

STUDY KIT 7

Title: The Archeological Site of Thorikos – Lavrion.

Topic: Civilisation has always been based on economy and technology. Power, social classes, democracy, and the power of arms formed a new super power in the Mediterranean: the case study of the mines in Thoriko.

Keywords: archaeological excavation, citizens, democracy, economy,

sustainable use, water management, theater, technology, rainwater, minerals, iron, silver, olive tree.

Subject: History, Geology, Economy, Archaeology, Political science, Sociology, Drama

Cross-curricular Topic: Outdoor activities, healthy lifestyle, Cultural heritage, Peace Education, Water management, Sustainable Development.

Level: Upper secondary

Age: 16+

Number of students: 30

Duration in hours: 2

Place (classroom, outdoor etc.): outdoor

Author: Vasileios Psallidas, Eftichia Korkidi, Katerina Christodoulou School /Institute: Ralleio Geniko Lykeio Thileon Pirea, Mediterranean Information Office –MIO-ECSDE /MEdIES, Athens, Hellas. Language: ENGLISH

Overview: Participants will visit Chaos, the cliff over Thorikon, and then the Thorikon area in Lavrio. They will observe one of the first open-air theaters in the world, an ancient mining gallery and learn about ancient "laundry" technology for processing and enriching the mineral named gallinitis. On the path to the theater will observe the ancient quarry activities in natural marble in the hill and the ancient rainwater management projects.

Objectives:

- To observe excavations of galenical processing facilities from the 5th century BC.
- To learn about the life and work of Athenian citizens and slaves.
- To understand the role of the theater in ancient Greek civic education.
- To monitor the development of technology for the management of natural resources
- To learn about promoting a democratic way of life for citizens of the time



with responsible environmental behavior in line with the goals of Sustainable Development.

• To learn about Value Education and Peace education.

Learning material and tools:

- Map of the area
- Summary of basic points (ANNEX 1)

Preparation:

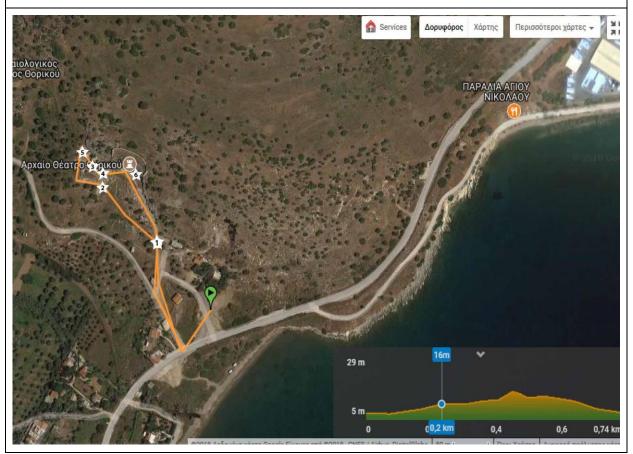
• All the material will have been uploaded on **Wikiloc application** AND/OR

• Paper handouts in the form of **Worksheets**.

Evaluation:

The answers on the worksheet

Extra material: NONE















Detailed description/ instruction:

The purpose of this study kit is for students to see and understand how Athenian citizens and slaves lived during the period of the Athenian "Golden Age" (5th century BC). In addition, they will work on the impact of mining activities on economy, culture, education, technology development, science, philosophy and water management.

Students work in groups of 6 (3 foreign+3 Greek students).

The participants begin their hike at the parking area moving towards the excavation of the Ancient Theater of Thorikos. After studying the map and recognizing the landscape and important archaeological discoveries, they follow the path to the Ancient Theater. On the way they observe all the ancient technological practices for mining; they collect minerals and discover the geological formation that provides information about its underground and its composition. They take part in simulations and act out Aristophanes' Lysistrata in the ancient theatre.

https://el.wikiloc.com/peripatos-diadromes/thoriko-mine-economy-culture-22450288

ANNEX 1

History

The modern town of Laurium/ Lavrio is at the site of the ancient village of Thoricus. The earliest evidence for mining dates to the beginning of the Bronzue Age, ca. 3200 BC. Systematic exploitation of mineral resources seems to have begun in the 6th century BC. After the battle of Marathon, Themistocles persuaded the Athenians to devote the anticipated revenue derived from a major silver vein strike in the mines of Laurion circa 483 BC to expanding the Athenian fleet to 200 triremes, and thus laid the foundation of the Athenian naval power. The mines, which were the property of the state, were usually farmed out for a certain fixed sum and a percentage on the working; slave labor was exclusively employed. As many as 20,000 slaves were employed at the height of the mining. A silver mint (Argyrocopeum) was situated at Laurion. Towards the end of the 5th century, the output fell, but the mines continued to be worked. The ancient workings, consisting of shafts and galleries for excavating the ore, and washing tables for concentrating the ore, may still be seen at many locations. There were well engineered tanks and reservoirs to collect rainwater for washing the ore since abundant supplies from streams or rivers was impossible at the site.

https://en.wikipedia.org/wiki/Laurium



Waypoint 0: "Chaos"

The area of Lavrio has many hills and small, narrow valleys. On the surface of the soil we see metamorphic mesozoic rocks (marbles and slate) and, in few places, granite (approx. 10 million years old). Also ore (rock or sediment that contains sufficient minerals with economically important elements, typically metals, that can be economically extracted from the deposit) can be found that are associated with the solutions that accompanied granite (pyrogenic rock). The ore are found in marbles and in contact with the overlying shale. The ancient were concerned only with PbS, namely lead sulphide, and curousite (PbCO3), ie lead carbon, because these minerals were the only silver.

It has been found that the silver content of the ore ranges from 500 to 5000 grams per ton. According to archaeological and archaeometric research, copper, gold, silver and lead are among the first metals that man used. The very large number of gold, silver, lead and bronze objects found in the cemeteries requires an organized and developed mining (and metallurgical) activity.

Since ancient times, mining and quarrying in mines and quarries has always played an important part in the economic life of Greece. All these activities, whether surface (quarrying) or underground (mines), were regulated by the Mining Code, special Legislation regulating the rental of mining areas, the price of rent, etc. The death penalty was the punishment for anyone who destroyed the natural supports of the galleries to pick up the ore. The climate in the wider area is dry with little rainfall and high temperatures in the summer. During the summer months there are strong winds ("meltemia") in the south.

https://www.meteoblue.com/en/weather/forecast/modelclimate/sounio_gree ce_260477

1. Which are the main rocks / minerals in the Lavrion area?

2. What are the main climatic characteristics of the wider region?

Waypoint 1: Landscape Observation

An acropolis is a settlement, especially a citadel, built upon an area of elevated ground—frequently a hill with precipitous sides, chosen for purposes of defense.

Social and financial classes in Ancient Greece

CITIZENS: they were the descendents of citizens or those who had aquired civil rights honoris causa. Only about 6% of the citizens owned farming land, workshops and shops. Those rich citizens had to to provide administrative, religious and military services to the city, and they had to purchase their arms themselves. The better educated citizens were involved in



discussions about philosophical and political issues. The vast majority of citizens were farmers with small pieces of land and a pair of oxen. Poor citizens had very few resources and were oarsmen in military vessels. Athenian citizens looked down on manual work; metics (immigrants) and slaves were responsible for that!

METICS: They were the technicians of the time. They had no permanent residence and moved from one city to another to find work. In this way they also communicated their technical knowledge and skills allaround Greece at the time.

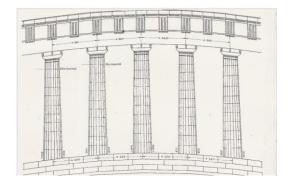
SLAVES: owned by their masters who could sell or lend them according to their wishes and needs.

- 1. Why was the Acropolis built in the highest point of the hill?
- 2. What kind of economic and social activities can you discern in the hill slopes?
- 3. What social classes were there in ancient Athens?

Waypoint 2: Marble cutting technology –local and natural construction. Open-air and underground quarries and mines. Marble cutting.

The stencilling of the marble blocks was done through a narrow passage fitting only one person. Then, with the help of wooden wedges, they moved the block from its original location. The wedges were wet and their enlargement caused the stencilled block of marble to detach. The marble was carried out of the quarry using logs to roll them on. The main tools used were steel hammers, cutters, crowbars, pickaxes, wooden and metal wedges, ropes, logs and pulleys. The marble quarried here was used to build the theatre whose final seating capacity was 6,000.The marbles were interconnected with lead and special alloys of lead and iron to avoid oxidation and the destruction of marbles.





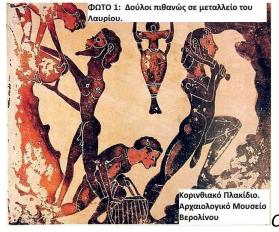
1. Describe the way in which marbles were cut. How were they carried out of the quarry?



2. How were they interconnected to create a single construction?

Waypoint 3: Mining Gallery : 1st simulation

The mining galleries for silver and lead and the slaves of the Athenians



Corinthian tile (Berlin Archaeological

Museum) depicting slaves at work in Lavrion mines

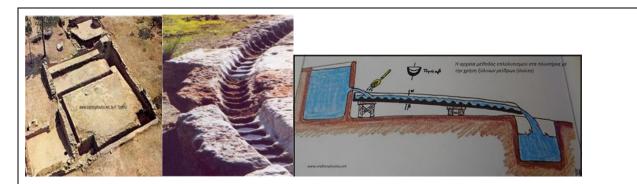
The main driving force for the development of the ancient mines in Lavrio were definitely the miners. They were slaves who mined the underground galleries, enriched the minerals in the laundries and operated the furnaces. To dig the mining galleries they used hand tools, mainly hammers and chisels. The only source of light were ceramic olive oil lamps. They performed this enormous task under exceptionally difficult circustances. They were given names by their mastres, but not surnames. They did not have the right to ownership. If they had saved some money, they could only use it upon their masters' perission. They couldn't marry or have children without their masters' consent. Their children also belonged to their masters. https://en.wikipedia.org/wiki/Slavery in ancient Greece#Athenian slaves

- 1. Who dag the galleries? What were their technical skills?
- 2. What kind of tools did they use?
- 3. Do you think that homage should be paid to Athenian slaves? Why/Why not?

Waypoint 4: Laundry: 2nd simulation

Enrichment techniques in Lavrion. Water recycling





There were two stages in processing minerals:

- a. Cleaning: As minerals came out of the mines in pieces, they were carried to the cleaning stations were they were prepared to be enriched and furnaced. All useless materials were removed by hand and then the minerals were smashed into small pieces using stone mortars. The crashed minerals were then ground in hand mills. The minerals were turned into thin powder, they were shifted in special stone basins and carried to the laundry where they were enriched using water.
- b. Enrichment at the laundries: In Lavrion, Athenians had installed flat circular laundries of 6 metres in diameter and spiral in construction. This means that the end of the laundry was 20 centimetres lower than its beginning. It was a channel with many concavities in a row in which the mineral powder flowed in water. In the first concavities heavier minerals (rich in lead and silver) were collected whereas in the last only "poor" minerals could be found. The water used for the process ended up in a particular place of the laundry where slaves collected it and reused it as it was scarce in the area. The bottom and the walls of the laundries were covered with special waterproof coating, still in good condition today.
- 1. How was water used to enrich minerals?
- 2. How did they recycle-reuse water?
- 3. From ore to currency: Ordering

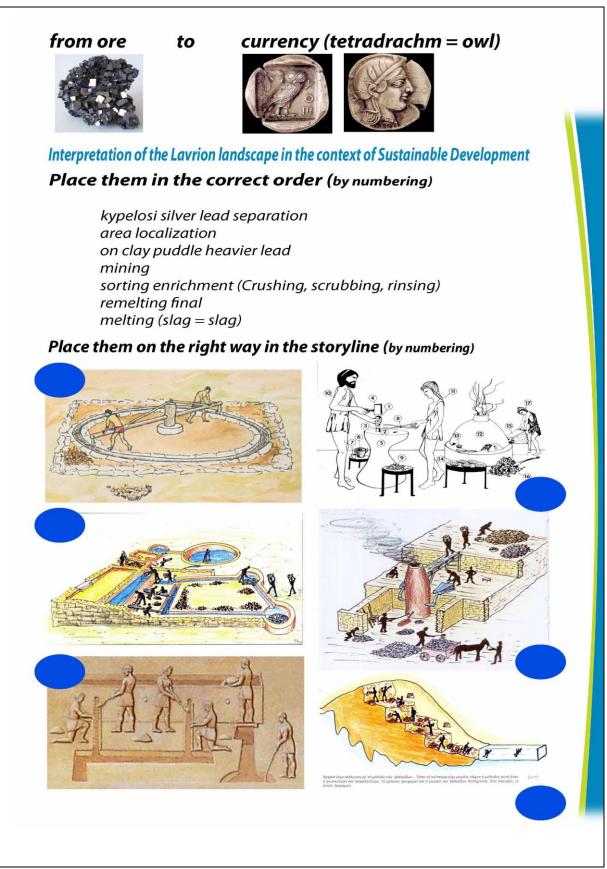














Waypoint 5: Rainwater Harvesting (ancient technology)

Collecting rainwater, protecting it from evaporation. Waterproof material technology.



Near the laundries there were water tanks with capacity from 100 to 600 m³ to collect rainwater as there were no other sources for water in the area. To protect the water from evaporation, the tanks and the laundries were covered with wooden roofs. The watertanks were built on tilting hill slopes from which the water flowed to the waterproof tanks naturally through streams. Firstly the water was collected in small open tanks, where the sediments sat in the bottom and then the cleaned water overflowed to the main tanks. These tanks fed the laundries with water for the enrichment of the minerals. An annual 25,000 m³ of water was necessary for the laundries but rainwater in the area was only 2,000 m³, that is why they had to recycle and reuse it. To minimize loss of water all channels, tanks, dams etc were made waterproof with special coating, still in good condition today, made from a metal which was abundant in the area. This was for sure an Athenian patent!



- 1. Why did the Athenians have to collect rainwater in Lavrion?
- 2. Where was it kept and protected?

Waypoint 6a: The role of theatre in Athenian Education Theatrical game



Education in ancient Athens. The role of the Theatre for citizens and slaves

In ancient Athens, children were home educated. From the age of 6, boys only had tutors for their primary education. They were taught reading, writing, basic Maths and Literature (the great poets). They were also taught how to play the seven-cord lyre and trained in running, discus throw, wrestling and pankration. The pedagogue of the family, usually a slave, was responsible for the coordination of their education. The sons of poor families were offered only this kind of primary education. Richer boys continued their education after the age of 14, which was called secondary. This was provided in "gymnasiums". In ancient Athens there were 3 big gymnasiums: Kynosarges, Plato's Academy and Lykeio. There, teenage boys were taught by sophists, rhetors and philosophers. The Greek theatre, both Tragedy and Comedy, were considered education in "values". Tragedy is a form of drama based on human suffering that invokes an accompanying catharsis or pleasure in audiences. The most important tragedians of the time were Aeschylus, Sophocles and Euripides.

The theatre of Thoriko had at least 4,000 seats, which means that slaves also attended the performances. Built in late 6th century BC, it is the oldest theater in the area of Attica. There were 21 rows of stone seats. The theatre was made bigger in the middle of the 4th century BC



and 12 more rows were added increasing its seating capacity to 6,000.

- 1. Why was the theatre an integral part of the education of boys in ancient Athens?
- 2. Why do you think slaves were allowed to attend performances?

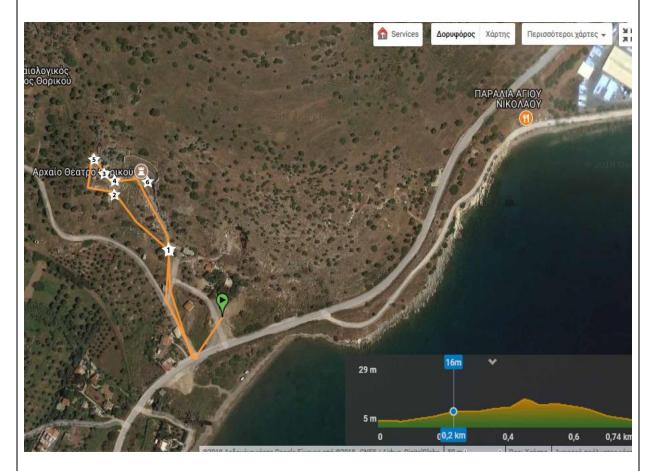
Waypoint 6b: Theatrical game: Aristophanes' Lysistrata

https://en.wikipedia.org/wiki/Lysistrata

Lysistrata is a comedy by Aristophanes. Originally performed in classical Athens in 411 BC, it is a comic account of a woman's extraordinary mission to end the Peloponnesian War by denying all the men of the land any sex, which was the only thing they truly and deeply desired. Lysistrata persuades the women of Greece to withhold sexual privileges from their husbands and lovers as a means of forcing the men to negotiate peace—a strategy, however, that inflames the battle between the sexes. The play is notable for being an early exposé of sexual relations in a male-dominated society. It was produced in the same year as the Thesmophoriazusae, another play with a focus on gender-based issues. At this time, Greek theatre was a profound form of entertainment, which was extremely popular for all audiences as it addressed political issues relevant to that time.



LAVRIO-THORIKO STUDENTS' WORKSHEET



NAME	NATIONALITY

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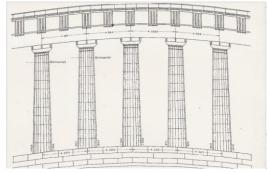


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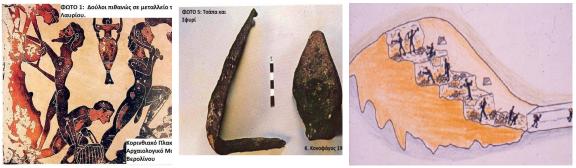
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Waypoint 3: Gallery activities: 1st simulation

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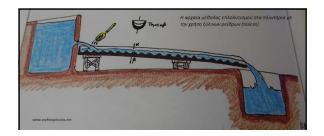
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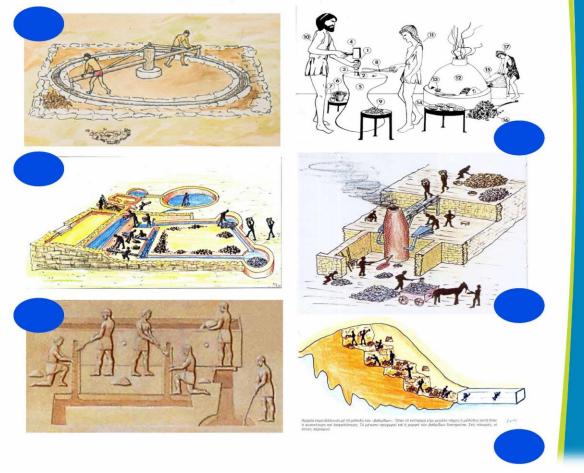


Interpretation of the Lavrion landscape in the context of Sustainable Development

Place them in the correct order (by numbering)

kypelosi silver lead separation area localization on clay puddle heavier lead mining sorting enrichment (Crushing, scrubbing, rinsing) remelting final melting (slag = slag)

Place them on the right way in the storyline (by numbering)





Waypoint 5: Waypoint 5: Rainwater Harvesting (ancient technology)

Collecting rainwater, protecting it from evaporation. Waterproof material technology.



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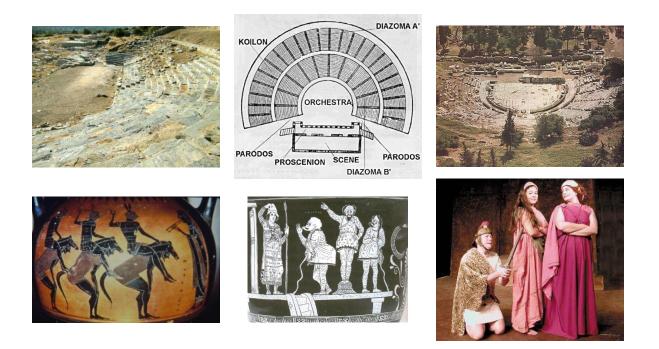
Waypoint 6a: The role of theatre in Athenian Education Theatrical

game

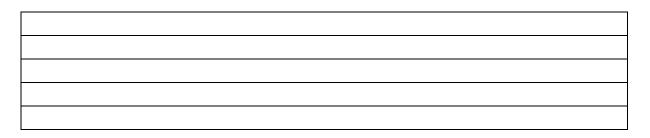
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