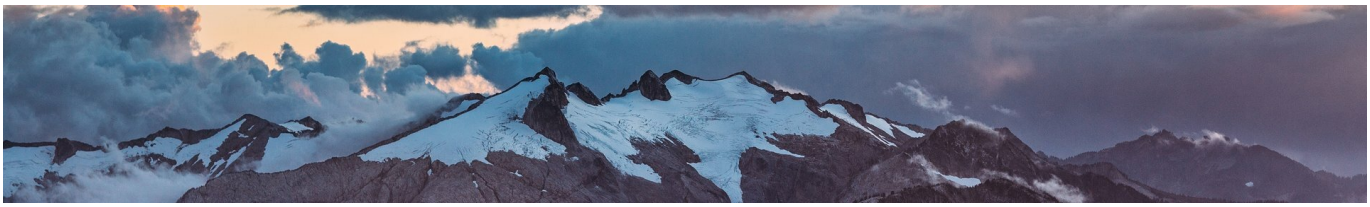
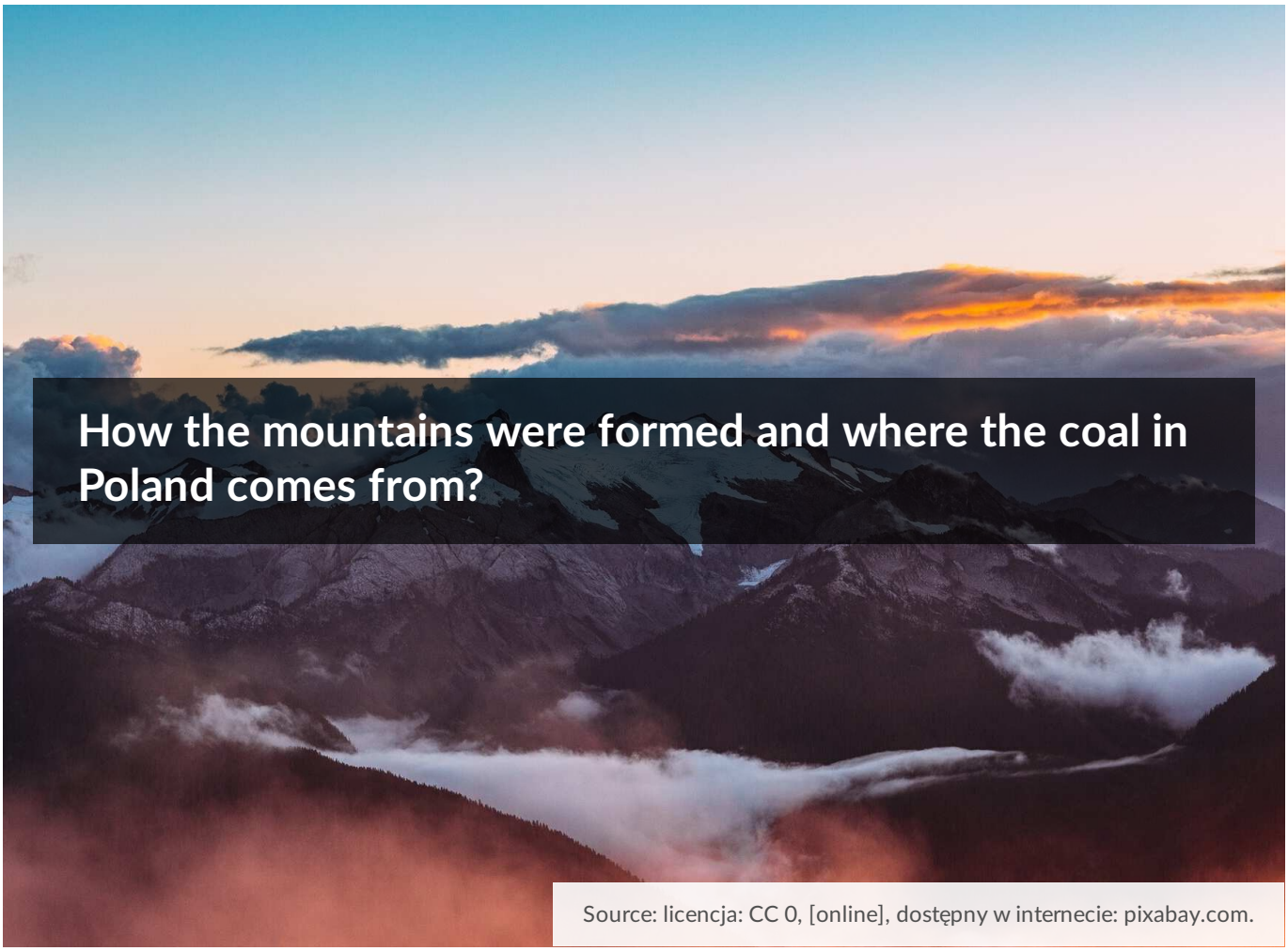


How the mountains were formed and where the coal in Poland comes from?



Source: licencja: CC 0, [online], dostępny w internecie: pixabay.com.

Link to the lesson

Before you start you should know

- what forms of relief are found in Poland;
- when and what major geological events took place in Poland.

You will learn

- discuss the processes conducive to the formation of mountains;
- explain how the mountains in Poland were formed;
- give information about the location of different types of mountains found in Poland;
- name the formation stages of hard coal;
- discuss the processes conducive to the formation of coal;
- show brown and hard coal deposits in Poland.

Nagranie dostępne na portalu epodreczniki.pl

nagranie abstraktu

Before starting the class, arrange the puzzle and think about what mountains have been shown in the picture.

Exercise 1

Put together the puzzle.

Source: licencja: CC 0.

Over millions of years, the landscapes on our planet have changed many times. In the area of today's Poland there were different natural conditions as well. Some of the lands was flooded with sea water, other times mountains uplifted as a result of the movements of the Earth's crust. There were also periods when the area of our country was overgrown with lush tropical forests, from which coal was formed later on. The geological history of the Earth is fascinating, and it is worth learning a little more about it.

Using the knowledge gained so far, solve the following task.

Exercise 2

Complete the text.

Mountains arise as a result of uplifts which are the result of _____ movement where lithospheric plates press against each other with enormous strength, the terrain undergoes _____ and uplifting, and mountains are formed. The Carpathians were formed as a result of the movement of the _____ plate northwards and its collision with the _____ plate. This slow process of mountain-forming movements is called _____ and continues to this day. The proof is in the form of _____.

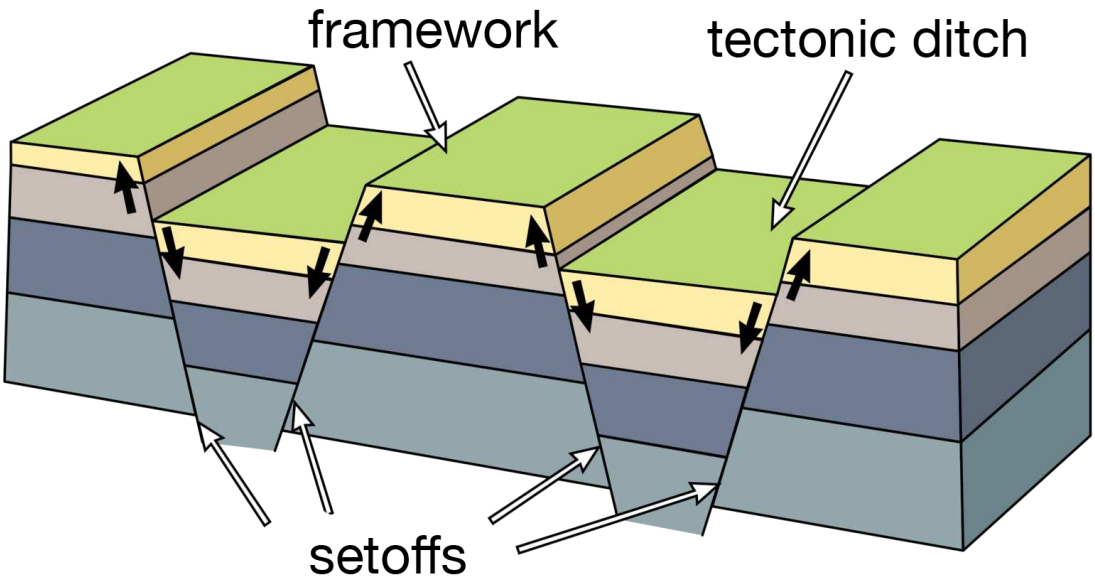
Eurasian | orogenesis | continents | earthquakes | african | folding

How the mountains were formed

Internal processes (endogenous) – mountain-, land-, and ocean-forming movements, as well as earthquakes and volcanic phenomena – contribute to changes in the appearance of lands and oceans. They determine the formation of mountains and lead to changes both in the vertical (relief) and the horizontal (coastline) shape of the land. They are the result of forces having their source in the depths of the Earth. **Internal factors** have remained basically the same from the beginning of the formation of our planet. They include: enormous pressure, very high temperatures, as well as pressure differences (effects of the activity of energy inside the Earth).

Mountains are formed mainly as a result of the uplift which is the result of continental movement. This is the **lithospheric plate theory**. Where the lithospheric plates press against each other with enormous force, the terrain is folded and uplifted – **fold mountains** are formed. The Carpathians were formed as a result of the movement of the African plate northwards and its collision with the Eurasian plate. It is worth remembering that this slow process is still continued. Earthquakes that occur in the south of Europe from time to time are the best proof.

At the beginning of the Cenozoic era, during the most intense folding of the Carpathians, there was a rejuvenation of the relief in the Sudetes. There were significant shifts of rock layers along faults and the so-called fault **block mountains** were formed.



Construction diagram of the block mountains
Source: tylko do użytku edukacyjnego na epodreczniki.pl.

1. The Sudetes were formed in the Paleozoic era. At first, in the place of today's Sudetes there was a sea on the bottom of which sedimentary rocks were formed. During Caledonian folding (the first part of the Paleozoic era), huge mountains were created in this area.
2. Then, for many millions of years, the Caledonian massif was destroyed.
3. During the Hercynian-forming movements (the second part of the Paleozoic era), the Caledonian massif was divided, and the Eastern Sudetes were uplifted and formed. At that time, the main foundation of today's Sudetes was formed. The oldest range of the Sudetes is the Sowie Mountains (part of the Central Sudetes), the younger is the Eastern Sudetes, and the youngest is the Western Sudetes, and some individual ranges, such as the Table Mountains. At the same time, there was also an intense volcanic activity, the effects of which were intrusions of magma into the layers of older rocks. This way, the ranges of the Karkonosze Mountains and the Jizera Mountains were formed.
4. During the alpine tectonic movements (the beginning of the Cenozoic era), the old massif of the Sudetes cracked and shaped the relief of today's Sudetes. The fault block mountains were formed.
5. Various external processes are still forming the Sudetes.

Another type of mountains is **volcanic mountains**. They were formed as a result of volcanic activity, for example, in the Kaczawskie Foothills in the Sudetes or in the Silesian Upland.

Mount Saint Anna

Source: Thorton, licencja: CC BY-SA 3.0.

Mountains of volcanic origin

Source: SchiDD, licencja: CC BY-SA 3.0.

Exercise 3

Put in the correct order from the youngest orogenesis to the oldest one.

Hercynian (Variscan) orogenesis

Alpine orogenesis

Caledonian orogenesis

How coal was formed

Internal processes diversify the Earth's surface through uplifting and folding. However, **external processes** (exogenous) – weathering, erosion, accumulation, mass movements – contribute to levelling out the Earth's surface. One of these processes – accumulation – significantly contributed to the formation of **coal** deposits in Poland.

In the Paleozoic era, in the Carboniferous period, **black coal** deposits were formed. At that time, there was an equatorial-like climate in Poland. There was lush, ever-green vegetation rich in various species, similar to modern equatorial forests. Plant remains were covered with rock deposits brought by wind and water. Under anaerobic conditions and at high pressure, these remains transformed into peat first, then into brown coal, and finally black coal. It was the so-called coalification, i.e. increasing the content of element CC (coal) in rocks.

After some time, plant remains accumulated on sediments again, and subsequent layers of coal were formed. In some periods there were earthquakes, and rock layers, including those with coal, were mixed along faults. That is why today, hard coal is found at very different depths – from a few meters to several kilometres. In Poland, deposits of this energy material are located in the Silesian Upland and the Lublin Upland, and are still being exploited. Whereas in the Sudetes near Wałbrzych, black coal mining was completed several years ago.

In the Cenozoic, a few dozen million years ago, there was a humid and hot climate, and coal deposits could form again. However, until today they have managed to reach only the **brown coal** stage. The deposits of this raw material lie shallow underground and are quite rich in Poland. Currently, brown coal is mined in opencast mines near Bełchatów, Konin and Turoszów.

Exercise 4

The mountain Kilimanjaro visible in the photo is a:

- ◯ folded mountain
- ◯ block mountain
- ◯ volcanic mountain

Source: licencja: CC 0.

Exercise 5

Select the items in the correct column.

Brown coal occurs in ...	Brown coal occurs in ...	Brown coal occurs in ...
Konin	Konin	Bełchatów
Bełchatów	Bełchatów	Bogatynia
Bogatynia	Bogatynia	Jaworzno
Jaworzno	Adamów	Wałbrzych

Homework

1. For volunteers: using the Learning Apps app (learning game Millionaires), create questions related to the issues learned in today's lesson.
2. Homework for all students from selected issues from the e-textbook.

Key words

orogenesis, coal, mountains

Glossary

Orogenesis

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

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orogeneza - okres intensywnych ruchów górotwórczych

Caledonides

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

Kaledonidy - góry powstałe podczas orogenezy kaledońskiej

Alpids

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

Alpidy - góry powstałe w orogenezie alpejskiej

Lesson plan (Polish)

Temat: Jak powstały góry i skąd się wziął węgiel w Polsce?

Autor: Magdalena Jankun

Adresat

Uczeń klasy VII ośmioletniej szkoły podstawowej.

Podstawa programowa

IX. Środowisko przyrodnicze Polski. Uczeń:

5. przedstawia wpływ ruchów górotwórczych i zlodowaceń w Europie na ukształtowanie powierzchni Polski;

15. Wskazuje na mapie rozmieszczenie głównych surowców mineralnych Polski oraz omawia ich znaczenie gospodarcze.

Cel lekcji

Uczniowie dowiedzą się, jak powstały góry oraz skąd się wziął węgiel w Polsce.

Kryteria sukcesu

- omówisz procesy sprzyjające powstawaniu gór;
- wyjaśnisz, w jaki sposób powstawały góry w Polsce;
- wskażesz na mapie Polski poszczególne typy gór;
- wyjaśnisz etapy powstawania węgla kamiennego;
- omówisz procesy sprzyjające powstawaniu węgla;
- wskażesz na mapie Polski występowanie pokładów węgla kamiennego i węgla brunatnego.

Kompetencje kluczowe

- porozumiewanie się w języku ojczystym;
- porozumiewanie się w języku obcym;
- umiejętność uczenia się;
- kompetencje informatyczne.

Metody/formy pracy

- z wykorzystaniem narzędzi TIK;
- praca z materiałem edukacyjnym oraz multimediami na platformie epodreczniki.pl;

- metoda problemowa: burza mózgów;
- praca indywidualna, w grupach i całego zespołu klasowego.

Środki dydaktyczne

- e-podręcznik do nauczania geografii;
- tablica interaktywna;
- rzutnik multimedialny;
- tablety/komputery;
- mapa fizyczna świata;
- mapa świata Geologia-tektonika;
- mapa fizyczna Polski;
- atlasy geograficzne.

Przebieg zajęć

Faza wstępna

1. Nauczyciel rozpoczyna zajęcia od ćwiczenia interaktywnego dla uczniów: ułóż obraz z puzzli. Po kolei uczniowie podchodzą do tablicy interaktywnej i układają jeden element tak, by w całości powstał obraz przedstawiający góry Tatry.

2. Nauczyciel podaje uczniom temat lekcji i cele sformułowane w języku ucznia.

3. Wprowadza ciekawostkę: według badań geologów szczytowe partie Mount Everestu są zbudowane ze skał osadowych, powstałych na dnie głębokiego oceanu. Następnie kieruje pytanie do uczniów: Co przyczyniło się do wyniesienia skał na wysokość wielu tysięcy metrów? Praca metodą problemową burza mózgów.

Faza realizacyjna

1. Nauczyciel uzupełnia wypowiedzi uczniów, między innymi wskazując, że źródłem procesów endogenicznych (wewnętrznych) jest energia cieplna wnętrza Ziemi, która wywołuje ruch materii (prądy konwekcyjne), a tym samym powoduje zmiany w litosferze. Powstanie łańcuchów górskich jest rezultatem szeregu procesów tektonicznych nazywanych ruchami górotwórczymi lub orogenezami.

2. Ćwiczenie interaktywne wykonane przez wskazanych uczniów na tablicy interaktywnej. Uzupełnij tekst.

3. Na mapie ściennej świata Geologia-tektonika uczniowie wskazują płyty tektoniczne, które przyczyniły się do ruchów górotwórczych na obszarze Europy, w tym Polski. Uczniowie wyszukują film „Tak powstawały Karpaty” w lekcji „Jak powstawały góry” na stronie epodreczniki.pl.

4. Zadanie dla uczniów: wyjaśnij proces powstania Karpat. Wskazanie jednego ucznia, by spróbował omówić to zagadnienie, mając na uwadze przedstawioną animację.

5. Pytanie skierowane do uczniów: czy w Polsce występują góry wulkaniczne? Krótka dyskusja. Wizualizacja gór wulkanicznych na przykładzie zdjęć Pogórza Kaczawskiego w Sudetach i Góry Św. Anny na Wyżynie Śląskiej.

6. Uczniowie korzystają z atlasów geograficznych i wyszukują Pogórze Kaczawskie w Sudetach i Górę Św. Anny na Wyżynie Śląskiej, które są dowodami na działalność wulkaniczną w Polsce.

7. Ćwiczenie interaktywne. Porządkowanie elementów: ustaw w poprawnej kolejności od najstarszej orogenezy do najmłodszej. Do tablicy podchodzi wskazany uczeń.

8. Praca w grupach. Na podstawie tekstu w e-podręczniku i innych źródeł opracuj informacje: co przyczyniło się do powstania pokładów węgla kamiennego i węgla brunatnego?

- etapy powstawania węgla kamiennego
- kiedy miał miejsce proces tworzenia się pokładów węgla kamiennego i węgla brunatnego?
- zlokalizowanie na mapie Polski miejsc występowania tych surowców. Omówienie pracy grup.

9. Odwołanie uczniów do lekcji w e-podręczniku. Nauczyciel wyświetla film z e-podręcznika „Jak powstał węgiel" w lekcji „Jak powstawały góry i skąd się wziął węgiel w Polsce". Odtworzenie nagrania na ekranie głównym tablicy interaktywnej.

10. Chętny uczeń/uczennica wykonuje polecenie 2 z lekcji w e-podręczniku i wskazuje na tablicy interaktywnej miejsca, w których występuje węgiel brunatny i kamienny w Polsce.

11. Ćwiczenie interaktywne. Zaznacz elementy w poprawnej kolumnie. Węgiel brunatny występuje... Do tablicy interaktywnej podchodzi uczeń, który wskazuje poprawną odpowiedź, wcześniej wyszukując te miejsca na mapie surowcowej Polski.

Faza podsumowująca

1. Jako podsumowanie uczniowie wykonują ćwiczenia interaktywne z ilustracjami, m.in. mają rozpoznać typ gór.

2. Nauczyciel ocenia pracę uczniów na lekcji, doceniając ich wkład i zaangażowanie.

3. Zadanie domowe dla chętnych uczniów i dla wszystkich uczniów (treść poniżej).

Praca domowa

1. Dla chętnych: korzystając z aplikacji Learning Apps (gra dydaktyczna Milionerzy) utwórz pytania odnoszące się do poznanych zagadnień na dzisiejszej lekcji.

2. Praca domowa dla wszystkich uczniów z wybranych zagadnień z e-podręcznika.

W tej lekcji zostaną użyte m.in. następujące pojęcia oraz nagrania

Pojęcia

Orogenesis

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

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orogeneza - okres intensywnych ruchów górotwórczych

Caledonides

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

Kaledonidy - góry powstałe podczas orogenezy kaledońskiej

Alpids

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

Alpidy - góry powstałe w orogenezie alpejskiej

Teksty i nagrania

Nagranie dostępne na portalu epodreczniki.pl

nagranie abstraktu

How the mountains were formed and where the coal in Poland comes from?

Before starting the class, arrange the puzzle and think about what mountains have been shown in the picture.

Over millions of years, the landscapes on our planet have changed many times. In the area of today's Poland there were different natural conditions as well. Some of the lands was flooded with sea water, other times mountains uplifted as a result of the movements of the Earth's crust. There were also periods when the area of our country was overgrown with lush tropical forests, from which coal was formed later on. The geological history of the Earth is fascinating, and it is worth learning a little more about it.

Using the knowledge gained so far, solve the following task.

Internal processes (endogenous) – mountain-, land-, and ocean-forming movements, as well as earthquakes and volcanic phenomena – contribute to changes in the appearance of lands and oceans. They determine the formation of mountains and lead to changes both in the vertical (relief) and the horizontal (coastline) shape of the land. They are the result of forces having their source in the depths of the Earth. **Internal factors** have remained basically the same from the beginning of the formation of our planet. They include: enormous pressure, very high temperatures, as well as pressure differences (effects of the activity of energy inside the Earth).

Mountains are formed mainly as a result of the uplift which is the result of continental movement. This is the **lithospheric plate theory**. Where the lithospheric plates press against each other with enormous force, the terrain is folded and uplifted – **fold mountains** are formed. The Carpathians were formed as a result of the movement of the African plate northwards and its collision with the Eurasian plate. It is worth remembering that this slow process is still continued. Earthquakes that occur in the south of Europe from time to time are the best proof.

At the beginning of the Cenozoic era, during the most intense folding of the Carpathians, there was a rejuvenation of the relief in the Sudetes. There were significant shifts of rock layers along faults and the so-called fault **block mountains** were formed.

1. The Sudetes were formed in the Paleozoic era. At first, in the place of today's Sudetes there was a sea on the bottom of which sedimentary rocks were formed. During Caledonian folding (the first part of the Paleozoic era), huge mountains were created in this area.
2. Then, for many millions of years, the Caledonian massif was destroyed.
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rocks. This way, the ranges of the Karkonosze Mountains and the Jizera Mountains were formed.
4. During the alpine tectonic movements (the beginning of the Cenozoic era), the old massif of the Sudetes cracked and shaped the relief of today's Sudetes. The fault block mountains were formed.
5. Various external processes are still forming the Sudetes.

Another type of mountains is **volcanic mountains**. They were formed as a result of volcanic activity, for example, in the Kaczawskie Foothills in the Sudetes or in the Silesian Upland.

Internal processes diversify the Earth's surface through uplifting and folding. However, **external processes** (exogenous) – weathering, erosion, accumulation, mass movements – contribute to levelling out the Earth's surface. One of these processes – accumulation – significantly contributed to the formation of **coal** deposits in Poland.

In the Paleozoic era, in the Carboniferous period, **black coal** deposits were formed. At that time, there was an equatorial-like climate in Poland. There was lush, ever-green vegetation rich in various species, similar to modern equatorial forests. Plant remains were covered with rock deposits brought by wind and water. Under anaerobic conditions and at high pressure, these remains transformed into peat first, then into brown coal, and finally black coal. It was the so-called coalification, i.e. increasing the content of element CC (coal) in rocks.

After some time, plant remains accumulated on sediments again, and subsequent layers of coal were formed. In some periods there were earthquakes, and rock layers, including those with coal, were mixed along faults. That is why today, hard coal is found at very different depths – from a few meters to several kilometres. In Poland, deposits of this energy material are located in the Silesian Upland and the Lublin Upland, and are still being exploited. Whereas in the Sudetes near Wałbrzych, black coal mining was completed several years ago.

In the Cenozoic, a few dozen million years ago, there was a humid and hot climate, and coal deposits could form again. However, until today they have managed to reach only the **brown coal** stage. The deposits of this raw material lie shallow underground and are quite rich in Poland. Currently, brown coal is mined in opencast mines near Bełchatów, Konin and Turoszów.

1. For volunteers: using the Learning Apps app (learning game Millionaires), create questions related to the issues learned in today's lesson.
2. Homework for all students from selected issues from the e-textbook.

orogenesis, coal, mountains

Lesson plan (English)

Topic: How the mountains were formed and where the coal in Poland comes from

Author: Magdalena Jankun

Target group

7th-grade students of an eight-year elementary school.

Core curriculum

IX. The natural environment of Poland. The student:

5. Shows the influence of Poland's surface;

15. Shows the distribution of the main importance.

The general aim of education

Students will learn how the mountains were created and where did the coal come from in Poland.

Criteria of success

- You will discuss the processes conducive to the formation of mountains;
- You will explain how the mountains in Poland were formed;
- You will show particular types of mountains on the map of Poland;
- You will name the formation stages of hard coal;
- You will discuss the processes conducive to the formation of mountains;
- You will show the occurrence of hard coal and brown coal on the map of Poland.

Key competences

- communication in the mother tongue;
- communication in a foreign language;
- learning to learn;
- digital competence.

Methods / forms of work

- using ICT tools;
- activity with educational material and multimedia on the epodreczniki.pl platform;
- problematic method: brainstorming;
- individual activity, activity in pairs, and collective activity.

Teaching aids

- e-textbook for teaching geography;
- interactive whiteboard;
- multimedia projector;
- tablets/computers;
- physical map of world;
- map of world, geology - tectonics;
- physical map of Poland;
- geographical atlases.

Lesson plan overview

Introduction

1. The teacher starts classes from an interactive exercise for students: place a picture of the puzzle. In turn, the pupils approach the interactive whiteboard and arrange one element so that the whole picture of the Tatra Mountains is created in its entirety.

2. The teacher gives students the topic of lessons and goals formulated in the student's language.

3. It introduces a curiosity: according to surveys of geologists, the peak parts of Mount Everest are built of sedimentary rocks formed at the bottom of the deep ocean. Then he directs the question to the students: What contributed to the elevation of the rocks to the height of many thousands of meters? Working on the brainstorming problem method.

Realization

1. The teacher completes the students' statements, among others, indicating that the source of endogenous (internal) processes is the thermal energy of the Earth's interior, which causes motion of matter (convection currents), and thus causes changes in the lithosphere. The formation of mountain chains is the result of a series of tectonic processes called tectonics or orogenesis.

2. Interactive exercise made by indicated students on the interactive whiteboard. Complete the text.

3. On the wall map of the world, Geologia-tectonic students indicate tectonic plates that contributed to tectonic movements in Europe, including Poland. The students search for the film „This is how Karpaty was created" in the lesson „How the mountains were made" on the epodreczniki.pl website.

4. Task for students: explain the process of the Carpathians. Indication of one student to try to discuss this issue, bearing in mind the presented animation.

5. Question addressed to students: are there volcanic mountains in Poland? A short discussion. Visualization of volcanic mountains on the example of photos of the Kaczawskie Foothills in the Sudetes and the Holy Mountain Anna in the Silesian Upland.

6. Students use geographical atlases and look for the Kaczawskie Foothills in the Sudetes and the Holy Mountain. Anna in the Silesian Upland, which is evidence of volcanic activity in Poland.

7. Interactive exercise. Arrange elements: set in the correct order from the oldest orogenesis to the youngest. An indicated student approaches the board.

8. Work in groups. On the basis of the text in the e-manual and other sources, develop information: what contributed to the formation of coal seams and lignite?

- stages of hard coal formation
- when was the process of hard coal and brown coal formation taking place?
- locating the places of occurrence of these raw materials on the map of Poland. Discussing the work of groups.

9. Appeal to students in the e-textbook. The teacher displays a video from the e-manual „How coal was created" in the lesson „How the mountains were made and where did the coal come from in Poland". Play the recording on the main screen of the interactive whiteboard.

10. The willing pupil / student performs the instruction 2 of the lesson in the e-textbook and indicates on the interactive whiteboard the places where lignite and brown coal occur in Poland.

11. Interactive exercise. Select the elements in the correct column. Lignite occurs ... An interactive student approaches an interactive whiteboard that indicates the correct answer, first searching for these places on the raw material map of Poland.

Summary

1. As a summary, students perform interactive exercises with illustrations, including they have to recognize the type of mountains.

2. The teacher assesses the students' work during the lesson, appreciating their contribution and commitment.

3. Homework for eager students and for all students (content below).

Homework

1. For volunteers: using the Learning Apps app (learning game Millionaires), create questions related to the issues learned in today's lesson.

2. Homework for all students from selected issues from the e-textbook.

The following terms and recordings will be used during this lesson

Terms

Orogenesis

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

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orogeneza - okres intensywnych ruchów górotwórczych

Caledonides

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nagranie słowa

Kaledonidy - góry powstałe podczas orogenezy kaledońskiej

Alpids

Nagranie dostępne na portalu epodreczniki.pl

nagranie słowa

Alpidy - góry powstałe w orogenezie alpejskiej

Texts and recordings

Nagranie dostępne na portalu epodreczniki.pl

nagranie abstraktu

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Earth's crust. There were also periods when the area of our country was overgrown with lush tropical forests, from which coal was formed later on. The geological history of the Earth is fascinating, and it is worth learning a little more about it.

Using the knowledge gained so far, solve the following task.

Internal processes (endogenous) – mountain-, land-, and ocean-forming movements, as well as earthquakes and volcanic phenomena – contribute to changes in the appearance of lands and oceans. They determine the formation of mountains and lead to changes both in the vertical (relief) and the horizontal (coastline) shape of the land. They are the result of forces having their source in the depths of the Earth. **Internal factors** have remained basically the same from the beginning of the formation of our planet. They include: enormous pressure, very high temperatures, as well as pressure differences (effects of the activity of energy inside the Earth).

Mountains are formed mainly as a result of the uplift which is the result of continental movement. This is the **lithospheric plate theory**. Where the lithospheric plates press against each other with enormous force, the terrain is folded and uplifted – **fold mountains** are formed. The Carpathians were formed as a result of the movement of the African plate northwards and its collision with the Eurasian plate. It is worth remembering that this slow process is still continued. Earthquakes that occur in the south of Europe from time to time are the best proof.

At the beginning of the Cenozoic era, during the most intense folding of the Carpathians, there was a rejuvenation of the relief in the Sudetes. There were significant shifts of rock layers along faults and the so-called fault **block mountains** were formed.

1. The Sudetes were formed in the Paleozoic era. At first, in the place of today's Sudetes there was a sea on the bottom of which sedimentary rocks were formed. During Caledonian folding (the first part of the Paleozoic era), huge mountains were created in this area.
2. Then, for many millions of years, the Caledonian massif was destroyed.
3. During the Hercynian-forming movements (the second part of the Paleozoic era), the Caledonian massif was divided, and the Eastern Sudetes were uplifted and formed. At that time, the main foundation of today's Sudetes was formed. The oldest range of the Sudetes is the Sowie Mountains (part of the Central Sudetes), the younger is the Eastern Sudetes, and the youngest is the Western Sudetes, and some individual ranges, such as the Table Mountains. At the same time, there was also an intense volcanic activity, the effects of which were intrusions of magma into the layers of older rocks. This way, the ranges of the Karkonosze Mountains and the Jizera Mountains were formed.
4. During the alpine tectonic movements (the beginning of the Cenozoic era), the old massif of the Sudetes cracked and shaped the relief of today's Sudetes. The fault block

mountains were formed.
5. Various external processes are still forming the Sudetes.

Another type of mountains is **volcanic mountains**. They were formed as a result of volcanic activity, for example, in the Kaczawskie Foothills in the Sudetes or in the Silesian Upland.

Internal processes diversify the Earth's surface through uplifting and folding. However, **external processes** (exogenous) – weathering, erosion, accumulation, mass movements – contribute to levelling out the Earth's surface. One of these processes – accumulation – significantly contributed to the formation of **coal** deposits in Poland.

In the Paleozoic era, in the Carboniferous period, **black coal** deposits were formed. At that time, there was an equatorial-like climate in Poland. There was lush, ever-green vegetation rich in various species, similar to modern equatorial forests. Plant remains were covered with rock deposits brought by wind and water. Under anaerobic conditions and at high pressure, these remains transformed into peat first, then into brown coal, and finally black coal. It was the so-called coalification, i.e. increasing the content of element CC (coal) in rocks.

After some time, plant remains accumulated on sediments again, and subsequent layers of coal were formed. In some periods there were earthquakes, and rock layers, including those with coal, were mixed along faults. That is why today, hard coal is found at very different depths – from a few meters to several kilometres. In Poland, deposits of this energy material are located in the Silesian Upland and the Lublin Upland, and are still being exploited. Whereas in the Sudetes near Wałbrzych, black coal mining was completed several years ago.

In the Cenozoic, a few dozen million years ago, there was a humid and hot climate, and coal deposits could form again. However, until today they have managed to reach only the **brown coal** stage. The deposits of this raw material lie shallow underground and are quite rich in Poland. Currently, brown coal is mined in opencast mines near Bełchatów, Konin and Turoszów.

1. For volunteers: using the Learning Apps app (learning game Millionaires), create questions related to the issues learned in today's lesson.
2. Homework for all students from selected issues from the e-textbook.

orogenesis, coal, mountains