| **OrientationCompass with solid fill** | **QR audio** |
| --- | --- |

Through the preceding activities, some questions arose regarding the Stern Knee Timber...

1. What information can we gather about the wood and the origin of the shipwreck? What processes can we use to obtain this information?

2. Are there any alterations to the wood?

3. What types of conservation processes were applied and why?

*Discuss the above questions in the classroom as a whole*

**How can we answer these questions?**

**Record the results of the discussion**

| ***The students record the results of the discussion, concluding with the following***  **To answer the above questions, we need to:**   * **Zoom in on the object to see details** * **Identify the ingredients from which it is made** |
| --- |

| *Record the views heard  with a short video or audio recording.  Name it “1.a Problem and Solutions”* | | *QR audio* |
| --- | --- | --- |
| **ConceptualizationQuestions outline** | **QR audio** | | |

*Discuss as a whole class.*

**How can we observe item details?**

*Note or draw tools we can use   
to see details of an object*

| Instruments / Devices | Selection |
| --- | --- |
| **Magnifying glass** |  |
| **Binoculars** |  |
| **Telescope** |  |
| **Optical microscope** |  |
| **Close up eye vision** |  |
|  |  |
|  |  |

| ***The students fill in their ideas above or draw the above instruments in this space.*** |
| --- |

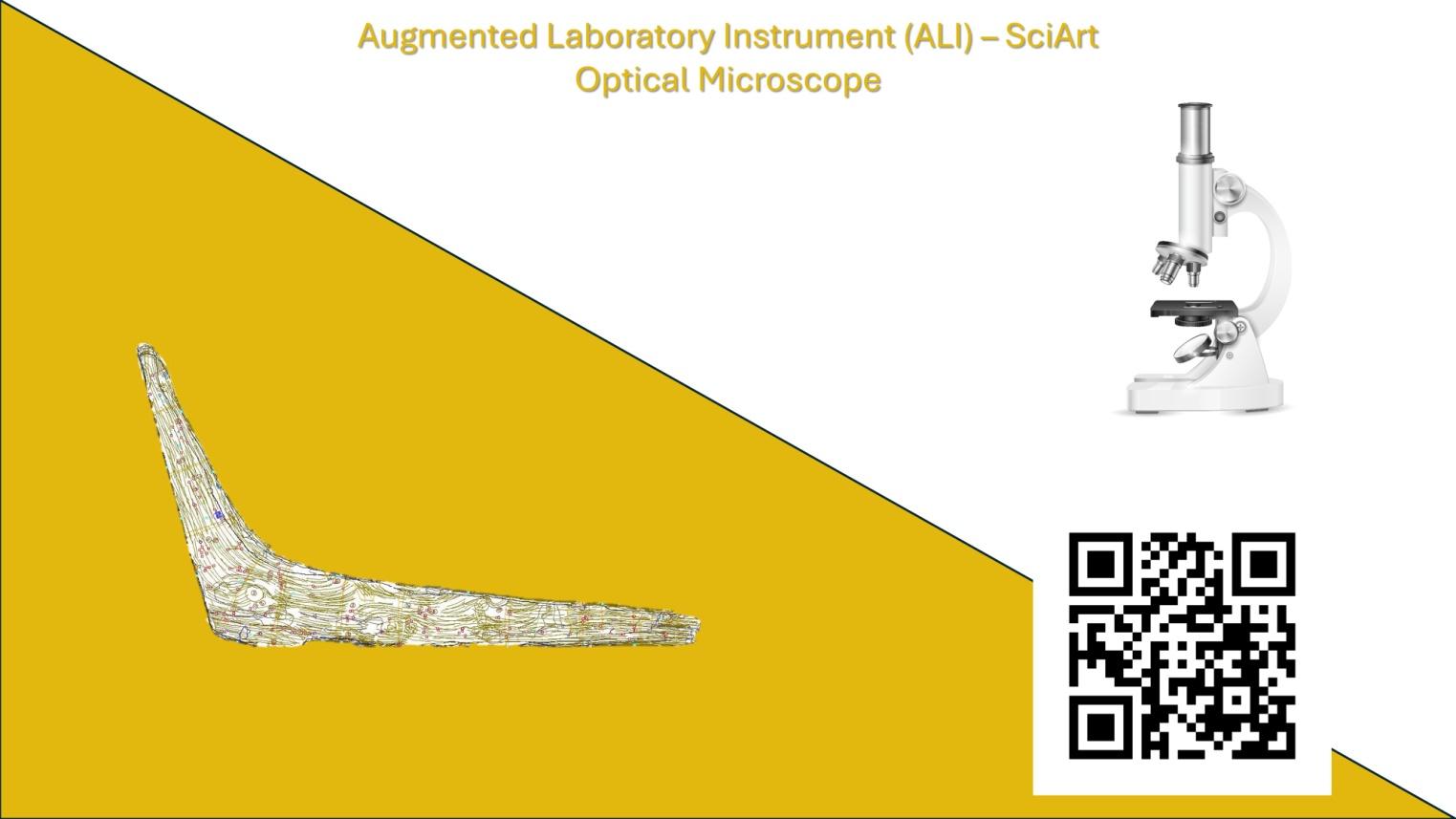
*Discuss as a whole class about the instrument that can give us the best results and choose it from the table above.*

***Through the discussion we come to the optical microscope.***

| *Record the views heard  with a short video or audio recording.*  *Name it “1.b Conceptualization”* | | *QR audio* |
| --- | --- | --- |
| **Investigation Research with solid fill** | **QR audio** | |

Use your mobile devices (tablets, mobiles, etc.) and scan the QR below.

Watch the video and download the results given by your chosen device for the wooden stern knee by clicking the **"Results"** button.



***Discuss with the whole class the results of this particular device***

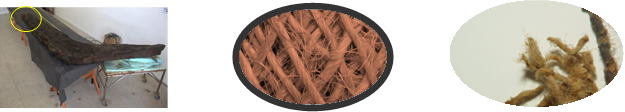
* In the first point of interest, how does the wood appear in the Optical Microscope?

**

Picture 1 Picture 2 Picture 3

***The discussion with the students concludes that it is interesting to study the type of wood used in the ship's stern knee. The first point of interest is at the center of the wooden knee (Picture 1). By zooming in on the point of interest (wood), we observe signs of wear, allowing us to take a sample without damaging the artifact (Picture 2). With higher magnification using the optical microscope (Picture 3), students can observe the wood in greater detail.***

* In the second point of interest, a snagged piece of textile was identified at the edge of the wood. How does the textile appear when magnified?

**

Picture 1 Picture 2 Picture 3

***The second point of interest is the edge of the wood (Picture 1), where a piece of textile (Picture 2) has gotten stuck, making it interesting to study. At higher magnification under the Optical Microscope (Picture 3), students can observe that the textile is made up of threads, which, in turn, are composed of fibers.***

| *Discuss and record the device functions with a short video or audio recording.*  *Why do we use it and what results can we get?   Name it “1.c Research”* | *QR audio* |
| --- | --- |

| **ConclusionThought outline** | **QR audio** |
| --- | --- |

* **Why do we see three different images for the same point of interest? Can you sort them from lowest to highest magnification?**

**The three images give us an increasingly higher magnification of the same point.**

**The higher the magnification, the greater the detail we can observe.**

* **Do you observe anything different in the images of the different points of the object we focused on?**

*Write down your observations or draw the pictures below with arrows for the points of special interest.*

| **From the images taken by the Optical Microscope, points of interest include the type of wood from the stern beam and the textile found at its edge. Therefore, it is interesting to gather more information about these two areas.** |
| --- |

| *Record your answers  in three different short videos or recordings.*  *Name them "1.d Conclusion A", "1.d Conclusion B"* | | *QR audio* |
| --- | --- | --- |
| **ConceptualizationQuestions outline** | **QR audio** | | |

*Discuss as a whole class.*

**What do we need to do to get more information   
about points of interest?**

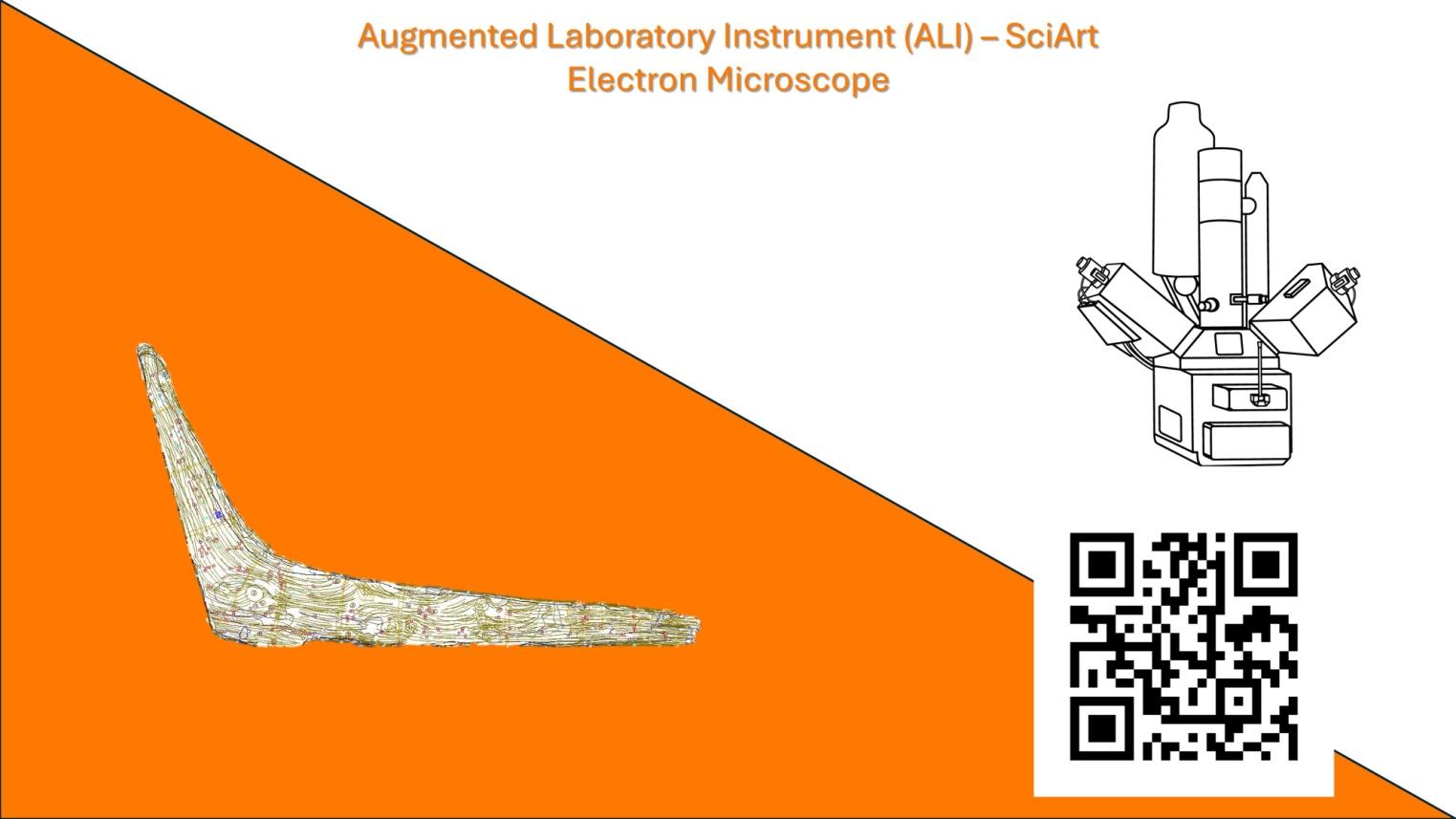
***A discussion is provoked in the class, in which we guide the students to focus on the need for further magnification.***

***The teacher introduces the Electronic Microscope as a solution for extra magnification.***

| *Record the views heard  with a short video or audio recording.*  *Name it “2.b Conceptualization”* | | *QR audio* |
| --- | --- | --- |
| **Investigation Research with solid fill** | **QR audio** | | |

Use your mobile devices (tablets, mobiles, etc.) and scan the QR below.

Watch the video and download the results given by the device for the wooden stern knee by clicking the **"Results"** button.



***Discuss the results of this device in the classroom***

* In the first point of interest, from the sample of wood taken from the stern beam, what do you observe in the SEM image? Are there any morphological features that help us recognize the type of wood?

***The SEM image on the left illustrates the morphology and microstructure of the wood.*** Εικόνα που περιέχει δέντρο, στιγμιότυπο οθόνης, κείμενο, ασπρόμαυρο

Περιγραφή που δημιουργήθηκε αυτόματα

***Within the large grooves called tracheids, we observe round formations (as indicated by the arrow) called pits.***

***These features are characteristic of wood from coniferous trees***.

* In the second point of interest from the sample taken from the fibers of the textile that was found stuck to the wood, what do you observe in the SEM image? What do textile fibers look like in SEM and what material are they made of?

***The SEM image on the left shows the fibers from the threads found at the end of the wooden stern beam. From their morphological characteristics, the material can be identified****. The fibers show a cylindrical and uniform shape.* Εικόνα που περιέχει στιγμιότυπο οθόνης, ασπρόμαυρο, μονοχρωματικό, φυτό

Περιγραφή που δημιουργήθηκε αυτόματα

*Comparing the obtained image with SEM images of various fibers used in textiles (shown on the right image), we observe that their characteristics resemble those of silk fibers.* Εικόνα που περιέχει στιγμιότυπο οθόνης, ασπρόμαυρο, μονοχρωματικό, μονοχρωματική φωτογραφία

Περιγραφή που δημιουργήθηκε αυτόματα

| *Describe how the device works and what we use it for with a short video or audio recording.*  *Name it “1.c Research”* | *QR audio* |
| --- | --- |

| **ConclusionThought outline** | **QR audio** |
| --- | --- |

* **Which one of the two different points of interest, scanned with the SEM method, has the highest magnification? How can we find it?**

**Image 2 has the highest magnification of 3000x. We can directly read the magnification from the information given at the image's bottom. We can also calculate the magnification from the given scale.**

***The two images have a magnification of 150x (Image 1) and 3000x (Image 2). We can read the magnification in the information given at the image’s bottom. We can also calculate the magnification from the given scale.***

* **Why do we get black and white images?**

**We get black and white images because SEM does not use natural light but electrons.**

***We help students come to the above conclusion by mentioning the video's information.***

* **Comparing the SEM image of the textile with the data from the table, what do you conclude about the material of the textile?**

**By comparing the SEM image of the object we are studying with the data from the reference image, we conclude that the textile is silk.**

***The students conclude that the textile is made of silk.***

* **What do we observe in the images? What might they mean for our subject? Can we draw conclusions about the components at the points of interest (wood and textile fibers)? What information could we gather from other methods regarding the points of interest?**
* **No matter how high the magnification of the artifact is, it cannot give us clear answers about the components that the wood consists of.**
* **We select the points where the magnification from SEM shows us that there are different materials to find their components with a new method, EDS.**

| *Record your answers  in three different short videos or recordings.*  *Name them "2.d Conclusion A", "2.d Conclusion B",* | | *QR audio* |
| --- | --- | --- |
| **ConceptualizationQuestions outline** | **QR audio** | |

*Discuss as a whole class.*

**What do we need to do to find the components   
of the points of interest of the artifact we are studying?**

**What should we recognize?**

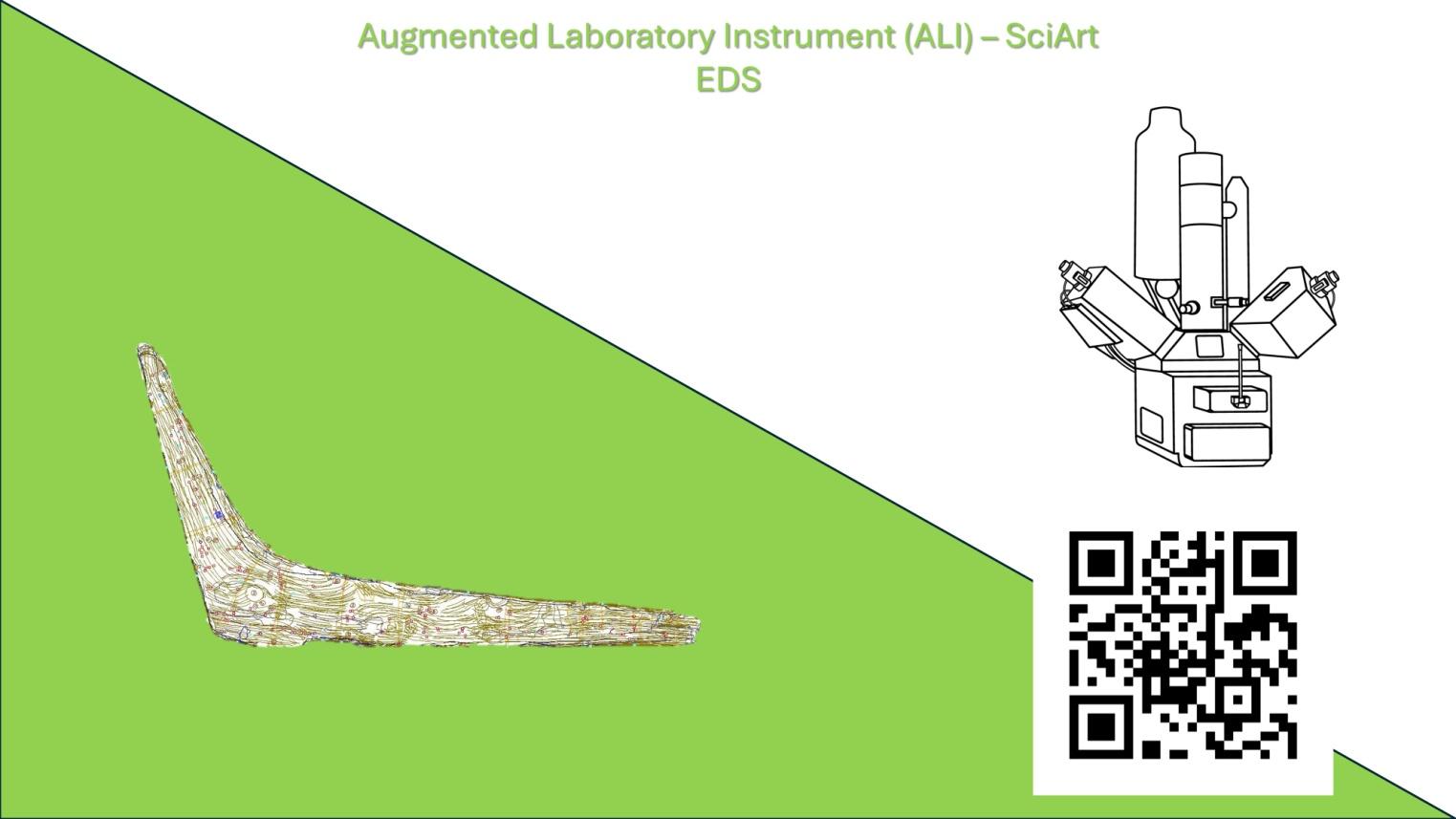
***A class discussion is provoked which leads to the need to identify the elements that the materials in the points of interest (wood, textile) are made of.***

***The teacher introduces the EDS method for the elemental analysis of the selected points. "EDS is an analytical method used to identify the elements found in a sample."***

| *Record the views heard  with a short video or audio recording.*  *Name it “1.b Conceptualization”* | | *QR audio* |
| --- | --- | --- |
| **Investigation Research with solid fill** | **QR audio** | | |

Use your mobile devices (tablets, mobiles, etc.) and scan the QR below.

Watch the video and download the results of the method for the wooden stern knee by clicking the **"Results"** button.

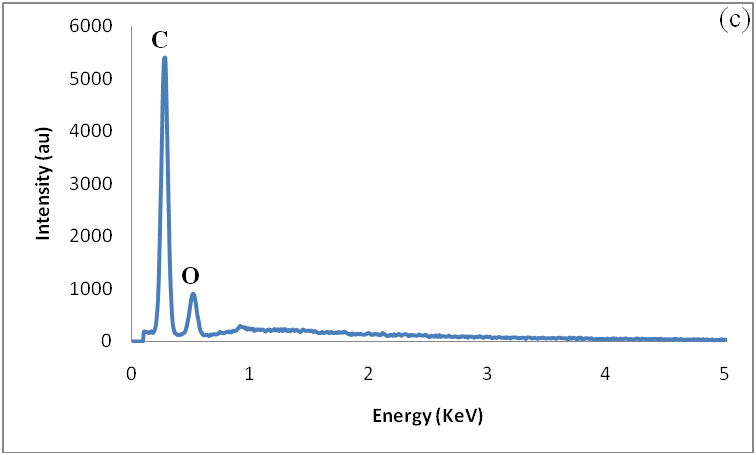


***Study in your group and then discuss with the whole class   
the results of this particular method***

***Students observe the spectrum and table of elements and identify the elements of the sample.***

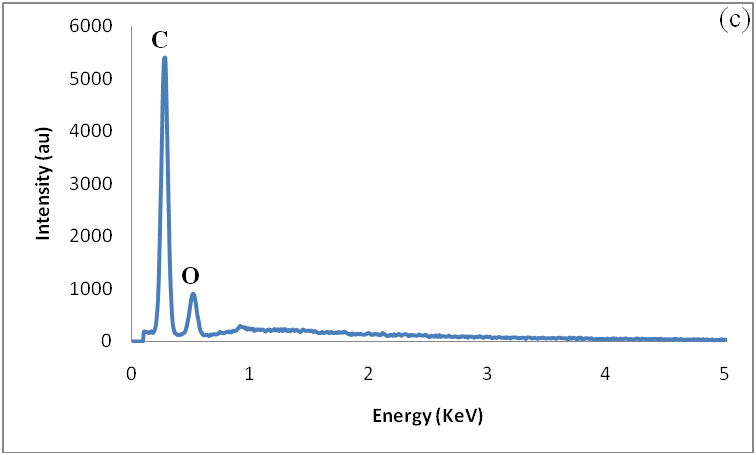
***The teacher explains to the students that an EDS spectrum is only obtained by selecting points of interest from the SEM images and asks the students to identify the elements found in the spectrum by the EDS method.***

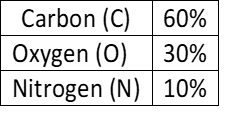
* In the first point of interest, from the sample taken from the wood, what do you observe in the EDS spectrum? What elements does the wood, as an organic material, consist of?



***This is the spectrum we obtain from the EDS method for the point of interest of the stern wooden beam. From the EDS spectrum, it is clear that we only have carbon and oxygen. This is a typical spectrum of organic materials. The identification of the wood was already completed through its morphological characteristics observed in the SEM. Here, the connection is made that the wood, being an organic material, is composed of oxygen (O) and carbon (C).***

* In the second point of interest, from the sample taken from the textile fibers found in the wood, what do you observe in the EDS spectrum? What elements does silk, as an organic material, consist of?

***This is the spectrum we get from the EDS method for the point of interest of the textile found on the wood. From the spectrum, it is shown that we have 60% carbon (C), 30% oxygen (O), and 10% nitrogen (N). The identification of the silk fibers was already completed through their morphological characteristics observed in the SEM. Here, the connection is made that silk, being an organic material, consists of oxygen (O) and carbon (C), and also contains nitrogen (N).***



| *Discuss and record how the method works with a short video or audio recording.*  *What results did it give us? What else did we have to do?*  *Name it “3.c Research”* | | *QR audio* |
| --- | --- | --- |
| **ConclusionThought outline** | **QR audio** | | |

List the materials in which the elements are found in our sample in the table below.

| **Points of interest** | **Chemical Compounds** |
| --- | --- |
| Type of wood from the stern beam | **A compound containing C and O, which, in combination with the SEM results, confirms that the wood is an organic material.** |
| Textile fibers found on the wooden stern beam | **An organic compound, which, in combination with the SEM results, confirms that the textile is made of silk fibers.** |

| *Record your answers  in a short video or audio recording.*  *Explain how you got there.*  *Name them "3.d Conclusion"* | | *QR audio* |
| --- | --- | --- |
| **ConceptualizationQuestions outline** | **QR audio** | | |

*Discuss as a whole class.*

**What do we need to do to obtain more information about the points of interest? Can we use the FTIR method to see what additional information it can provide us?**

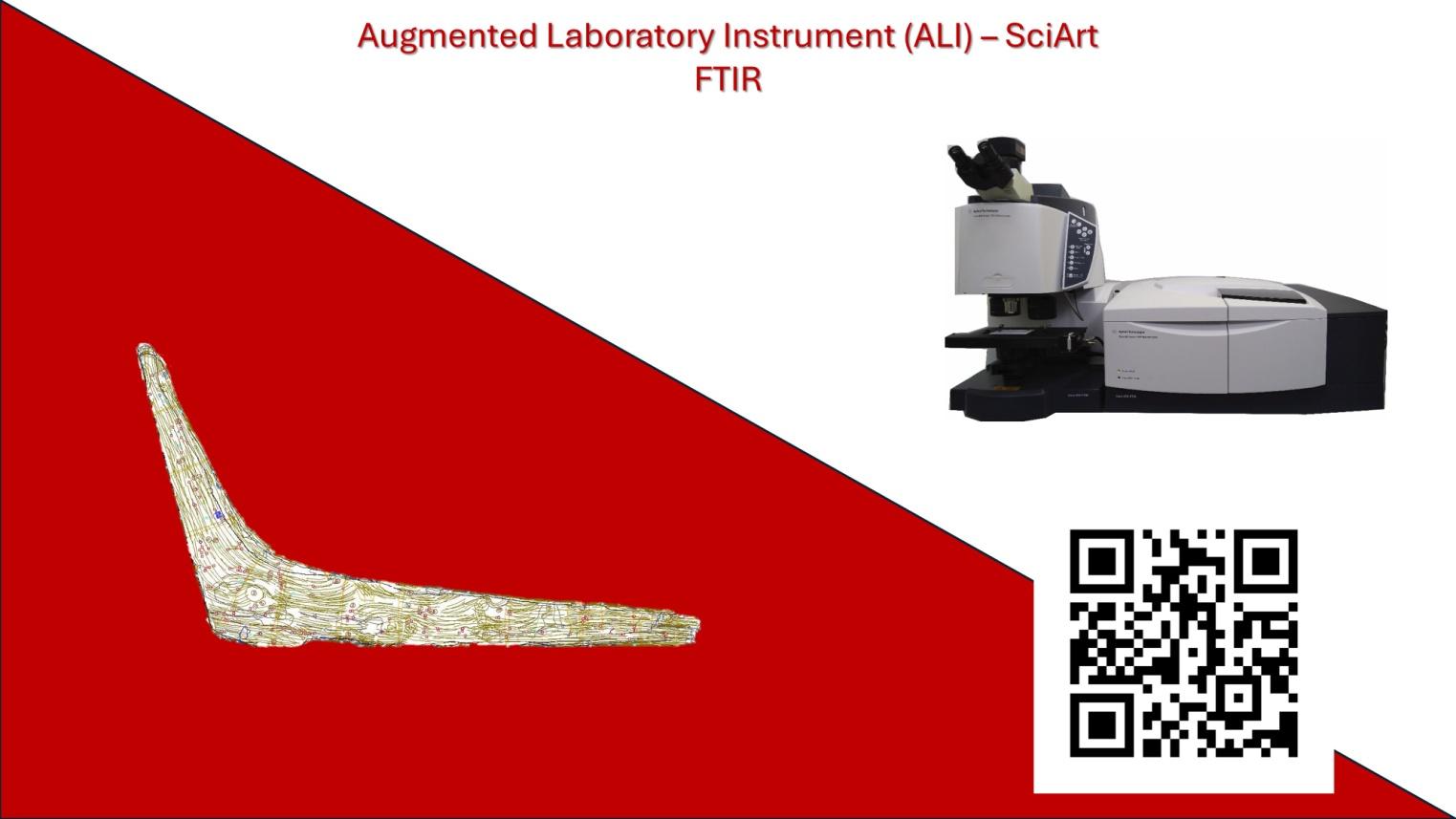
***The above observation makes it necessary to limit the possible compounds present in our sample. The discussion highlights the need for further analysis to identify a specific chemical compound. Students will use the FTIR method.***

***A discussion with the whole class follows, where we guide the students to focus on the need for further investigation using the FTIR method.***

| *Record the views heard  with a short video or audio recording.*  *Name it “4.b Conceptualization”* | | *QR audio* |
| --- | --- | --- |
| **Investigation Research with solid fill** | **QR audio** | | |

Use your mobile devices (tablets, mobiles, etc.) and scan the QR below.

Watch the video and download the results of the method for the wooden stern knee by clicking the **"Results"** button.

****

***Discuss the results of this method with the whole class***

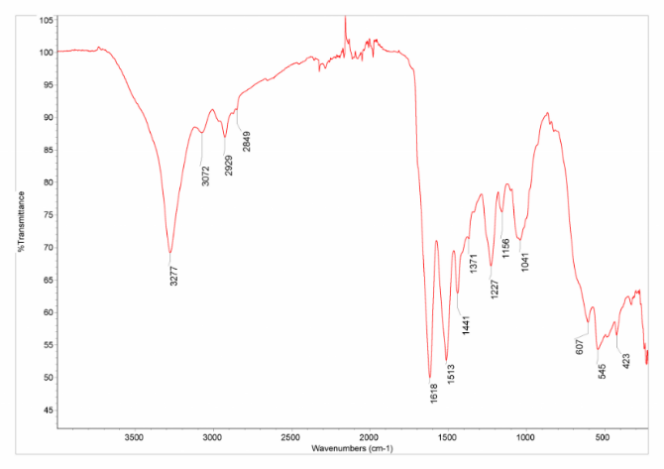
* In the first point of interest, from the sample we took from the wood of the stern beam, what do you observe in the FTIR spectrum? What is the composition of the wood?

Εικόνα που περιέχει κείμενο, διάγραμμα, γραμμή, γράφημα

Περιγραφή που δημιουργήθηκε αυτόματα

***The FTIR method provides a spectrum with peaks for the stern beam wood, indicating that, like all kinds of wood, it consists of cellulose, hemicellulose, and lignin.***

* In the second point of interest, from the sample taken from the fibers of the textile found on the wood, what do you observe in the FTIR spectrum? Does the FTIR method confirm the type of textile found, as identified by the previous method?



***The FTIR method provides a spectrum with inverted peaks for the textile area found on the wood, confirming that the textile is made of silk.***

| *Discuss and record how the method works  with a short video or audio recording. What results did it give us?*  *Name it “4.c Research”* | | *QR audio* |
| --- | --- | --- |
| **ConclusionThought outline** | **QR audio** | | |

* **Which compound was identified in the wood?**

| **Cellulose (C6H10O5), hemicellulose, and lignin** |
| --- |

* **Which compound was identified in the textile by FTIR?**

| **Silk** |
| --- |

| *Record your answers  in a short video or audio recording.*  *Explain how you got there.*  *Name them "4.d Conclusion"* | | *QR audio* |
| --- | --- | --- |
| **ConceptualizationQuestions outline** | **QR audio** | | |

*Discuss as a whole class.*

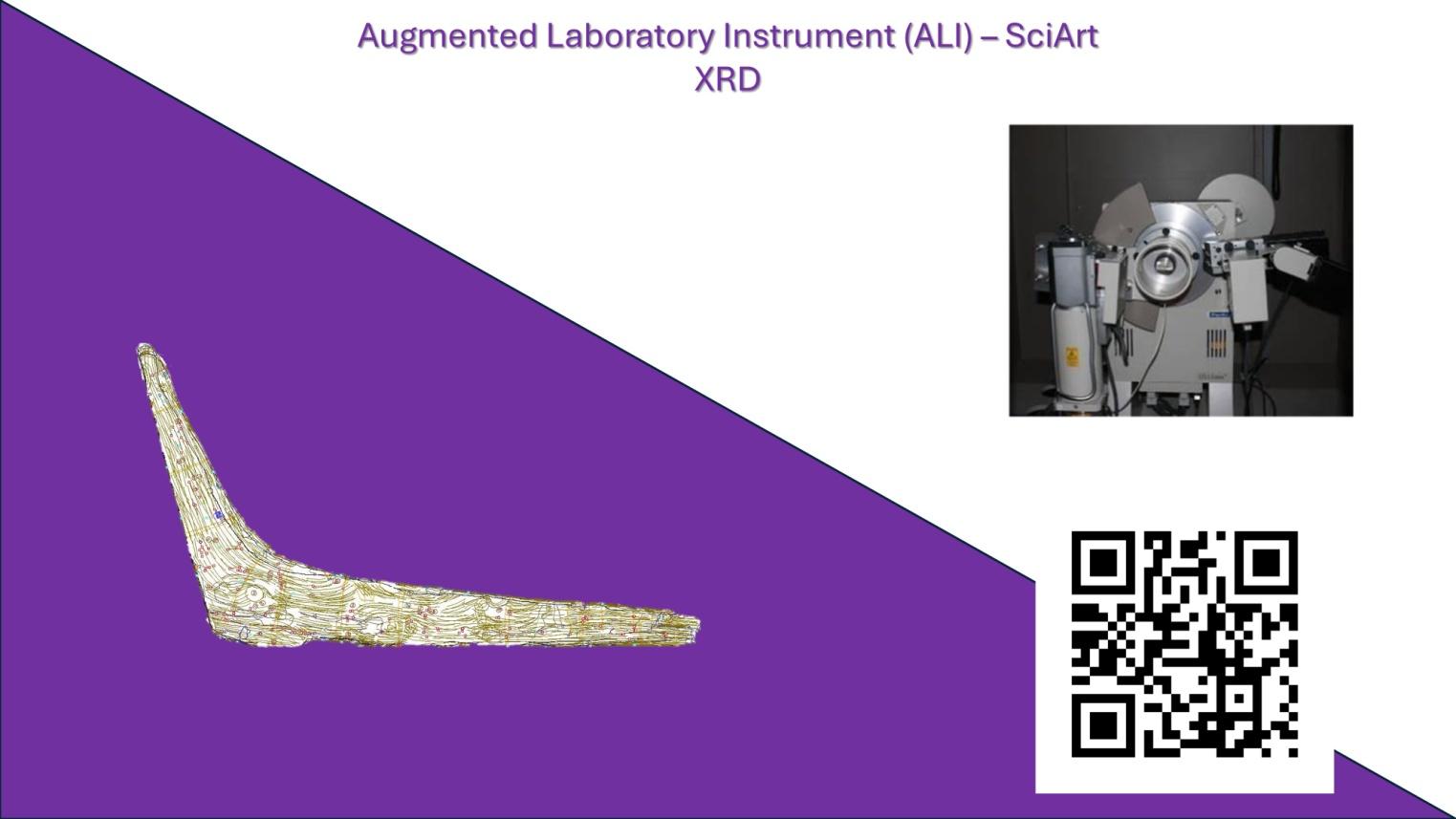
**What difference does the XRD method give for the points of interest?**

***The teacher introduces the XRD method.***

| *Record the views heard  with a short video or audio recording.*  *Name it “5.b Conceptualization”* | | *QR audio* |
| --- | --- | --- |
| **Investigation Research with solid fill** | **QR audio** | | |

Use your mobile devices (tablets, mobiles, etc.) and scan the QR below.

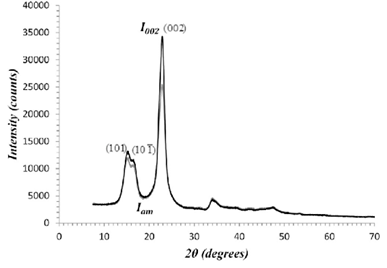
Watch the video and download the results of the method for the wooden stern knee by clicking the **"Results"** button.

****

***Discuss in the whole class the results of this particular method***

***Students observe the diffractogram graph. The teacher initiates a discussion about the necessity to ascertain the region of origin of natural ultramarine.***

* In the first point of interest, from the sample we took of the wood, which compound is confirmed based on the XRD diffraction pattern?

***The analysis of the XRD pattern from the wood sample shows the participation of cellulose, which is common for wood samples.***

* In the second point of interest, from the sample we took of the textile found on the wood, which compound is confirmed based on the XRD diffraction pattern?

Εικόνα που περιέχει κείμενο, γράφημα, διάγραμμα, γραμμή

Περιγραφή που δημιουργήθηκε αυτόματα

***The analysis of the XRD diffraction pattern of the threads from the textile does not lead to any conclusions, other than suggesting it is likely an organic material.***

.

| *Discuss and record how the method works  with a short video or audio recording.*  *What results did it give us?*  *Name it “4.c Research”* | | *QR audio* |
| --- | --- | --- |
| **ConclusionThought outline** | **QR audio** | | |

* **In the table below, summarize the information you have obtained about the main material from which all woods are made and what type of material silk is.**

| **Points of interest** | **Chemical Compounds** |
| --- | --- |
| Stern beam wood | **Woods are composed of cellulose** |
| Textile found on the wood | **Silk is an organic substance** |

| *Record your answers  in a short video or audio recording.*  *Explain how you got there.*  *Name them "4.d Conclusion"* | *QR audio* |
| --- | --- |

**Back to the initial questions…**

1. What information can we gather about the wood and the origin of the shipwreck? What processes can we use to obtain this information?

2. Are there any alterations to the wood?

3. What types of conservation processes were applied and why?

| **ConceptualizationQuestions outline** | **QR audio** |
| --- | --- |

*Discuss as a whole class.*

**How can we use the conclusions drawn from archaeometric methods to answer the initial questions?**

*Please provide questions that you can ask an AI machine. The answers it gives you, combined with the results you already have, will help address the initial questions.*

| ***The teacher facilitates a class discussion to formulate the questions that students need to address the above questions. Such questions may be:***   * **What is the stern knee on a ship?** * **What are the parts of a ship, besides the stern?** * **Since when has silk been produced?** * **How is silk made?** |
| --- |

| *Record the questions you will ask on ChatGPT with a short video or audio recording.*  *Name it “6.b Conceptualization”* | *QR audio* |
| --- | --- |
| **Investigation Research with solid fill** | **QR audio** |

Use ChatGPT to get information on the above questions. Write down the information you need to answer the questions.

| **Question** | **Main ChatGPT Answer Points** |
| --- | --- |
| What is the stern knee on a ship? | **The stern knee on a ship is a structural component that forms part of the ship's stern. It is a large, curved piece of wood or metal that connects the transom (the flat or nearly flat surface at the stern of the ship) to the keel or the frame structure. The stern knee provides additional strength and support to the aft (rear) part of the ship, helping to maintain the integrity of the hull and distributing stresses that occur during sailing.** |
| What are the parts of a ship, besides the stern? | **………** |
| Since when has silk been produced? | **………** |
| How is silk made? | **………** |
|  |  |
|  |  |

*Discuss in class the answers  
to the specific questions you posed on ChatGPT*

| *Note the main points of the answers for each question.  Did it help you find the answer?  How?*  *Name it “4.c Research”* | | *QR audio* |
| --- | --- | --- |
| **ConclusionThought outline** | **QR audio** | | |

*Record the answers to the initial research questions.*

| **1. What information can we gather about the wood and the origin of the shipwreck? What processes can we use to obtain this information?** |
| --- |
| ***The wood comes from a coniferous tree.*** |
| **2. Are there any alterations to the wood?** |
| ***Silk textile was found.*** |
| **3. What types of conservation processes were applied and why?** |
| ***……………………………*** |

|  | *QR audio* |
| --- | --- |

**Create a video of your answer to each   
interview question.**

**One of you will ask the question**

**and the other person will answer!!!!**

*Name the videos "Final Answer 1", "Final Answer 2", etc.*