



MAMMOTHS, POLLENS AND CLIMATE

MSTEM

METaverse-BASED STEM EDUCATION FOR A
SUSTAINABLE AND RESILIENT FUTURE
2023-1-FR01-KA220-SCH-000151516



Co-funded by
the European Union



Pollens and climates of the past

DESCRIPTION OF THE LESSON, SUBJECT OF THE LESSON

The session allows pupils to identify the climate change that took place around 11,000 years ago (Pleistocene-Holocene transition) by studying fossil pollens collected in European peat bogs. The pollen data is available on the [European Pollen Database](#).

Each pupil/group chooses a sample appropriate to the period. A poster will be produced with the group's pollen diagram, the identification of some characteristic pollens under the microscope and an estimate of the age of the Pleistocene-Holocene transition according to the chosen location.

Added value of the metavers

- Getting several groups from different countries to work together and compare the results obtained. Pollen data is available for all European countries. It is therefore possible to imagine parallel research and then the organisation of a European conference on the climate 11,000 years ago.
- Identification of the organs that produce pollen through VR dissection of a flower.
- Microscopic observation of fossilised pollen corresponding to temperate or cold periods.
- Visualisation of the formation of sediments in a lake with fossilisation of the pollen from the surrounding plants.
- Serious game: create your cold/warm climate pollen layer.



Co-funded by
the European Union



TEACHING METHOD

- Problem solving

The mammoth will be used as a hook to identify the climate change that took place around 11,000 years ago.

The mammoth, an animal familiar to students, allows the students' representations of ancient climates and the methods used by scientists to reconstruct climates to emerge.

Based on the students' comments and questions, various scientific problems will be developed in the classroom. One of these problems will be to determine whether there was a change in the climate in Europe about 11,000 years ago.

Other problems such as the feasibility of cloning the mammoth and the role of humans in the disappearance of the mammoths may be addressed later.



Co-funded by
the European Union



Lesson plan

Starting point

2 photos of mammoths (one reconstruction and one fossil). Let the pupils discuss and note down their ideas.



Title: reconstruction of woolly mammoths and woolly mammoth fossil preserved in the permafrost of Russia (wikipedia)

Examples of comments or questions from pupils

- Mammoths had hair because it was very cold.
- Mammoths have disappeared.
- There are researchers who want to revive mammoths using mammoths frozen in the ice in Siberia.
- It's like in the film Ice Age, the ice is melting because it's getting warmer and Manny and his friends are looking for an area where they can continue to live.

Example of questions the teacher can ask to help the pupils think

When were the mammoths? When did they disappear? Because of what?

Writing one or more problems to be solved

The problem to be solved in this lesson will be:

How were scientists able to establish that the climate had warmed up around 11,000 years ago?

Students formulate hypotheses and then formulate a problem

How does the study of fossilised pollen enable us to identify the warming of the climate around 11,000 years ago?

Lesson plan

Stages of the pupils' work

- Choice of the site for collecting pollen from the European Pollen Database
- Creation of a pollen diagram with a spreadsheet (Excel, Libreoffice Calc)
- Identification of some pollens under a microscope
- Communication of the results in the form of a poster

Ideas for further thinking

- What made the mammoths disappear: the climate? Hunting? Or both?
- Contributions of ice cores to identifying climate variations.
- Is mammoth cloning possible?



Co-funded by
the European Union



Lesson table

Stages of the course	
Mammoths' picture to bring out the pupils' representations.	20 min
Pooling of pupils' ideas and development of a scientific problem	15 min
Choice of site and analysis of palynological data by research groups	1h
Communication of data in the form of a poster. All the posters can be put online on an interactive European (or world) map (Genially). Conference of schools in the metaverse.	1h

Lesson resources

RESOURCES

- European pollen database <https://libmol.org/pollens/>

Students will be able to find pollen data that can be used for different locations around the world.

It is possible to use the [netoma explorer](#) website, which is in English but where downloading and using the data is not as simple as on the previous site.

- What is pollen?

https://www.youtube.com/watch?v=tYj-QYDM6Vw&ab_channel=ScienceForStudents

This video presents the origin of pollen grains and the characteristics of their membranes.

It is a video for students who have studied meiosis.

The 3D pollen project

If you have a 3D printer, you will be able to print your pollen grains

<https://3dpollenproject.wixsite.com/main>

- Excel or Libreoffice spreadsheet
- Table of the ecological requirements of different plants
- Microscopic observations of different pollens
- Work at home
 - <https://kids.tpl.ca/wonders/why-did-woolly-mammoths-go-extinct>
 - <https://www.mnhn.fr/fr/pourquoi-les-mammouths-ont-ils-disparu>



Co-funded by
the European Union



Work and homework

INDIVIDUAL WORK

The pupils will explore the various coring sites in order to find a palynological record that includes the period around -11,000 years ago.

The extraction of the data and its presentation in graphic form makes it possible to highlight the succession of climatic conditions in the area and, above all, to identify the climatic change that characterises the transition to the Holocene.

HOMEWORK

Article to read or podcast on the causes of the disappearance of the mammoths.

Evaluation and indicators

Evaluation criteria	
Contents of the poster <ul style="list-style-type: none">graph showing species characteristic of the climate change from the transition to the HoloceneHighlighting of the change in floraPhotos of characteristic pollens with captions	1
Layout of the poster <ul style="list-style-type: none">General title, organisation that facilitates reading, pleasant to read	1



Co-funded by
the European Union



Overview of the lesson

This lesson allows students to practise a scientific approach and discover the role of pollens in climate reconstruction. Based on the principle of actualism (also known as uniformitarianism, the basic principle that past phenomena acted in the same way as current phenomena), students will be able to observe pollens under a microscope and work with real pollen data from the European Pollens Database platform.

The richness of the theme allows for further work on other methods of climate reconstruction, on the phylogeny of Proboscideans or on the comparison of climate change 11,000 years ago with that which we are currently experiencing.



Co-funded by
the European Union

