

Lavrion from Ancient Greece to the Present Day: A Study of how an Ore Deposit Shaped History

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Introduction

The carbonate replacement ore deposit of Lavrion and the methods through which Ancient Athenians and subsequently Romans mined for silver have been the subject of many detailed researches. Also, many authors have correlated the course of Athens in Antiquity with the profits gained from the exploitation of Lavrion. In addition, contemporary researchers have written about the crisis that came about in the 1870s and its repercussions in Greek economy. Here, we attempt to present a collective assessment of the impact of this, the most famous ore deposit of European Antiquity, in the course of the Greek Nation through the ages.

Geology of the Ore Deposit of Lavrion

The diversity of the ore deposits of Lavrion is well known, and the ore is preferentially concentrated between contacts of rocks with different permeability. The Kamariza ore district, which was mined in ancient times (Gelaude *et al.*, 1996) is a carbonate replacement system whose development is attributed to the exhumation and formation of a Miocene metamorphic core-complex, in the Atticocycladic Crystalline belt. The ore bodies at Kamariza occur as infillings along fracture zones and faults and also as massive stratabound replacement sulfide bodies and chimneys. The fractures and faults were the pathways for the ascending mineralising fluids (Voudouris *et al.*, 2008). The minerals of the carbonate replacement system are pyrite, arsenopyrite, sphalerite, galena and chalcopyrite. The ores are enriched in As, Sb, Ag, Bi, Sn and Au. Galena is the principal carrier of Ag, with enrichment reaching up to 3000 gr/t (Voudouris *et al.*, 2008). This, in brief, is the nature of the ore deposit mined in antiquity and in modern times.

Lavrion and its Importance in Antiquity

It is not precisely known when the first mining activities at Lavrion occurred. Archaeological finds of the Minoan Era indicate that this happened around 3000 BC. Organised mining activities are believed to have started around the 8th century BC, with silver production starting around the 7th century BC (Economopoulos, 1996). In the 5th and the 4th century BC silver production reached its peak. The mines of Lavrion were controlled by the City of Athens and were leased to private contractors, who paid for exclusive mining rights of small sections of the galleries. Slaves were also used to mine for galena inside the galleries. To extract silver from lead ore a two step process is necessary; initially the ore is smelted and silver-rich lead is produced while the remaining slag is discarded. In the second part of the process, the so-called «cupellation» the lead is ignited and burned in a furnace with a strong influx of air. Then only pure silver remains at the bottom of the furnace. Thus, 99 % pure silver is produced while large amounts of litharge, the monoxide of lead, are discarded (Rehren, 2000).

In part, the income generated from the mines made possible the construction of the temples at Acropolis. Colonnaded temples were amongst the most expensive buildings in antiquity, not to mention the cost of the metopes, the murals, the statues and the towering gold-ivory statue of Athena Promachos itself (Stuttard, 2013). Combined with the tribute of the Delian League, the income from Lavrion made Athens the wealthiest city-state in the Ancient World.

The creation of the vast Athenian fleet in 482 BC was the result of the Lavrion mining activities, and was initiated following a public dispute over the exploitation of a recently discovered silver vein at the mines. With the generated wealth directed to the addition of 100 triremes the Athenian fleet now reached the unprecedented number – for a single Greek city-state – of 200 triremes manned with trained oarsmen and hoplites. Two years later, during the naval battle of Salamis, the Greek fleet numbered around 380 triremes, of which more than half were the triremes of Athens.

The wealth generated by the mining activities at Lavrion was one of the main factors of Athenian strategic dominance during much of the Peloponnesian War. In peacetime, Athens maintained and manned a fleet of about 300 triremes, building 20 new each year, as old ships were in constant need of replacement. Such a fleet was manned by 60000 seamen and supported by 20000 dockyard workers. Each ship needed one talent to be constructed and an additional one for crew wages and ship maintenance for each month at sea. During one naval campaigning season – 8 months – having around 2/3 of its ships at sea, the city had to pay around 1600 talents – more than twice the annual tribute of the whole Delian League. Undoubtedly, paying for an entire ship and its crew – around 200 men – entailed a sizeable expense. Such a large fleet enabled Athens to coerce more than 200, mostly maritime, city states, to join its alliance. Athens entered into the war with a reserve of 5000 talents. Not until the last stages of the war did the Lacedaemonians succeed in disrupting the mining activities and thus cutting off Athens from the last major source of its income. The income from the mines allowed the Athenians to sustain a fleet out of all proportion to the realistic capacity of any city state of the era. Supplemented by smaller navies of other members of the Delian League it gave Athens an insurmountable advantage. Even after the complete disaster and the loss of most of the Athenian fleet at Sicily in 413 BC Athens was able to rebuild her fleet. All in all, Athens built and lost two entire fleets during the Peloponnesian War

and went on to fight for 27 years (Davis Hanson, 2005). The mining activities at Lavrion continued well into the Late Roman period with more advanced mining techniques involving drainage procedures for extending the galleries below the water table.

Interim Years and Mining in the 19th and 20th Centuries

Despite the absence of mining activity since Roman times, the existence and possible economic potential of the mines did not go completely unnoticed. British explorer G. Wheler who visited Attica during 1675-1676 reports that there were older people remembering a lead mine in the area, which was abandoned for fear that it would be taxed by the Ottomans. In fact, the same people reported that there were traces of silver within the lead mined. In 1790, the British explorer Hawkins reported that there might be economic potential in mining the Ag-Pb ores at Lavrion. German surveyors brought by the Greek Government in 1835 and 1841 gave conflicting opinions about the possibility of exploiting any ore at Lavrion and what ores could be exploited.

The ancient slags remaining at Lavrion since Antiquity were recognised as economically important by the geologist A. Kordellas in 1860. Since the nascent Greek State did not have the organisational and financial capacity to found a State Mining Company, in 1864 Jean-Baptiste Serpieri founded the Italian-French Company Roux-Serpieri-Fressynet C.E. This year marks the creation of the modern day Lavrion. However, despite acquiring the lease of some 15000 acres from the Greek State, the Company also bought illegally heaps of slags from the Municipality of Keratea, without permission from the State. Besides this, the Company expropriated all kinds of slags found in the area, with no State permission and ignoring courts' decisions. The Italian-French company behaved with a cavalier attitude, more reminiscent of a colonial affair. This behaviour enraged the Greek State while the ambassadors of France and Italy issued a proclamation defending the company's interests. In the end, the appearance of French warships of Lavrion resulted in Greece accepting an unprofitable settlement. In 1873 Roux-Serpieri-Fressynet C.E. was bought by the Bank of Constantinople's co-owner Andreas Syggros, and was renamed to Lavrion Metallurgy Company. Many people rushed to buy the new companies' shares only to discover soon enough that many of them were fakes. This triggered a downfall of the shares' price and ultimately a collapse of the Stockmarket. Thousands of individuals soon discovered that they had worthless stocks at their hands, having spent thousands of drachmas to no real gain. In addition, the Company actually decreased its slag production output and Syggros successfully blackmailed the State to lessen the annual tribute of the Company to State. The stockmarket crisis and the significant reduction in state profits from the mines of Lavrion were amongst the contributing factors for the bankruptcy of the Greek State in 1893. Meanwhile, Serpieri founded the Compagnie Française du Laurium which acquired the sole right of exploitation of the area's underground mineral wealth. As the amount of slags was exhausted in 1917 the Greek company was forced to close, while the French Company continued its activities until 1977 (Dermatis, 1994).

Conclusions

By the aforementioned we have demonstrated the significance of the presence of Lavrion throughout the Greek history as another example of how geology and history intertwine. It can be stated with certainty that had this ore deposit not existed Ancient Athens in particular and Ancient Greece in general would have followed radically different historical courses. For it can be considered as a sacrosanct principle that to civilisation and war making, these two driving forces of human history, a steady influx of money is a prerequisite. From the military exploits of Ancient Athenians who checked the Persian invasion time and again to the exquisite temples at Acropolis, the mark of Lavrion's ore deposit is resplendent. In modern times, the mineral wealth of the area became the locus of initially international and subsequently national enterprising and corporations. It shaped the international relations of Greece with France and Italy through the 1860s to the 1880s and was one of the major steps leading to the financial crisis of 1893. This then is the complete story of the importance of Lavrion for Greece, a tumultuous saga of ever increasing mining profits and their management and allocation.

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