about 300,000 ducats allocated to the hydraulic aspect of the ironworks, equivalent to around 30 million euros today. He was also privy to the plans of the architect Vanvitelli, which envisioned the use of the Assi ironworks to

produce 50 km of pipes for the Carolino aqueduct, the fountains of the Caserta Royal Palace gardens, and the Royal silk mill of S. Leucio. (Franco, D. (2019).

This setback, however, was not in vain, as it spurred renewed interest from the Crown in industrial development in the steel sector. Thus, the failure of the Lamberti factory played a decisive role in directing the Bourbon royals' attention towards the realization of a larger and more ambitious project: the creation of the Mongiana steel complex (Fiorenza, E. 2023). This new facility would represent a significant leap forward in the Kingdom's steel production, combining technological innovations with more efficient production organization, positioning itself as one of the main metalworking centers of the time.

Mines of Bivongi

The mines located in the territory of Bivongi delineate a complex of mining sites that historically have been exploited for the extraction of a variety of minerals (Cuteri, F.A., 2020). These deposits were known for their abundance of galena and molybdenum.

In addition to these, other extracted minerals included chalcopyrite, a mineral containing copper and iron. The mining sites of Bivongi were significant for extracting minerals used in industry and metal production. Extraction techniques varied over time and with available technologies, influencing the local and regional economy. Over time, extraction operations became more advanced, transitioning from manual methods to techniques involving machinery and chemical processes. These activities contributed to industrial development but also created environmental and health problems for workers due to the hazardous nature and pollution from mining operations.

Mining exploration and exploitation in Calabria have ancient roots, dating back to the era of ancient Greece, with mines known for the extraction of silver, used, as we have seen, for the minting of coins like the Incuse Staters of Caulonia.

The name "Argentera" highlights the long tradition of silver-related mining activities in that locality (Franco, D., 2003).

In 1782, Calabria Ultra boasted a total of 42 mines, with 23 dedicated to silver extraction in combination with lead, positioning Bivongi and other locations as key centers in a silver-bearing district (Cunsolo, L., 1965).

The interest in the region's mineral resources has not waned over the centuries. The presence of molybdenum, for example, was detected in 1893 and attracted the attention of several companies throughout the twentieth century (Cuteri, F.A., 2020). The research and exploration conducted by entities like Torelli and Re in 1917 and later by Breda in 1939 demonstrate a

continuous interest in the area's mineral wealth. The opening of approximately 60 mines in various municipalities of Calabria represents a broad attempt to exploit these resources (Franco, D., 2003).

However, the mining history of the area is marked by ups and downs, with periods of intense activity followed by phases of stagnation or cessation. The interruption of mining operations during World War II and the subsequent failure to resume activities by Breda raise questions about the operational, economic, and perhaps even political challenges encountered in this sector.

The studies conducted by the Sila Studies Center in 1948 and the establishment of Mineraria Calabria in 1951, an initiative of Montecatini and the Sila Authority, were attempts to revive the mining industry in Calabria but were unsuccessful due to the difficulties and complexities in the use of the territory (Franco, D., 2003).

The mines currently known in the territory of Bivongi are Cava, Frana, Garibaldi, Gattaraghi, Giamba, Giolli, Paoli.

The exploration and exploitation of the mines in the valley demonstrate the richness and complexity of the region's geological and socio-cultural history, illustrating the evolution of mining techniques and local society over the centuries.

The Laveria Flotation Plant.

The Laveria flotation plant, located near the Stilaro river, was dedicated to processing molybdenite ore. Located in the Perrocalle (or perhaps Vignali?) district, it stood on a small hill and operated actively until the 1950s. The structure, originally divided into three floors, each dedicated to a specific phase of the flotation process.

The molybdenite ore was transported to the plant via a cableway, an efficient solution for difficult terrain. On the first level, it was crushed and cleaned to remove impurities. Flotation separated the molybdenum from other substances, obtaining a pure concentrate, which was then stored for transportation or further processing.

The upper floor of the plant, once a center of intense industrial activity, has been converted into a restaurant. This adaptation serves as an example of the reuse of abandoned industrial structures for new purposes, a practice common in many parts of the world where industrial heritage is repurposed for commercial or cultural purposes.

Mines of Pazzano and Bivongi

The mines of Pazzano, in Calabria, were significant for the regional mining industry, especially for pyrite. These mines, now inactive, were

crucial for the local mining industry, exploiting important geological resources such as iron minerals. Pazzano is known for its mineral deposits, especially of iron minerals (Accademia dei Lincei, 1911).

Mining operations in this area employed both open-pit and underground methods, adapting to geological conditions. Advanced technologies and mining engineering practices were employed for efficiency and safety. However, factors such as the depletion of deposits and global economic changes led to the closure of the Pazzano mines. The remaining mining structures have been integrated into the Ecomuseum of Ironworks and Foundries of Calabria, preserving history and offering a window into the local industrial past.

History tells the story of the evolution of mining and ironworking in Calabria, with periods of intense activity followed by phases of decline, reflecting the economic and political dynamics of each era.

A list of known mines in Pazzano: Explosives deposit (former church), Principe Ereditario ('700), Carolina ('700), S. Ferdinando ('700), Regina, Noceto, Scolo, Galleria Italia (Mount Stella at 370 m. altitude), Galleria Piave (at 430 m. altitude), Galleria Acqua Calda, Contrì, San Giuseppe, R. Principe, Colle di Banno, Lucarello, S. Maria, Perrone, Gotto, Perronello, Clementina, Clementina II, San Carlo, San Nicola, Campoli, Garibaldi, San Luigi, Grotta Nuova, Provvisoria, Regina Ribasso, Melichicchi, Umberto I.

The mines of Bivongi, alongside those of Pazzano, have historically been used to extract galena, molybdenum, and other minerals such as chalcopyrite. In 1782, Bivongi was one of the silver districts in Calabria Ultra, along with Stilo, Badolato, Longobucco, and Reggio Calabria, with mines like Raspa, Argentera, Costa della Quercia, and Due Fiumare (Cunsolo, L., 1965). In 1893, Beccarla discovered minerals in this area. The Torelli and Re company began searching for molybdenite in 1917, followed by Breda in 1939. They opened about 60 mines in Bivongi, Stilo, Placanica, Guardavalle, Caulonia, and Nardodipace, such as Giolli, Punghi, Franco, Bagni, Acqua Calda, Piave, and Regina. During World War II, operations were suspended, and Breda unsuccessfully attempted to resume them. In 1948, the Silani Studies Center evaluated the possibility of resuming mining, and in 1951, La Mineraria Calabria was established, but it also failed (Franco, D., 2003). Among the mines of Bivongi are Cava, Frana, Garibaldi, Gattaraghi, Giamba, Giolli, and Paoli.

Conclusion

The Stilaro Valley in Calabria has represented a center of mining and metalworking of great historical and economic importance. The mines of Stilo, Pazzano, and Bivongi, along with other extraction activities along the

belt between Aspromonte and Serre Calabre, have played a crucial role in the development of the region.

Mining and metallurgical activities attracted ancient populations that settled in the area, contributing to the formation of a local culture and economy based on the mining industry. The iron, silver (and gold?) resources in the valley fueled a flourishing production of artifacts and tools, supporting economic activity and trade in various contexts.

Although many mines have been abandoned over the centuries, the historical and cultural heritage linked to these activities remains a fundamental element in the identity of the local community. The conservation and study of this heritage are crucial for understanding the economic and social history of the region and for preserving the memory of the traditions and activities that have shaped the social and industrial fabric of this part of Southern Italy.

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