

Teachers' Guidelines

Title of the package: Postglacial relief of northern Eurasia

Information about the package:

Brief Description: The modern relief of northern Europe and Asia is the result, among others, of the activity of the Scandinavian ice sheet, which began its expansion about 2.5 million years ago. The ice age that began then is called the Pleistocene. In the modern relief, the period of the last glaciation (Vistulian) is the most significant, and the area covered by it is characterized by distinct postglacial forms (young glacial landscape).

The package might be used as a supplement to the school curriculum in the field of exogenic processes - sculpting activity of glaciers and glacial waters. The way of presenting the problem was designed to link the contemporary research on glaciers with knowledge what was happening in the area where we live now several million years ago. Hence, photographic materials from the vicinity of the Polish Polar Station Hornsund in Spitsbergen were also used.

How does the package relate to STEAM education: Educational package refers directly to the geography curriculum. However, the processes presented require knowledge of other subjects, especially physics.

Keywords: land forms, erosion, ablation, melting, sublimation, accumulation, detracton, detrusion, exaration, young glacial landscape, old glacial landscape, Vistulian.

Age Range: 15-18

Didactical hours: 1

Learning objectives:

The student will:

- describe climatic conditions in the Pleistocene;
- read from a map the names of geographic regions that were influenced by specific ice sheets and their domes;
- explain the importance of snowfall for the formation of ice sheets;
- explain the significance of the youngest glaciation (Vistulian) on the modern relief of northern Eurasia;
- explain the meaning of the terms 'young glacial landscape' and 'old glacial landscape';

Project office: Księcia Janusza 64, 01-452, Warsaw, Poland edu-arctic2.eu edukacja@igf.edu.pl

EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland and Norway receives a grant of ca. 240 000 EUR received from Iceland, Liechtenstein and Norway under EEA funds. The purpose of the EDU-ARCTIC 2 project is to: enhance the knowledge about nature, geography, natural resources, political specificities concerning polar regions and increase awareness of environmental issues and climate change, increase of interest in pursuing STEM education and careers due to enhancement of knowledge about scientific research, and their place in the modern world, familiarizing young people with scientific career opportunities; introduce innovative tools by way of an e-learning portal and effective methods of teaching science in schools.

- describe the destructive, transporting, and building activities of glaciers and glacier-flowing waters;
- name erosional and accumulative glacial and fluvioglacial forms;
- recognize on photos and map selected erosional and accumulative landforms;
- explain the meaning of the terms: denudation, erosion, detrusion, detracton, exarasion, ablation.

Content of the package and guidelines for teachers:

Link to the package: <https://graasp.eu/s/lbwe2r>

We encourage teachers to copy the graasp package to their own graasp space in order to become 'owner' and be able to modify the content, hide or unhide some materials, add quizzes, etc. Moreover, teachers may share the package with their students and check the progress of each student. A short video tutorial on how to do it is available at:

<https://view.genial.ly/5f7ef81f1b2b330d2efa3411/video-presentation-tutorial-graasp>

If you don't have access to the graasp package, contact us: edukacja@igf.edu.pl

Package consists of 4 sections described in detail below:

1. Pleistocene - the ice age

In the first part, students will learn what conditions on Earth prevailed 2.5 million years ago, when the ice age, the Pleistocene, began. The text with graphics is to broaden students' knowledge about this epoch except for standard knowledge relayed during geography classes. Students will learn, among others, that the glaciated areas in northern Europe and Asia were divided into two ice sheets, which in turn divided into domes. Using the map provided, students will be able to identify the geographic regions that were influenced by the indicated ice sheets and their domes. The aim of this activity is to learn about the names of geographic objects in the Arctic.

Students will also explain why big part of the Eastern European Plain, Siberian Plain, Mongolia, and Tibet were free of permanent ice sheets.

Materials:

- Presentation "Postglacial relief of northern Eurasia" (slides 2-4)
- Worksheet – Exercise 1
- Section "Pleistocene - the ice age" on graasp.eu platform

Estimated time: 10 minutes

2. Mysterious Vistulian glaciation

Students will learn more about Vistulian, which is the last glaciation. It is the most important from the point of view of modern relief. Students will recall what is a young glacial and old glacial landscape. Thanks to animation they will also learn how the range of this glaciation changed from 38.000 to about 10.000 years ago.

Materials:

- Presentation “Postglacial relief of northern Eurasia” (slides 5-9)
- Animation “Reconstructing of the Eurasian ice sheet extent”
- Section “Mysterious Vistulian glaciation” on graasp.eu platform

Estimated time: 5 minutes

3. Glacial forms

It's the main part of the lesson, which aim is to show the students how glaciers have transformed the Earth's surface. To help students remember the term ‘glacial landforms’ they will learn term ‘glacier’ in different languages, then watch the animation “How do glaciers shape the landscape?”. After that basing on it they will describe what the destructive activity of glaciers is.

Then, together with their teacher, students will organize their knowledge of this topic by introducing the terms erosion, detracton, detrusion, and exaction. They will also learn about the origins of erosional glacial forms. A short exercise will test students' understanding of this part of the topic.

Next, students will learn the broad meaning of the term ‘moraine’, which refers to both the material transported by a glacier and the landforms created by its accumulative activity. Students will also understand why some accumulation forms are typical only for mountain glaciers (lateral and medial moraines) and others are formed by both mountain and continental glaciers (ice sheets). In this part of the presentation were used, among others, current photographs of moraines taken near Polish Polar Station Hornsund in Spitsbergen.

At the end of this section, the formation of the most complex forms - drumlins - will also be discussed. Their structure and composition allows us to assume that they are the result of the interaction between the glacier and the waters flowing from it.

Materials:

- Presentation “Postglacial relief of northern Eurasia” (slides 10-19)
- Worksheet – Exercises 2, 3 and 4

- Animation “How do glaciers shape the landscape?”
Link to the movie: <https://www.youtube.com/watch?v=loI584OFVpE>
- Section “Glacial forms” on graasp.eu platform

Estimated time: 15 minutes

4. Fluvioglacial forms

In the final section, students will learn how the water flowing from a melting glacier affects modern landforms. They will also learn why we should use the term ‘ablation’ rather than ‘melting’ to describe the process of glacier decline. Students will learn about the erosive, transporting, and accumulating activities of water flowing from a glacier.

The material describes how such forms as tunnel and glacial valleys, sandurs, eskers, and kames were formed. Wrap-up exercises will help students to check their understanding of the topic.

Materials:

- Presentation “Postglacial relief of northern Eurasia” (slides 20-25)
- Worksheet – Exercise 5
- Section “Fluvioglacial forms” on graasp.eu platform

Estimated time: 15 minutes

Answer key:

Exercise 1.

Indicate whether the sentence is true or false.

1. During the Vistulian Glaciation the whole area of Poland was covered by ice
2. The Svalbard area came within the range of the Eurasian Ice Sheet
3. Scandinavia and Novaya Zemlya were influenced by the same ice sheet
4. The northernmost dome of the Eurasian ice sheet was the British-Irish dome
5. Almost all of the northern part of the lands belonging to Ukraine today was covered by the Eurasian Ice Sheet

Exercise 2.

Check in an online dictionary how the term ‘glacier’ sounds in other foreign languages. Enter 5 examples of terms for ‘glacier’ that are similar in sound to the English word ‘glacier’.

Example answers:

Gletser (Indonesian)
Gletscher (Luxembourgish)
Glacier (Latin)
Gletsjer (Dutch)
Gletscher (German)
Glaciär (Swedish)
Ghiacciaio (Italian)

Exercise 3.

Complete the sentences by choosing the correct terms.

mountain glaciers and ice sheets, glaciers and glacial waters, U-shaped valley, V-shaped valley, mountain glaciers, ice sheet, detrusion, exaration

Glacial forms are the result of the sculpting activity of **mountain glaciers and ice sheets**. These forms can be formed by both destructive and building activities. The most characteristic erosional glacial form is the **U-shaped valley**. Valleys of this type are also found in Poland (e.g. in the Tatra Mountains) and they are the evidence of the presence of **mountain glaciers** in that area. The remains of the ice age are also roche moutonnées or sheepbacks. Their smooth and polished surface is the effect of **detrusion**.

Exercise 4.

Indicate whether the sentence is true or false.

1. The term 'moraine' means both material transported and deposited by a glacier and glacial form TRUE
2. The medial moraine is formed by the merging of two lateral moraines TRUE
3. Medial moraine may be the result of mountain glaciers and ice sheets activity FALSE
4. Material deposited by glacier activity is composed of rock crumbs of the same size FALSE
5. Detraction is an example of destructive glacier activity TRUE

Exercise 5.

Indicate whether the sentence is true or false.

1. Terms 'ablation' and 'melting' mean exactly the same FALSE
2. Based on the form of the tunnel valley, we can determine the direction in which the glacier front moved TRUE
3. Ribbon lakes are generally long and deep TRUE
4. There are no surface waters that currently flow in the glacial valleys FALSE

5. Sandurs are an example of an accumulative fluvio-glacial forms

FALSE

6. In sandurs, the rock material is sorted, which is a result of the decrease in water energy as it moves away from the glacier front

TRUE

7. The eskers are elongated in shape, and the kames take the form of hills or highlands

TRUE