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Let's Go GeoExploring

PROJECT SUMMARY AND RECOMMENDATIONS FOR GEOPARKS

Young European GeoExplorer

IMPROVING ENGLISH CONNECTED WITH NATURAL SCIENCES, GEODIVERSITY AND CULTURAL HERITAGE

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ERASMUS+: KA220-SCH- Cooperation partnerships in school education

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1. INTRODUCTION

Welcome to the Young European GeoExplorer project – an innovative initiative aimed at enhancing high school education by integrating natural science and language learning through the Content and Language Integrated Learning (CLIL) method. Co-financed by the EU Erasmus+ Programme, this project brings together partners from the UNESCO Global Geoparks Network and local schools to transform teaching practices and educational experiences.

The project's primary goal is to develop new services in geoparks and innovative teaching methods for teachers and staff in educational organizations. By harnessing the power of CLIL methodology, the project seeks to address the evolving needs of schools and teachers, offering an engaging approach to science and language education.

Through collaboration with schools, the project aims to highlight the importance of sustainable development and serve as a model for broader educational integration. By gathering information from teachers, studying existing curricula, and developing high-quality teaching tools and methodologies, the project strives to promote cross-curricular integration and enhance teacher competence and confidence.

The GeoExplorer Toolkit, main result of this project, provides educators with valuable resources and tools to enhance outdoor learning experiences. By following the guidelines outlined for effectively incorporating the toolkit into outdoor learning, teachers can create engaging and meaningful activities that foster exploration, inquiry, and hands-on learning. By embracing nature, prioritizing safety, aligning activities with curriculum objectives, and encouraging exploration and reflection, educators can create transformative learning experiences for their students.

The project's results will be shared through various platforms, including the Erasmus+ Project Results Platform, eTwinning portal, and School Education Gateway, ensuring widespread dissemination and accessibility.

As we embark on this journey together, let us embrace the opportunities that the Young European GeoExplorer project presents to transform education and inspire the next generation of learners.

2. PRESENTATION OF PROJECT PARTNERS

2.1. Styrian Eisenwurzen UNESCO Global Geopark

AREA

The UNESCO Global Geopark Steirische Eisenwurzen is in the northern part of Styria, Austria. It's in the center of Austria, where three states, Lower Austria, Upper Austria, and Styria, meet. This Nature and Geopark covers an area of 586 square kilometers and includes parts of the towns Altenmarkt, Landl, St. Gallen, and Wildalpen.

Figure 1: Map of Nature- and Geopark Styrian Eisenwurzen (light green) and surroundings (Design: most-media.at)

GEOLOGY

In the Styrian Eisenwurzen Nature and Geopark, which is part of the Northern Limestone Alps, there are special rocks that are really old, about 253 million years ago. Back then, there was a huge continent called Pangaea. Near the edge of this continent, the rocks of the Limestone Alps formed. About 240 million years ago, the sea covered the land, and that's when limestone and dolomite rocks, like the Reiflinger limestone, started to form. These rocks have dark gray cherts that were made from the remains of tiny sea creatures.

Over time, the sea floor slowly went down during the Triassic period, but the sea didn't get deeper because the remains of algae and marine animals balanced it. Then, about 205 million years ago in the Jurassic period, the continent began to break apart, and that's when different kinds of rocks formed. In a place called Nothklamm, you can see red limestone with lots of remains from sea lilies, which are related to starfish and sea urchins.

There's also a cave in Nothklamm called "Kraushöhle" that's 350 meters long. It's special because it's full of small gypsum crystals and sparkling stalactites. This cave is one of the oldest caves in Austria, and it's the biggest gypsum cave in the german speaking countries. It's the only cave in Europe where hydrogen sulfide changed the limestone into gypsum.

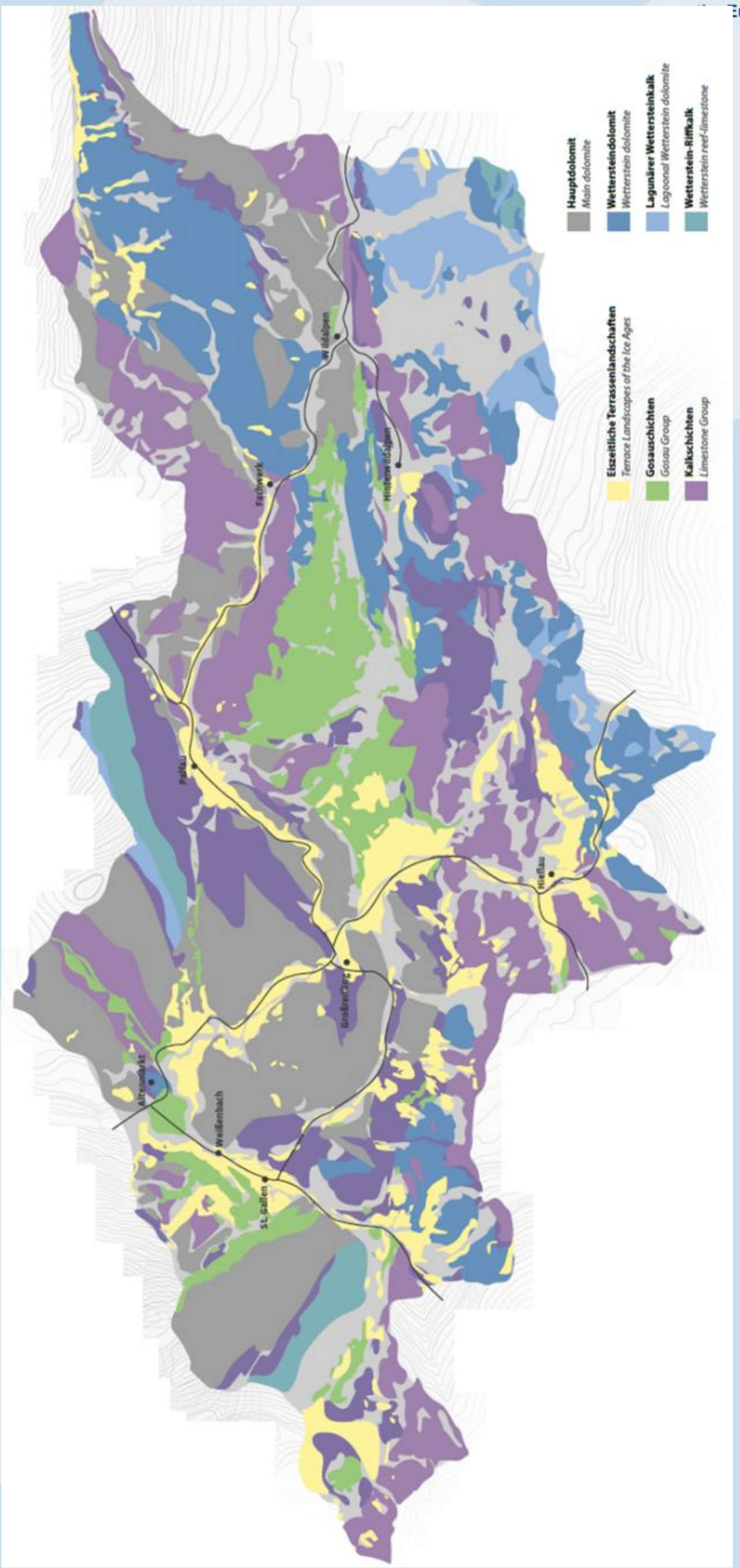


Figure 2: Simplified geological map of Styrian Eisenwurzen.

Figure 3: The so called »Kraushöhle« in the GeoVillage Gams is a special cave, because of its gypsum crystals (Foto: Stefan Leitner)

LANDSCAPE

Eisenwurzen is a special place near the Styrian ore mountain called "Erzberg." Originally, it was only about this ore deposit, but in the 18th century, it became about all the places where they processed iron in the wider area. They also worked on smaller deposits, like at "Arzberg" near Wildalpen in the Nature and Geopark. Besides iron, they made charcoal in the region, and they used water power for many tasks.

A fantastic thing to do is to take a walk through a gorge called "Spitzenbachklamm", also known as the "Valley of Butterflies." It's home to around 450 different butterflies. This gorge has been protected since 1971 and is a great place for nature fans, especially in early summer.

Gallenstein Castle is very old, dating back to the 13th century. It used to be a safe place and an important spot for Admont Abbey until the late 19th century. The castle was rebuilt in the mid-1960s. Today, it's also a place for cultural events with a beautiful view over the Gesäuse mountains.

Figure 4: View from the top of Hochkar montain down to the valleys in Nature- and Geopark Styrian Eisenwurzen (Photo: Christian Scheucher)

Figure 5: Gallenstein Castle in Sankt Gallen (Photo: Christian Scheucher)

PLANTS

The area has different kinds of forests, including spruce and fir forests In spring, pretty flowers such as snow lilies, and buttercups bloom. The forest gorges are special, and there are some rare pine forests in specific places. The valleys have a lovely cultural landscape with meadows and orchards. Farmers mainly do grassland farming, raise cows, and manage the forests. Hikers enjoy alpine pastures, where beautiful flowers like arnica grow. The region has a variety of natural environments, including rock crevices with the auricula flower. In the Steirische Eisenwurzen Nature and Geopark, you can also find rare orchids.

Figure 6: The auricula (Primula auricula), a typical but rare plant in limestone walls (Photo: Andreas Hollinger, Nationalpark Gesäuse)

ANIMALS

The Gesäuse and Eisenwurzen region is home to many wild animals that are hunted like red deer, roe deer, chamois, and wild boar. There are many types of places for animals to live in, from river valleys to mountain pine fields. A special bird in the region is the sandpiper, a small bird found near water. It's important to protect sandpipers during May to July when they're having babies, as they hide well on gravel banks and peolpe walking there could accidentally step on them.

The Scarce Fritillary, a butterfly protected in the EU, lives in the Styrian Eisenwurzen Nature Park. It grows on ash trees in warm and humid forests and needs meadows with lots of flowers. This butterfly is very important in this park, especially in Wildalpen, and to keep it safe, a special protected area was made in 2017. It's crucial to save the places where these animals live to make sure they survive.

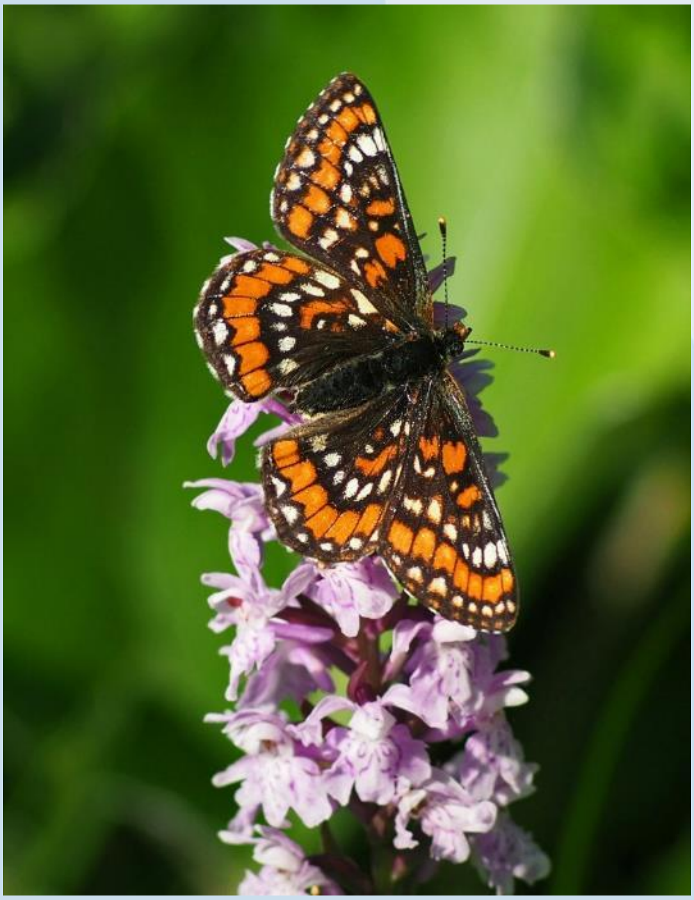


Figure 7: The Scarce Fritillary (Euphydryas maturna) is important for nature protection of the region (Photo: H. Brunner, ÖKOTEAM)

INTERESTING EARTH HISTORY FACTS

Birth of the Alps

The Alps were made because the big continent Pangaea broke apart and the african continental plate started to move to the north towards the eurasian continent. As the mountains got higher, the Limestone Alps and the Greywacke zone moved north and northeast. The Alps have been growing steadily since their formation. Even today, the African plate is still slowly moving to the north at around 5 cm per year, which is why the Alps grow by several millimetres every year.

Ice Age

A long time ago, there was a very cold period called the Ice Age, around 800 million years ago. But guess what? It wasn't always freezing. There were four times when it got really, really cold, and big parts of the Alps had huge sheets of ice called glaciers.

When the ice melted, it made rivers and streams. These rivers were so strong that they carried lots of rocks from the melting ice. When the water slowed down, it left the rocks behind as gravel, filling up the valleys.

The gravel got glued together with limestone, making a hard rock mix called conglomerate. After the Ice Age ended 12,000 years ago, the rivers started cutting deep into the conglomerate, making edges and slopes that go down to the rivers. On the top of the slopes there are flat areas called terraces. They can be often seen in the Enns Valley and the Salza Valley, creating the typical landscape.

How the Eisenwurzen got its name

The name "Eisenwurzen" comes from the iron production, which was really important here because of the nearby "Erzberg" where things like wood, coal, and water power was important. A long time ago, people called "Hammerherren", charcoal makers, and rafters played a big role in making things in this region.

But around 1860, making iron at the Erzberg slowed down because more factories came, charcoal was not important anymore, and making things got more expensive. This made many people leave, especially in the 1980s when big businesses in the area moved or closed.

In 1996, the Nature Park started. They wanted to protect nature, teach people, and bring in tourists to make things better for the land, nature, and the people. A big step was when the park joined the European Geoparks Network in 2002, and later in 2015, it became a UNESCO Global Geopark, part of the UNESCO World Heritage.

Figure 68: In deep gorges, with impressive conglomerate walls, the beautiful water of the Salza has made its way over time (Photo: Stefan Leitner)

2.2. Weissenbach Middle School

The Weissenbach Middle School is located in the municipalityof St. Gallen in the centre of the Eisenwurzen. A region that connects three states, Styria, Upper Austria and Lower Austria of Austria through common history and the will to manage the challenges of the future.

Responsibility for a world worth living in is taken on as an Austrian ÖKOLOG school through sustainable ecological approaches and activities in the areas of environmental protection, consumption and lifestyle, health promotion and the school as a living space. Within the framework of school autonomy, a focus on computer science and technology is offered.

Experimenting and research-based learning are central aspects of it. The secondary school is a place of learning that is committed to lifelike and action-oriented learning in the Eisenwurzen region. As a Nature Park school, the focus is on nature conservation, regional development and practical life education.

Our school would be nothing without all the people that bring the spirit of learning, living and joy alive. Keeping the needs of learners and teachers in mind, connecting knowledge with the aim to protect our environment and beeing an active part and partner of our community is the guideline of our work.

Figure 9: Weissenbach Middle School (photo: Weissenbach Middle School archive)

2.3. Idrija UNESCO Global Geopark

AREA

The Idrija Geopark is in the Municipality of Idrija in western Slovenia, covering 294 km2. It's where the Alps and Dinarides meet (photo 1), making it special. The landscape changes from subalpine to karst, offering many different features. There are deep valleys under high karst plateaus with peaks that give great views from the Julian Alps to the Adriatic Sea.

Figure 10: Location of Idrija Geopark at the junction of the Alps and the Dinarides.

Figure 11: View towards Julian Alps from the souther border of the Idrija Geopark (Photo: Anka Rudolf)

GEOLOGY

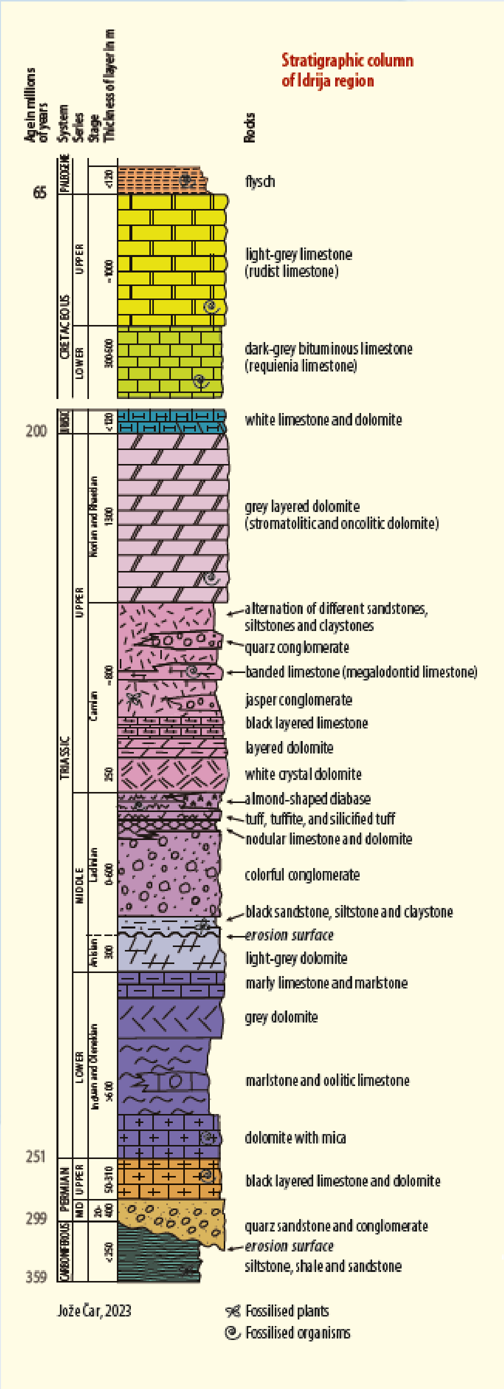


Figure 12: Stratigraphic column of Idrija area.

The Idrija region has very old rocks, like dark grey shales and sandstones from over 300 million years ago during Carboniferous Era. Slightly younger rocks are quartz sandstones, dolomites, and limestones from the Permian Era (273-252 million years ago). The Lower Triassic (252-251 million years ago) brought various rocks, like dolomites and marlstones, covering large parts of Idrija Geopark. Steep slopes with poor soil characterize these rocks. From Anisian period we have preserved light dolomites and conglomerates and from Ladinian stage conglomerates, shales, sandstones and pyroclastites can be found in the area.

During the Middle Triassic (Anisian and Ladinian), movements caused tectonic trenches, like the one forming the famous Idrija mercury deposit where mercury was deposited in the form of the mineral cinnabar and droplets of native mercury. This area experienced erosion and volcanic activity.

In the Carnian stage (237-227 million years ago), shales and sandstones with limestone inclusions were deposited.

Norian and Rhaetian stages (227-201 million years ago) added stromatolitic and oncolitic dolomites in many places. Jurassic limestones and dolomites are found south of the Idrija region in the Trnovo Forest. Lower (145-100 million years ago) and Upper Cretaceous (100-66 million years ago) rudist limestones followed. The last rocks, Palaeocene-Eocene flysh rocks, are relatively recent, dating from 66 to 34 million years ago.

During the uplift of the Alps, the rocks were pushed one on top of the other, which is why we say that the Idrija region has a thrust structure (Figure 13). These thrusts were later disrupted by faults. The most prominent among them is the Idrija Fault with a horizontal offset of 2500 m (Figure 14).

Figure 13: Thrust composition of Idrija area (author: Jože Čar)

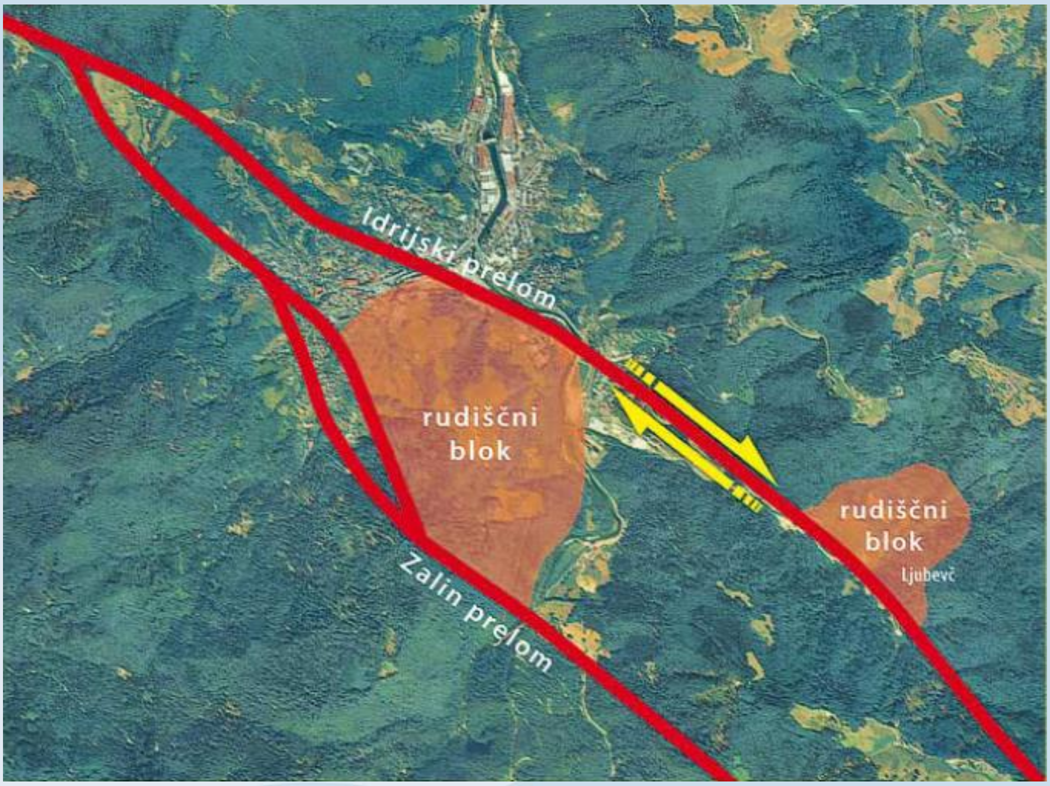


Figure 14: Through deep boreholes, it was determined that the ore deposit in Ljubevč is part of the Idrija ore deposit, which was cut off by the Idrija Fault and displaced 2.5 km southeastward with a right horizontal offset. (author: Jože Čar, design: Jaka Modic)

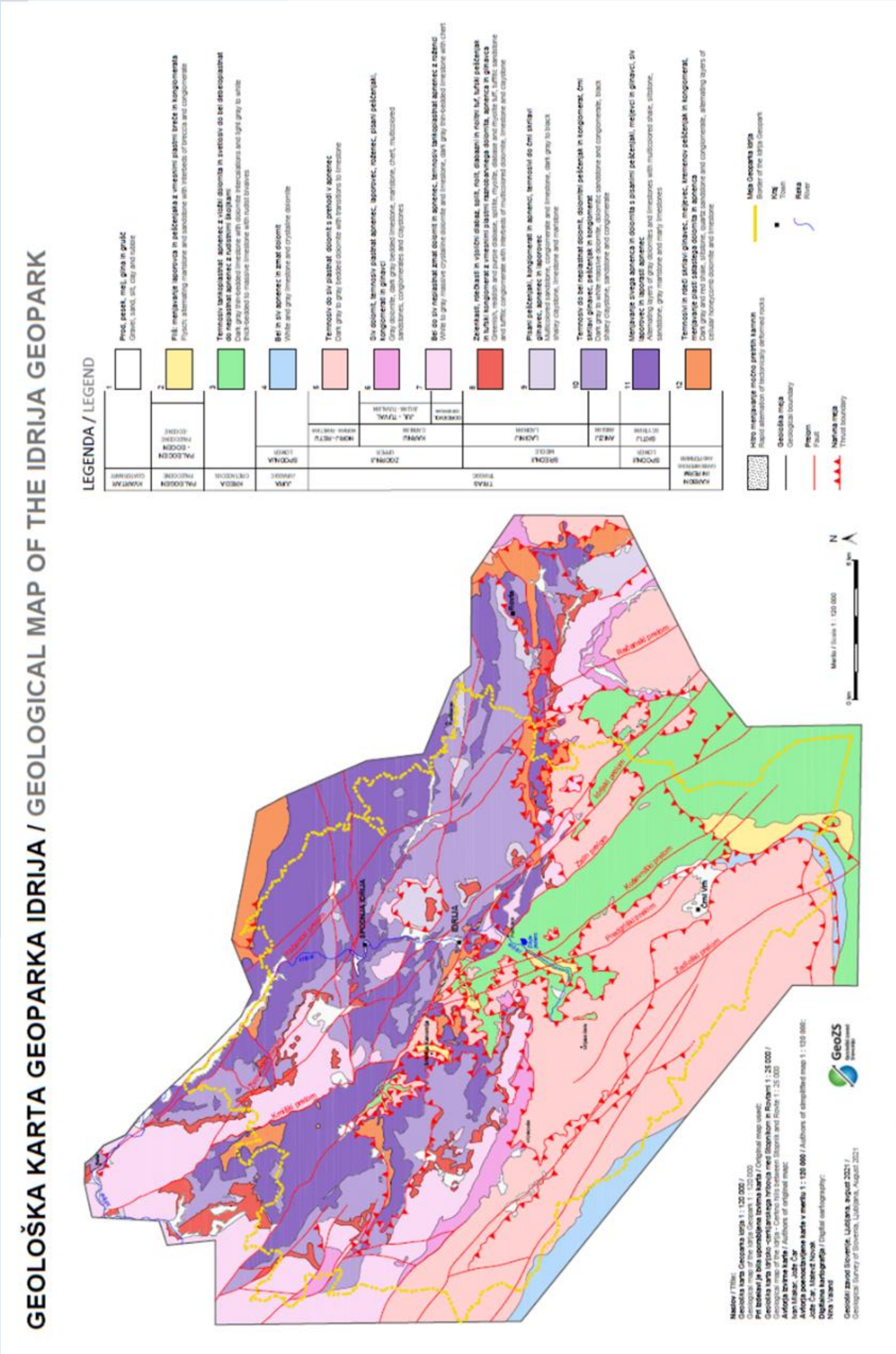

GEOLOŠKA KARTA GEOPARKA IDRIJA / GEOLOGICAL MAP OF THE IDRIJA GEOPARK
LEGENDA / LEGEND

Figure 15: Weathered middle permian rocks (Photo: Bojan Tavčar, Idrija Tourism Board)

Figure 16: The ladinian conglomerates, composed of older Anisian, Schytian, Permian, Carboniferous grains (Photo: Bojan Tavčar)

Figure 17: Syngenetic sedimentary mercury ore (Photo: Jani Peternelj, Idrija Municipality)

LANDSCAPE

The Idrija Geopark has a diverse landscape with high karst plateaus containing caves, ravines, sinkholes, and other karst features. These plateaus are separated by deep river valleys. Settlements thrive near the rivers' confluences and rocky banks. The region boasts peaks reaching up to 1,334 meters above sea level.

The Idrija fault splits the geopark from southeast to northwest. At the beginning, it was a vertical fault but changed into a dip-slip fault due to tension changes. Horizontally, the fault has moved by about 2 500 metres and is slipping by 0.10 mm every year.

Figure 18: Ledine karst plateau, on the right of the photo Idrijca river valley and part of Idrija town (Photo: Bojan Tavčar, Idrija Tourism Board)

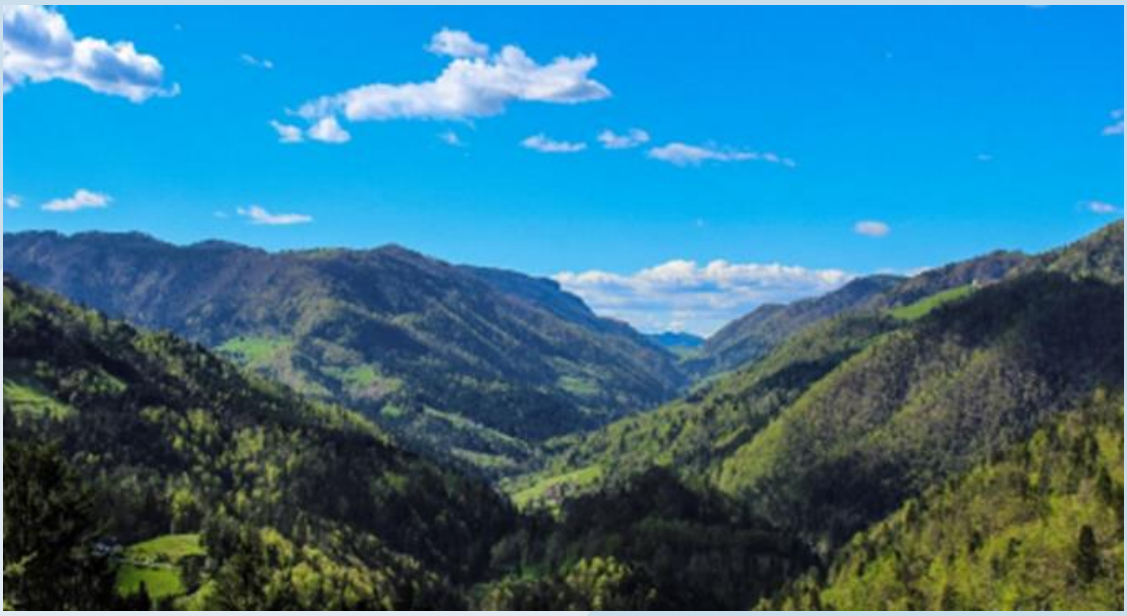


Figure 19: The Kanomljica Valley, which was formed along the Idrija Fault (Photo: Gregor Kacin, Idrija Tourism Board)

PLANTS

In Idrija Geopark, most of the land is covered by forests, almost 79%. This is more than the average forest cover in Slovenia. The wilderness of nature in the area protects the plants very well. Many important scientists came to Idrija in the past because of the mine. They didn't just study rocks but also discovered new plant species. Scopoli's Memorial Garden honors these scientists and is found at the beginning of the Rake Walking Path in Idrija.

The plants in Idrija Geopark are diverse and special, with different types from the Dinaric, Alpine, and sub-Mediterranean regions. They grow in specific soil and climate conditions created by the diverse geological structure. The steep slopes in the valleys and plateaus are home to many unique plants. There are some special plants, like all three kinds of primrose: the endemit Carniolan primrose (which is only found in Slovenia), auricula, and their mix Idrija primrose. Many protected plants also thrive here. The conditions here let plants from the Ice Age survive, like the ones found in the Alps. The warm, sunny slopes have their own group of special plants.

Figure 20: Idrija primrose (Primula x venusta) (Photo: Anka Rudolf)

ANIMALS

In the geopark, you can find many roe deer, which like the forest edges. Red deer are also increasing, coming out of the forests at night. Chamois live in lower and rocky areas. Wild hogs are appearing more, though they are still not common. Hares are decreasing due to less grassy places. Foxes, despite their thieving reputation, are important for controlling rodents and sick animals in the forest. The geopark's quiet, preserved forests and fruit trees provide a good home for bears. Wolves are also more common now. Many protected species also live here.

Figure 21: Brown bear (Ursus arctos) (Photo: Miran Krapež)

INTERESTING EARTH HISTORY FACTS

DISCOVERY OF MERCURY IN 1490

In 1490, there was a person named Škafar who made wooden barrels. One day, he found something strange in a stream near Idrija. It was shining and later turned out to be mercury. This discovery probably happened by mistake.

The story goes like this: Škafar soaked his wooden barrels in a small well overnight. The next morning, he tried to lift one of the barrels from the well, but it was too heavy. He considered pouring out some water to make it lighter, but when he did, he noticed something shiny and silver-like at the bottom of the barrel. He emptied the barrel and saw a new, very clear liquid. Even though there was only a little of it, the barrel remained heavy. Škafar didn't know what this liquid was, so he decided to take it with his other items to the market in Škofja Loka. At the market, a goldsmith quickly realized what Škafar had discovered. It was mercury.

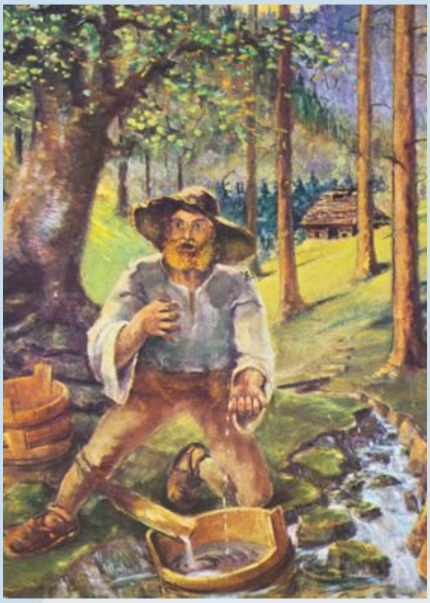


Figure 22: Škafar finds mercury (oil on woodonite), Janko Trošt 1953; (photo: the Photo Library of the Idrija City Museum)

THE IDRIJA EARTHQUAKE IN 1511

On March 26, 1511, the most powerful earthquake in Slovenian history occurred, causing one of the worst natural disasters in the 16th century Alpine region. The Idrija earthquake, with a magnitude of 6.8, devastated Idrija and its mine. A landslide from the quake blocked the Idrijca river, creating a flood that submerged the area. It had far-reaching effects, felt in many European regions. Venice saw canal waves reaching ground-level windows, and St. Mark's Basilica and St. Stephen Cathedral in Vienna were damaged. The earthquake's tremors even extended to northern Germany and the Czech Republic, resulting in an estimated twelve to fifteen thousand victims.

2.4. Črni Vrh Elementary School

Črni Vrh Elementary School is situated on the scenic Črni Vrh plateau in the western part of Slovenia, near Idrija and Ajdovščina. Hosting 150 students from diverse regions within this karst highland, the school establishes a vibrant and successful learning environment.

The school's work is closely tied to its local environment, essential for fostering a strong and integrated community. With a dedicated staff of 30 professionals specializing in various fields, the school maintains a high standard of education. Through the compulsory school program, intertwined with various afternoon activities, students engage in extensive learning, contributing to their overall development.

Proudly part of the Slovenian Healthy Schools network, Črni Vrh Elementary School prioritizes the physical and mental well-being of its students. Holding the title of a Cultural School highlights its emphasis on cultural activities and artistic expression. Enriching school life with diverse activities, including astronomy, logic, history, Slovenian language, art, sports, natural sciences, and music, the school particularly excels in the cultural sphere.

The school's success stems from the dedicated efforts of its teachers, pooling their professional expertise to offer students a broad spectrum of knowledge and experiences. Beyond being an educational institution, Črni Vrh Elementary School serves as a community center, nurturing values, knowledge, and creativity, and fostering strong connections among teachers, students, and the local community.

Figure 23: Črni Vrh Elementary School (photo: Tadeja Bonča)

2.5. Magma UNESCO Global Geopark

AREA

Magma Geopark is situated in the south-western part of Norway consisting of 5 muncipalities: (Bjerkreim, Eigersund, Flekkefjord, Lund and Sokndal) in 2 counties (Agder og Rogaland). Magma Geopark has around 34.000 inhabitants and is 2327 square kilometers in size.

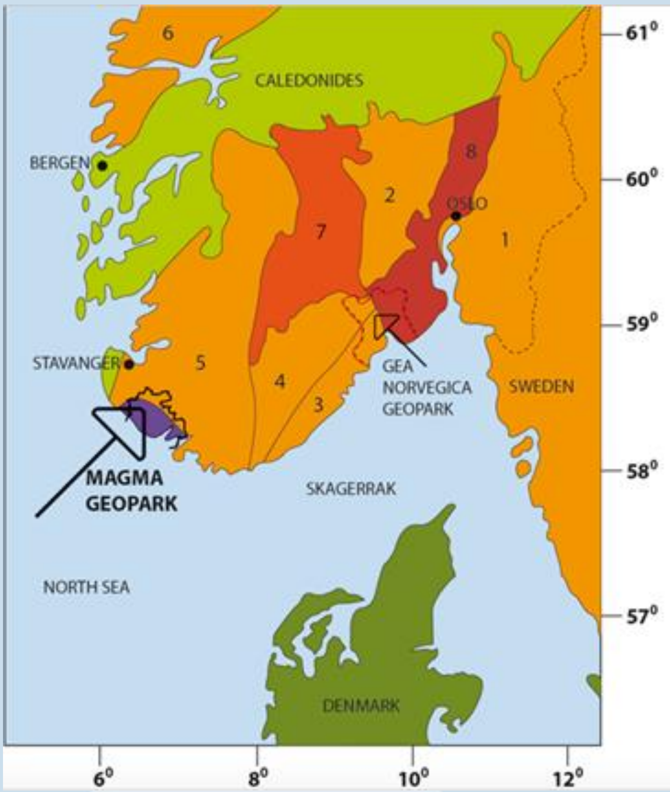


Figure 24: Magma Geopark is located along the southwestern coastline of Norway

GEOLOGY

The name Magma Geopark refers to the origin of most of the geology in this area, namely magma. The entire area has been shaped by molten rock, deep within the Earth approximately 930 million years ago! Large portions of this magma crystallized over an extended period, forming the rock type anorthosite. In an international context, this is a rare rock, yet everyone has seen it – that's because the bright parts of the moon consist precisely of anorthosite. Predominantly consisting of ancient igneous rocks formed about 930 million years ago, the area features unique geological formations, including large bodies of anorthosite.

The region underwent significant glaciation during the Quaternary, leaving diverse geological features, including the largest layered intrusion in Western Europe. The geological timeline spans the

Proterozoic Eon, with distinct eras and periods. The Magma Geopark also bears evidence of human history from the Stone Age to World War II, influencing its landscape.

The Geopark's classification includes "geosites" and "geopark localities," with 89 geosites and 58 geopark localities selected based on geological, cultural, and natural values. These are categorized by their regional, national, or international significance, primary use (Geotourism, Education, Science), protection status, accessibility, threats, and additional information.

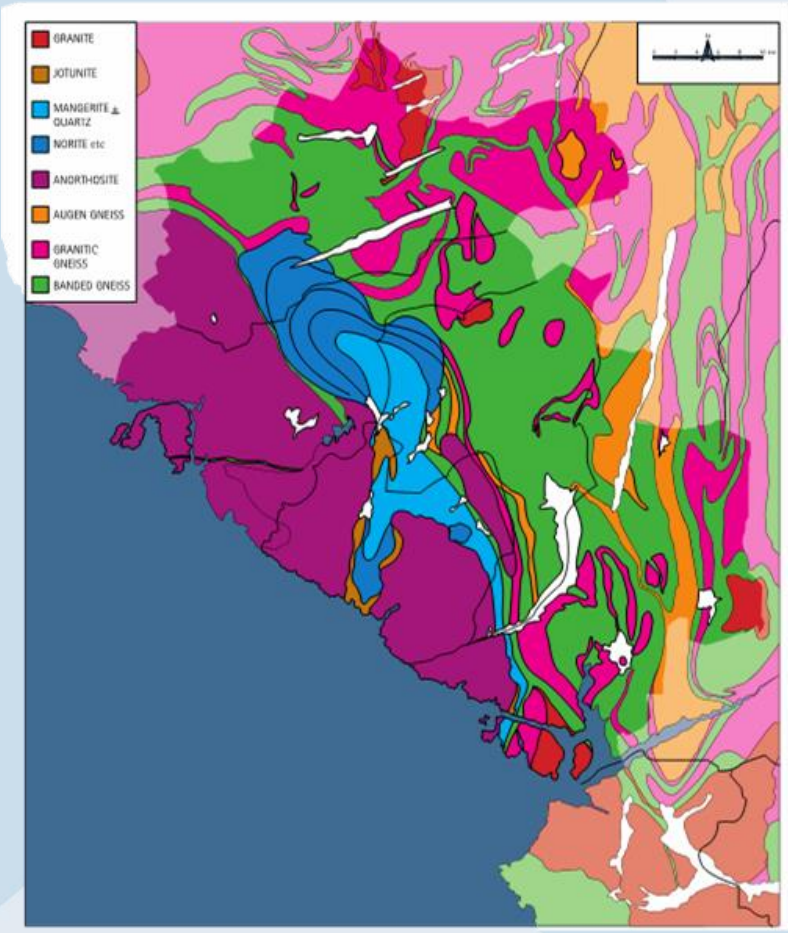


Figure 25: Magma Geopark – Geological Map

LANDSCAPE

Magma Geopark's landscape, shaped by water, ice, and geological processes, showcases a hilly topography with hundreds of valleys and over 6,000 lakes.

If you are standing on a hillside overlooking the landscape of Magma Geopark you may easily get the impression of being on another planet. The landscape in the Geopark is distinguished by its rolling, bare rocks. The dominant rock, Anorthosite, is hard and compact. This causes the soil to be low in nutrients and as a result the vegetation is sparse. In the North and East we find wider valleys with loose deposits from the last ice age. This provides a more lush landscape which is important for agriculture.

Many lakes, streams, rivers and waterfalls carve through the landscape creating a varied and appealing natural area.

Figure 26: Eigerøy Lighthouse with the North Sea as background is situated in caracteristic anorthosite landscape (photo: Magma Geopark archive)

Figure 27: The Brufjell Cave is a popular geological destination (photo: Magma Geopark archive)


Figure 28: The famous houses under the rock shelter (Helleren) in Jøssingfjord (photo: Magma Geopark archive)

PLANTS

In addition to the soil, the climate in the Geopark also has a significant impact on the selection of plant species. The coastal climate is suitable for plants that can not tolerate low winter temperatures and also want a long, hot summer to allow buds to develop and seeds to mature before the winter frost comes. This means that we find many plant species here that have very limited national distribution.

The coastal landscape was more wooded before modern man started farming and keeping livestock. The need for grazing habitats for livestock contributed to the disappearance of forest which was replaced between 2 and 4 thousand years ago by the extensive areas of bog known as myr in Norwegian. Another effect of deforestation was the increasing amount of marshland. As the forest has a significantly greater consumption of water than open fields the removal of woodland resulted in large areas of marsh forming along the coast.


Figure 29: Oak and heather are typical plants in Magma Geopark (photo: Magma Geopark archive)

ANIMALS

Magma Geopark has a rich bird and wildlife. You can find various large birds of prey here, including the golden eagle, the sea eagle, and the eagle owl. The area is also an important migratory route for birds. Magma Geopark is home to roe deers, deers, moose, beavers, lynx, as well as smaller mammals like squirrels, hares, and martens. And you find the largest population of the Nordic Brown Bee here.

Figure 30, 31: The Nordic Brown and Eagle Owl ((photo: Magma Geopark archive)

2.6. Flekkefjord Upper Secondary School

Flekkefjord upper secondary school is located in the southern part of Norway. It is a medium size school with about 400 pupils from 16 - 19 of age. There are approximately 60 employees at the school. The school offer different professional educational alternatives us carpenter, industrial process, electrician, and aquaculture. Close to the school, we have the marine and maritime teaching hub from where the pupils can visit several aquaculture facilities both sea-based and on land. Flekkefjord is a town with about 4000 inhabitants. Many pupils are from the countryside around the town.

UNESCO Geopark Magma have recently established a collaboration with Jøssingfjord science museum, located 1 hour from the school, who offer insight into geological relevant teaching activities for the pupils.

In the aquaculture educational program, the goal is to give the pupils relevant teaching through close collaboration with businesses. The pupils are therefore weekly visiting professional actors. At the end of the studies around half of the pupils decide to go to work as a trainee, meanwhile the rest of the class often decide to continue with higher education proposal. Our success rate for pupils that start and fulfill upper secondary school in Flekkefjord are around 99%.

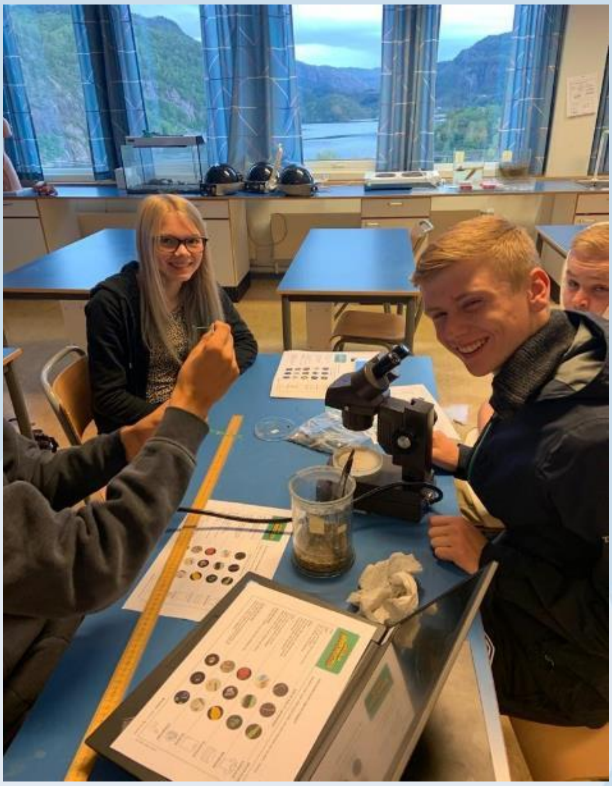


Figure 32, 33, 34: Flekkefjord upper secondary school (photo: Flekkefjord upper secondary school archive)

2.7. Odsherred UNESCO Global Geopark

Figure 35: Vejrhøj, the top of Odsherred, 121 meters above sea level, sits at the top of an old terminal moraine (photo: Claus Starup)

AREA

Odsherred is a region in Denmark, covering about 355 square kilometers. It's a bit more than an hour's drive from Copenhagen, the capital of Denmark. The area has three hilly parts, offering some of Denmark's most steepest hills. Other areas used to be covered by the sea. Odsherred is surrounded by sea on three sides, with bays, open water, and fjords, making beautiful beaches.

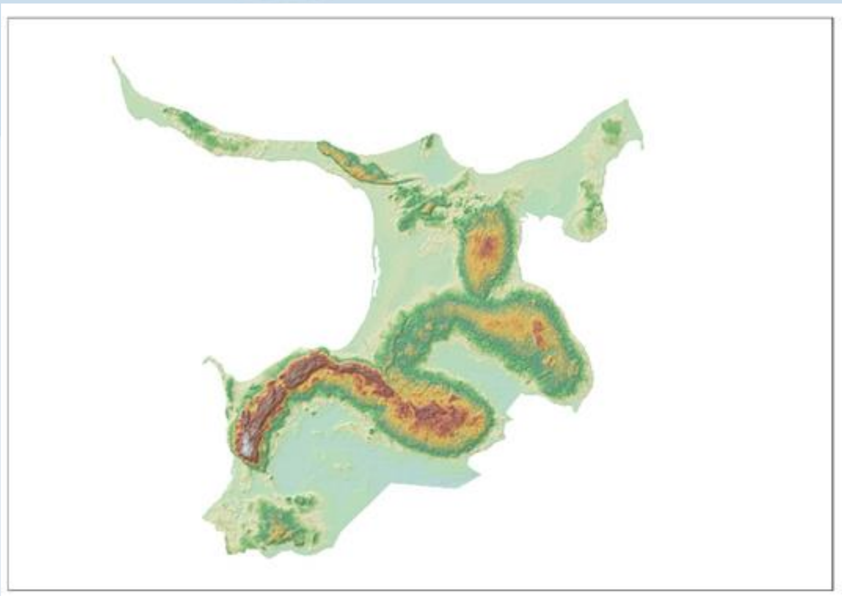


Figure 36: Terrain model of Odsherred, clearly showing the most dominant features of the area, especially the three major terminal moraines (photo: Gepark Odherred archive)

GEOLOGY AND LANDSCAPE

Odsherred's deposits is mostly of recent geological periods. It has three major hills, forming huge arches. The biggest one is the Vejrhøj arch, near a flat area called Lammefjord. Coastal areas show active processes shaping the land, e.g. spits, isthmuses, and barrier islands. The area shows classic glacial landscapes with hills, depressions, meltwater outlets, and plains. Some places have unique geology that researchers are studying, like Klintebjerg, Trundholm Bog, and Sidinge Fjord. Odsherred used to be an archipelago, e.g. islands and a peninsula up until 150 years ago. It has a diverse landscape with low-lying and high-lying areas, creating a contrast near the sea. An interesting fact is that a part the Lammefjord area has the second lowest point in any reclaimed area in Northern Europe, almost 7.5 meters below sea level.

PLANTS

Few plants stand out in Odsherred, but one is the small pasque flower, protected by the national nature agency and the local municipality. Some areas show how geology and plants interact. Rocky beaches have sea kale, and sandy areas have herbs and wildflowers. Starting in 2024, a few forests will be left untouched to help biodiversity.

Figure 37: Ordrup Promontory yields true cliffs and geology older than mainland Odsherred (photo: Claus Starup)

ANIMALS

Odsherred isn't famous for its wildlife, but it has fallow deer, hares, badgers, weasels, rodents, and common birds. Some areas have large bird populations, like white-tailed eagles and cormorants, especially around wetlands and lakes. Nightingales are more common in June due to denser bushy areas, part of efforts to let nature grow wild.

Figure 38: View of the low lying and reclaimed Lammefjord area (photo: Claus Starup)

THE SUN CHARIOT

The Sun chariot, an important discovery from Europe's Bronze Age, was found in Trundholm Bog in 1902 while plowing the land. The area, which used to be an old sea floor, wasn't considered valuable until the discovery of the Sun chariot. In 2020, georadar surveys were conducted to learn more about the area since there was limited information. These surveys uncovered Bronze Age beach ridge complexes in the western part of Odsherred, suggesting a landscape dominated by the sea around 3,250 years ago. Samples from the ground where the Sun chariot was found indicated a mixture of rich organic materials in sand and clay, possibly near a small lake close to the sea during the Bronze Age. This area might have been used for offerings.

Figure 39: The finding place of the Sunchariot. A new attraction was established in 2020 to highlight both the find of the Sunchariot, the Bronze Age worshipping of the sun and the nature in the area (photo: Jakob Walløe Hansen)

2.8. Asnæs School

Asnaes School is located in the southern part of Odsherred. It is a medium size school with about 400 pupils from 6 - 16 of age. There are approximately 60 employees at the school. The school has two tracks from 0-9th grade and there are about 20 pupils in each class. Close to the school, we have different sport facilities. The town is nearby with its museums of art, library and a mall with all kinds of shops. Asnaes is a town with about 3000 inhabitants. Many pupils are from the countryside around the town.

Nature and Unesco Geopark Odsherred are close to the school and we can easily work with topics related to the geopark and get out in the field to do so.

Well-being, joy and diversity are the foundation of a learning environment, where we work to ensure that each child receives a high academic benefit and a broad, social and cultural understanding. At Asnaes School, learning and well-being go hand in hand.

At our school, the learning environment and interaction are characterized by recognition, mutual respect and co-determination between active and engaged students, parents and teachers.

Our most important task is to educate socially and academically competent children to become capable people who take responsibility for themselves and others.

Figure 40, 41: Asnaes School (photo: Asnaes School archive)

3. PRESENTATION OF INTELLECTUAL OUTPUTS

3.1. Review of (cross-)curriculums, existing tools and materials used in natural science teaching

General introduction

This first output of *Young European GeoExplorer* has the role of creating a common framework for the development of a toolkit (IO2), cross-curriculum activities and new teaching methodologies implementation (CLIL) (IO3).

Methods

Different methods were used in order to provide the needed data, and the work package altogether comprised three different tasks. These tasks were carried out and implemented by each partner geopark in close cooperation with personal from each of their partner schools. The tasks were:

- Desktop curriculum analyses
    - Four analyses were made. The analysis of Slovenia and Norway are a product of the project *ESTEAM Enhancement of school teaching methods*, whereas the analyses of Austria and Denmark have been made for this project
- Questionnaires
    - After close consideration, only one questionnaire was produced. This included the following topics
        - General introduction
        - Teaching method experience
        - Outdoor teaching and equipment
- Focus group interviews
    - Focus group interviews were conducted in four schools, one in every geopark involved in the project. Interviews were conducted in the local language and afterwards transcripts were translated into English

Conclusions and deliverables

The data provided from the different tasks provided deep understanding of teachers needs and (cross-)curriculums in a participating country, especially when it comes to differences in the existing curriculum and cross-curriculum integration, tools and props teachers use in-class and out-of-class for teaching natural science, English teachers view on the CLIL method and natural science topics, as well as it sheds new light on the teachers' needs, which again needed to be identified before the preparation of the project O2.

Output 1 ended up consisting of an array of tangible deliverables:

- 4 desk research report for the participating country

- 2 online questionnaires for science teachers and English teachers
- 2 short reports with the results of questionnaires for all partnership
- 4 national Focus groups report on the review the materials, tools and props for natural science teaching and languages
- 1 joint document with the

a) review of the curriculums
b) cross-curriculum integrations
c) review of the current tools and profs for natural science teaching
d) understanding of the acquaintance with CLIL methods in natural science

The different reviews and especially the cross-curriculum integrations seemed to indicate the following:

- Severe cultural differences
- Geoscience is under-prioritized
- Limitations to transferability
- National curricula do not equal reality
- Few true cross-curricula integrations
- Limiting factors are clear and well defined
- Lack of written didactic materials
- Need for structural change in schools for CLIL to be fully implemented

As for the methods of the output 1, as for the actual result and deliverables of the output; the magnifying glass seemed to be the one thing teachers across the lined asked for – in more sense than one; the word cloud made from results of the questionnaires clearly indicates that the need for instruments and materials are dire. But also, that the teachers, in their daily work, struggle to find a way to incorporate geology and geoscience. Many barriers collide with rules and everyday work and CLIL might be the solution, if properly incorporated.

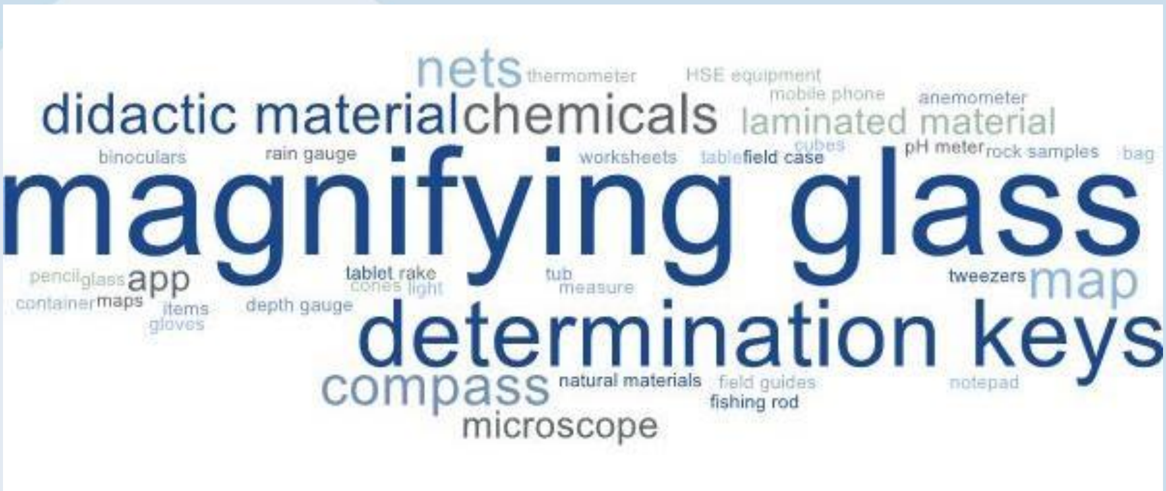


Figure 42: Word cloud -The most common tools used by teachers when they teach outdoor

3.2. Young European GeoExplorer Toolkit concept and examples

General introduction

The idea behind the second output was to develop the so-called "GeoExplorer Toolkit". A box filled with all the materials and props necessary for good practical teaching of geology, incorporating natural science, geoscience and language teaching. Students should learn more about geoparks and their region as well as other examples from the other geopark partners. Teachers and guides can use the toolkit both in the field as well as in the classroom and find everything for a good thematic lesson preparation, excursion tools or classroom games. Four prototypes were assembled and are there at the geopark partners to be taken in action and other geoparks and schools can reproduce them.

Methods

Each of the four geopark project partners delivered a specific geopark description including important facts about the area, its nature and (earth) history. Further a short profile of UNESCO Global Geoparks complements the information of individual Geoparks. In a next step, questionnaire was collected from nature educators and geopark rangers, to evaluate the needs of this group in the field of geology teaching, comparable to teachers surveyed under Output 1. The process of the "GeoExplorer Toolkit" development was accompanied by workshops during project meetings including one workshop on nature education and 2 workshops to create a concept paper (Fig. 1). Finally, the concept was implemented with the production of 4 "GeoExplorer Toolkits" filled with the typical tools of a geologist, safety equipment, stone samples and teaching material in one trolley, divided in an outdoor and a classroom compartment.

Figure 43: Workshops on nature education and the toolkit concept were held.

Conclusions and deliverables

All Geoparks have their own specific earth and cultural history, a remarkable fauna and flora and unique geology. Through the description of the four partner geoparks they become a model for geology teaching and pupils in the respective area get connected with their region and learn general school topics with a lot more focus on their surroundings. Teachers, guides and students are more aware of the Global Geopark Network through the delivered material. The descriptions are the basis for further didactical and target group related documents in Output 3 including content and language integrated learning (CLIL) as well as in Output 4 in the recommendations for stakeholders.

Information on nature education was gathered by the partners. The survey among nature educators, rangers and guides of different protected areas and geoparks shed light on the needs of this target group when it comes to geology education. For instance, we found out that most commonly used tools of the participants are magnifying glasses, compasses, hammers, maps, hydrochloric acid and cups (Fig. 2). Next, they were asked which tools they would like to have in a geoscience toolkit with most responses for a rock identification key, second a map equal with a magnifying glass, followed by rock samples. The educational programs of the participants were gathered, clustered and associated with the fields of Geosciences, Biosciences and Humanities in a Venn diagram showing that participating nature educators, rangers and guides have many bioscientific programs, many of which incorporate geoscience and humanities (Fig. 2). A comparison to teachers (from Output 1) was drawn where applicable.

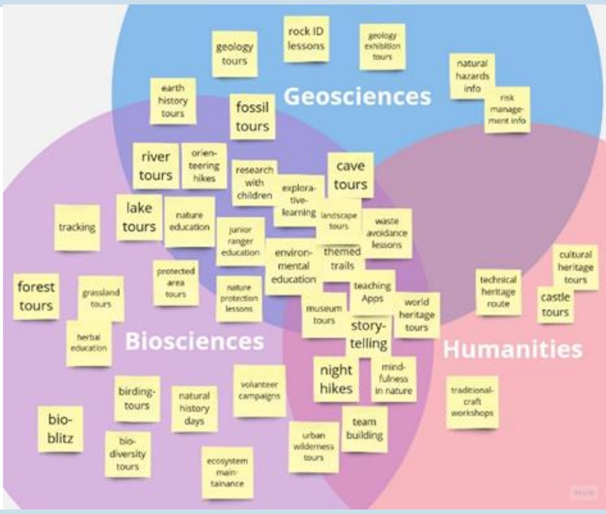


Figure 44, 45: Visualized survey results from nature educators, rangers and guides. Word cloud with tools used for their programs. Venn diagram with offered programs linked to biosciences, geosciences or humanities.

From the informations gathered in both surveys, the workshops and project meetings the concept for a GeoExplorer Toolkit was developed. The kit itself was chosen as a trolley as it became clear that all the contents become too heavy for easy carrying. The trolley is further devided into two sections: An outdoor toolkit part, separable from the rest, ready for the field and a classroom or indoor toolkit with space for printing materials, educational games, didactical material and samples, easily rollable to the classroom. The outdoor toolkit contains safety measures (helmet, gloves, safety glasses) for fieldwork and as illustrative material of best practice for teachers/guides. It further includes a geological/paleontological hammer, a compass, magnifying glasses, a Geiger counter and a folding spade. The indoor toolkit in turn is filled with GeoExplorer memory games and an accompanying booklet about partner geoparks including culture, nature and landscape. A 50-meter measure tape as geological timeline called "GeoExplorer time meter", GeoExplorer stone samples (9 from the corresponding geoparks region, 3 samples from the other partner geoparks), material and instructions in printed form and on USB flash drives for further copying and reprinting. For studying and identification of own samples or the GeoExplorer stone samples, a USB-Microscope for children, UV-light, diluted acid, GeoExplorer rulers and a Moh's hardness scale are included. To conclude, with this kit on hand, tools and props are no limiting factor for good geological education anymore! The four prototype toolkits (Fig. 3) remain at the four geopark project partners and can be borrowed for free by schools and nature educators. The intention is to roll out the GeoExplorer toolkit to other schools and geoparks in other regions across Europe. All sources of contents are open for the public and are there for proliferation!

Figure 3: GeoExplorer Toolkit prototype (Eisenwurzen), the separable outdoor toolkit in the upper section, the classroom toolkit trolley with drawers below. Filled with stone samples, tools and teaching props.

Output 2 lead to following tangible deliverables:

- 4 geopark documents about specific regional geopark information
- 1 geopark document about general geopark information
- 4 documents about nature education in the representative geoparks and useful tools
- 1 joined document on the above-mentioned deliverables
- 2 meeting reports (one from the concept paper meeting and another from the nature education meeting
- 1 concept paper for the "GeoExplorer Toolkit"
- 4 completed toolkits with geology tools, stone samples, classroom props and teaching material

3.3. Young European GeoExplorer cross-curriculum activities and new teaching methodologies implementation (CLIL)

General introduction

Output 3 in Young European GeoExplorer has the role of creating so-called cross-curriculum activities based on the new teaching methodologies implementation (CLIL= Content and Language Integrated Learning). The main deliverables were therefore two guidelines per geopark with tours description, competence goal for English and natural science subjects and indication about the use of the GeoExplorer Toolkit developed during Output 2. The target groups for guidelines were the lower secondary school and upper secondary school pupils. For the geoparks the guidelines had as target group the geopark rangers and the visitor and tourists. The overall goal of those guidelines for teachers and geopark rangers were to stimulate outdoor multidisciplinary teaching locally and take in use the tools provided by the GeoExplorer Toolkit.

Methods

In the third output we developed exercises for outdoor activities where English was implemented in the teaching of nature sciences, geodiversity and cultural heritage. The exercises should be connected to the local (national) curriculum.

Each geopark developed minimum 2 outdoor activities together with the local schools involved in the project.

The activities should meet the following points (A1 – A5)

A1: Cross-curriculum material for pupils

A2: Guidelines for pupils

A3: Cross-curriculum material for Geopark management and teachers

A4: Guidelines for teachers and guides

A5: Cross curriculum connection

Geoparks and the local school representant started therefore to develop deliverables for A1 by reviewing school curricula relevant for the age and subjects relates to this project. After that Geopark made a template (Annex 1) implemented with all the relevant fields necessary to perform the guidelines. The templates were presented to all the project participants (geoparks and school teachers) in order to gain feedbacks and do the necessary adjustments.

After agreeing to the template for the cross-curricula activity we started a group work were geoparks and teachers was divided according to their geographical location with the task to brainstorm and fulfill the content of the two guidelines. Questions and needs for clarification that emerged during this work were shared during the workshops.

In this way we worked effectively and were able to share our experiences and thoughts in a constructive way. When cross-curricula activities guidelines were finalized the geopark in charge for this Output 3, Magma Geopark, quality checked the content of each delivered outputs and reported the status to the project manager.

Conclusions and deliverables

Experiences shared by teachers during the project workshop confirm that the biggest bottleneck for outdoor cross-curricula teaching is the effort necessary to prepare those educational activities. The output 3 served therefore as a catalysator to stimulate for those type of educational and dissemination activity by preparing in an easy understandable and relevant way the guidelines for local outdoors cross-curricula activity. Those guidelines should be seen as “living documents” that geopark rangers and teachers can update and implement in order to adapt to curricula changes and to sharpen the content accordingly to the experiences and feedback gained from visitors and pupils.

At the same time the output 3 overall goal were to give practice guidelines about how and when to use the new GeoExplorer Toolkit implemented in the Output 2. Each of the produced guidelines pinpoint therefore in a pragmatic way the role of those tools in the field activity and/or in the classroom activities at discretion of the teachers and geopark rangers.

The feedback from the users during the multiplier events will be a very important tool for quality assurance of the deliverables from the output 3 and the previous outputs and make the necessary adjustments. Those multiplier events raise also the opportunity to give ownership about the totality of the results from this project to other school teachers and geopark rangers.

The outcome 3 from this project is:

2 Guidelines pr Geopark (2x4) = 8 guidelines

4. DESCRIPTION OF GEOEXPLORER TOOLKIT

4.2. What is the GeoExplorer Toolkit?

The GeoExplorer Toolkit is a field trolley equipped with various educational aids designed for experiential learning of science and foreign languages. It can be used both for outdoor teaching and classroom activities. The GeoExplorer Toolkit is primarily intended for science and language teachers, employees in geoparks and anyone involved in conducting educational activities outdoors.

Photo: GeoExplorer Toolkit with tools and materials (photo: Irma Pivk)

The field cart consists of two larger and two smaller drawers. The top drawer is detachable, allowing it to be used independently according to the needs of the task. The educational tools contained in the GeoExplorer Toolkit:

- mini collection of rocks with descriptions for teachers and students
- 10% HCl (hydrochloric acid)
- digital microscope
- geological hand lens
- geological hammer
- measuring tape
- geological compass
- geographical compass
- Mohs hardness scale
- Geiger counter
- safety helmet
- safety glasses
- memory game

The educational tools currently included in the GeoExplorer Toolkit are tailored to the content developed through the Young European GeoExplorer project. Each user can enhance the field cart with new educational aids according to their work needs. For example, a biology teacher could supplement it with tools necessary for conducting biological research, etc. Similarly, depending on the methodology of work, the field cart can be upgraded with content that integrates the learning of science and foreign languages.

When preparing content for activities using the field cart, it is recommended that the user utilize the form"Development of exercises for Geoexplorer outdoor activities" (priloga). This form guides users through all the key phases crucial for the successful implementation of activities. These include planning, execution, and evaluation of the activities.

4.3. Descriptions of educational tools

- MINI COLLECTION OF ROCKS

In a special box, there are 12 different samples of rocks from Idrija UNESCO Global Geopark, Oddshered UNESCO Global Geopark, Magma UNESCO Global Geopark and Styrian Eisenwurzen UNESCO Global Geopark collected. Descriptions of these rocks are included in the box, provided at two levels of difficulty – for students and for teachers.

The collection enables observation and study of rocks, understanding basic properties, and identifying them. When studying rocks, the following tools can be used: geological magnifying glass, microscope, hammer, 10% HCl (hydrochloric acid), ruler for measurement, etc.

Warning: When using the hammer and 10% HCl, it is necessary to observe safety regulations and use protective equipment (gloves, goggles, lab coat, etc.).

- 10% HCl (HYDROCLORIC ACID)

10% HCl (hydrochloric acid) is a solution of hydrochloric acid in water, with an acid concentration of 10%. Hydrochloric acid is a strong, colorless liquid with a very low pH and is highly corrosive.

10% HCl is commonly used in laboratory and industrial processes, such as the preparation of various chemicals, cleaning and removing oxidation from metal surfaces, and adjusting pH in different processes.

It is important to know that 10% HCl is a strong acid and can cause irritation to the skin, eyes, and respiratory tract. When handling it, appropriate safety measures should be observed, including wearing protective equipment, ensuring good ventilation, and handling it in accordance with safety guidelines.

- DIGITAL MICROSCOPE

A digital microscope is a modern version of the traditional microscope. Instead of looking through eyepieces, images of objects are displayed on the screen of a computer or other device. It operates by capturing light reflected from the object using a camera and converting it into a digital image. This image is then displayed on the screen, allowing for detailed observation.

A digital microscope also enables the storage of images and recording of videos for later use or analysis. Due to its ease of use and the capability of digital image capture, the digital microscope is popular in scientific research, medicine and education.

- GEOLOGICAL HAND LENS

A geological hand lens is a specialized tool used by geologists for detailed examination of small details of rocks, minerals and fossils. It resembles a small magnifying glass held in the hand. Geological hand lenses typically have strong magnification (10x), enabling geologists to see fine details. With the help of a geological hand lens geologists can identify different minerals, study rock textures and observe microscopic features.

- GEOLOGICAL HAMMER

A geological hammer is a specialized tool used by geologists for the study of rocks and minerals. It has a long handle typically made of a hard material such as steel or plastic and a heavy head at one end. The head is usually made of metal and has a sharp pointed part and a flat part for striking. Geologists use a hammer by striking rocks with the sharp end to break them up and study their interior. This helps them to determine the composition of the rocks, their age and other geological features.

- MEASURING TAPE

A measuring tape is a tool used for determining length. It consists of a tape wound within a housing. The tape is marked with units such as centimeters, meters, or feet, which are used to ascertain the length of an object or the distance between two points.

When measuring, the tape is extended from the housing and stretched to the desired length. The measuring tape is a simple and convenient tool that helps accurately measure distances in everyday life, construction, design, and other fields where precise measurement is required.

- GEIGER COUNTER

A Geiger counter is a device used to detect and measure ionizing radiation. It operates based on the ionization effect produced in a Geiger-Müller tube when radiation interacts with it. A Geiger counter is a device used for measuring radiation in the environment. It looks like a small handheld device with a numeric display. When turned on, the counter detects radiation particles in the environment.

As radiation particles pass through the counter, they create small electrical pulses that the counter counts. The display shows the number of detected particles per unit of time. Geiger counters are commonly used in various fields, including radiation protection, nuclear medicine, radiography, environmental monitoring, and geological exploration.

- GEOLOGİCAL COMPASS

A geological compass is a specialized tool used by geologists for fieldwork and geological mapping. It helps geologists determine the orientation, strike, and dip of geological features such as rock layers, faults, and joints.Typically, a geological compass consists of a magnetic needle that aligns with the Earth's magnetic field to indicate north, a compass housing with a rotating bezel marked in degrees for measuring direction, and a clinometer for measuring the dip angle of rock layers. Geological compasses may also include additional features such as a bubble level for ensuring the compass is held horizontally during measurements and a built-in magnifier for detailed examination of rock textures and structures.Overall, the geological compass is an essential tool for geologists conducting field surveys and mapping geological structures. It provides crucial data for understanding the geological history and processes in a particular area.

- GEOGRAPHICAL COMPASS

The compass is a simple tool used for determining direction on a map or in nature. It appears as a small disk with a rotating pointer that can move around its center. Typically, compasses are imprinted with letters representing the directions, such as north (N), south (S), east (E) and west (W).

You use the compass by holding it horizontally and aligning the pointer towards the north. Then you can read the directions indicated by the other letters on the compass. For instance, if the pointer is pointing north, east will be to your right, west to your left and south behind you.

The compass is a tool for orientation and navigation, especially during hiking, camping or exploring nature. It helps you to find your way and follow a specific direction, whether you're outdoors or studying a map.

What is the difference between a geological and a geographic compass?

Both the geological compass and the geographic compass are tools used for determining direction, but they have some key differences.

A geological compass is specifically designed for geological fieldwork and mapping. It is equipped with features such as a magnetic needle for determining north, a compass housing with a rotating bezel marked in degrees for measuring direction, and a clinometer for measuring the dip angle of rock layers. Geological compasses often include a bubble level for ensuring horizontal orientation during measurements and a magnifier for detailed examination of rock textures and structures. Geologists use geological compasses to determine the orientation, strike, and dip of geological features like rock layers, faults, and joints.

A geographic compass, commonly known as a standard compass, is used for general navigation and orientation purposes. It typically consists of a magnetic needle that aligns with the Earth's magnetic field to indicate north and a compass housing with a rotating bezel marked in degrees for measuring direction.Geographic compasses are used by travelers, hikers, and outdoor enthusiasts to navigate and determine cardinal directions while hiking, camping, or exploring.

In summary, while both types of compasses utilize magnetic needles to determine direction, a geological compass is specialized for geological fieldwork and mapping, whereas a geographic compass is more commonly used for general navigation and outdoor activities.

- MOHS HARDNESS SCALE

The Mohs hardness scale is a qualitative scale used to determine the scratch resistance of minerals. It was developed by German mineralogist Friedrich Mohs in 1812 and is based on the ability of one mineral to scratch another.

The scale is relative, meaning that a mineral higher on the scale can scratch any mineral lower on the scale. For example, a mineral with a hardness of 7, such as quartz, can scratch minerals with a hardness of 6 or lower, but it can be scratched by minerals with a hardness greater than 7.

The Mohs hardness scale is widely used in geology, mineralogy, and materials science to assess the hardness of minerals and to identify unknown minerals based on their scratch resistance.

The scale consists of ten minerals, arranged in increasing order of hardness:

1. Talc (hardness 1) - very soft mineral that can be easily scratched with a fingernail.
2. Gypsum (hardness 2) - soft mineral that can be scratched with a fingernail.
3. Calcite (hardness 3) - mineral that can be scratched with copper or a coin.
4. Fluorite (hardness 4) - mineral that can be scratched with a knife.
5. Apatite (hardness 5) - mineral that can be scratched with a knife but not easily.
6. Orthoclase (hardness 6) - mineral that can be scratched with steel.
7. Quartz (hardness 7) - mineral that can scratch glass.
8. Topaz (hardness 8) - hard mineral that can scratch quartz.
9. Corundum (hardness 9) - very hard mineral that can scratch most other minerals.
10. Diamond (hardness 10) - the hardest mineral on the Mohs scale, capable of scratching all other minerals.

- SAFETY HELMET

A safety helmet, also known as a hard hat, is a type of headgear designed to protect the wearer's head from injury in workplaces where there is a risk of falling objects, impact from fixed objects, or electrical shock.

Safety helmets typically consist of a hard outer shell made of durable plastic or fiberglass, which absorbs and deflects impacts, and an inner suspension system or padding that provides cushioning and helps distribute the force of impacts. Some helmets also feature adjustable chin straps to ensure a secure fit.

Safety helmets are commonly worn in construction, mining, manufacturing, and other industrial settings, as well as in activities such as rock climbing and cycling. They play a crucial role in preventing head injuries and ensuring the safety of workers and individuals engaging in potentially hazardous activities.

- SAFETY GLASSES

A safety glasses or safety goggles, are eyewear designed to protect the eyes from hazards such as flying debris, splashes of chemicals or intense light. Protective glasses typically feature impact-resistant lenses made of materials such as polycarbonate or tempered glass, which are capable of withstanding high-velocity impacts without shattering. The frames are often made of lightweight and durable materials like plastic or metal. Protective glasses are worn by workers in construction, manufacturing, laboratories, and other industrial settings, as well as by individuals participating in activities such as woodworking, shooting sports, or cycling. They are crucial for preventing eye injuries and ensuring the safety of the wearer in potentially hazardous environments.

- MEMORY GAME

The memory game in the the Young European GeoExplorer Toolkit consists of two parts: a booklet and cards.

Within the booklet, in addition to descriptions of the images on the cards for the classic Memory game, there are also:

- A description of the Young European GeoExplorer project
- An overview of UNESCO Global Geoparks
- Descriptions of project partners (UNESCO Global Geoparks and schools)
- Game instructions

Memory, as envisioned in the Young European GeoExplorer project, provides three gameplay options: classic memory, sorting, and quiz.

Incorporating Content and Language Integrated Learning (CLIL) into the educational process, we intentionally prepared certain sections of the book in five languages (English, Slovenian, German, Danish, and Norwegian), while others are available in only two languages (the language of the geopark and English). For example, the quiz is provided only in English. This approach aims to promote foreign language learning (specifically English) across all four partner UNESCO Global Geoparks.

4.4. Estimated cost of GeoExplorer Toolkit

Educational tool	Price including VAT
TOOLBOX	158,33 eur 177,27 eur
SORTING BOX FOR MINI COLLECTION OF ROCKS	7,95 eur 9,49 eur
GEOLOGICAL HAMMER	76,50 eur 86,70 eur
GEOLOGICAL HAND LENS	16,80 eur 21,96 eur
GEOLOGICAL COMPASS	153,60 eur
GEOGRAFICAL COMPASS	21,23 eur 29,99 eur
10 % HCl	1,61 eur
GEIGER COUNTER	68,99 eur
SAFETY GLASSES	3,79 eur 7,95 eur
SAFETY HALMET	26,49 eur 27,99 eur
MEASURING TAPE 50 M	28,99 eur 29,80 eur
DIGITAL MICROSCOPE	68,84 eur
BOX OF MINERALS	60,00 eur
MEMORY GAME (10 PIECES)	150,00 eur
GEOEXPLORER FIELD RULERS (10 PIECES)	11,5 eur
TOTAL	**854,62 eur – 905,69 eur**

Cheaper offer

More expensive offer

Price analysis was made for comparable products in Slovenia on January 30, 2024.
The price analysis does not include any potential delivery or shipping costs.

5. GUIDELINES FOR USING GEOEXPLORER TOOLKIT

The GeoExplorer Toolkit offers a versatile set of tools and resources to support outdoor learning and exploration. Whether you're a teacher, geopark staff or educatior working in the field outdoor education, effectively utilizing the GeoExplorer Toolkit can enhance your outdoor activities and engage participants in meaningful learning experiences.

5.2. How to use the GeoExplorer Toolkit effectively?

Guidelines for using the GeoExplorer Toolkit:

- **Familiarize Yourself with the GeoExplorer Toolkit**
  Before implementing activities with the GeoExplorer Toolkit, take the time to familiarize yourself with its features, functionalities, and capabilities. Familiarity with the toolkit will enhance your confidence and proficiency in facilitating outdoor learning experiences.

- **Tailor Activities to Learning Objectives**
  Align activities with specific learning objectives to ensure that they effectively support educational goals. Consider the concepts, skills or knowledge areas you want students to explore and design activities that target those objectives. Use the features of the GeoExplorer Toolkit creatively to create engaging and immersive learning experiences that promote exploration, critical thinking and environmental awareness.

- **Provide Clear Instructions and Support**
  When introducing activities with the GeoExplorer Toolkit, provide clear and concise instructions to participants, including how to use the toolkit's features effectively. Demonstrate key functionalities to ensure participants understand how to use them. Offer ongoing support and guidance throughout the activity to address any questions or challenges participants may encounter.

- **Foster Collaboration and Inquiry**
  Encourage collaboration and inquiry among students by designing activities that promote teamwork, communication, and problem-solving. Incorporate elements of inquiry-based learning, where participants are encouraged to ask questions, make observations and formulate hypotheses. Use the GeoExplorer Toolkit as a tool for facilitating group exploration and discovery, fostering a collaborative learning environment.

- **Reflect and Iterate**
  After completing activities with the GeoExplorer Toolkit, take time to reflect on the experience and gather feedback from participants. Encourage participants to share their thoughts, observations, and insights about the activity. Use this feedback to evaluate the effectiveness of the activity and identify areas for improvement. Iterate on the activity based on feedback received, making adjustments as needed to enhance future implementations.

5.3. Development of Exercises with using GeoExplorer Toolkit

The GeoExplorer Toolkit offers a range of resources and tools to enhance outdoor learning experiences. By designing exercises with the GeoExplorer Toolkit, educators can create engaging activities that promote exploration, critical thinking, and environmental awareness.

The process of developing exercises with the GeoExplorer Toolkit in three steps:

1. step
DEFINE LEARNING OBJECTIVES

- Begin by clearly defining the learning objectives you aim to achieve through the learning experience. Consider the specific concepts, skills or knowledge areas you want students to engage with and understand. Ensure that the objectives are aligned with educational standards and curriculum goals.

2. step
DESIGN ENGAGING ACTIVITIES

- Create engaging activities that leverage the features of the GeoExplorer Toolkit to facilitate hands-on exploration and discovery. Develop activities that encourage critical thinking, problem-solving, and collaboration among participants.

3. step
PROVIDE CLEAR INSTRUCTIONS

- Communicate clear and concise instructions for each activity, including how to use the GeoExplorer Toolkit effectively. Ensure that participants understand the purpose of each activity, as well as the steps they need to take to complete it successfully. Offer guidance and support as needed to facilitate participant engagement and learning.

5.4. Examples of Exercises with using GeoExplorer Toolkit

EXERCISE 1: Rock Observation

INTRODUCTION:

Rock observation is a fundamental aspect of geological study, involving the careful examination and analysis of rock formations to understand Earth's history, processes, and composition. By observing rocks, geologists can decipher clues about past environments, tectonic activity, and the forces that have shaped our planet over millions of years. This introductory exploration into rock observation will highlight key techniques and principles used by geologists to interpret the rich story embedded within Earth's rocky layers.

TOOLS:

- Mini collection of rocks with descriptions for teachers and students
- Hydrochloric acid solution (10% HCl)
- Ruler
- Pot with water
- Safety Gloves
- Safety goggles
- Lab coat

INSTRUCTIONS:

1. From the mini collection of rocks select three samples of rocks and determine their characteristics.
2. Label them with numbers from 1 to 3.
3. Explore the characteristic of the selected rocks. Record your findings in the table.

NAME OF THE ROCK - Name the selected rock samples. Use descriptions from the GeoExplorer Toolkit for assistance.

ROCK COLOR - Determine the color of the selected rock samples. How many different colors do you see? Which one predominates?

NUMBER OF MINERALS - Count the minerals in the selected rock samples and write down their colors.

GRAIN SHAPE - Carefully observe the rock samples and determine the shape of the grains. Are the grains rounded or angular?

ROCK WEIGHT - Hold the selected rock samples in your hand. Are they equally heavy? Try to sort them from heaviest to lightest.

GRAIN SIZE - Take a ruler from the GeoExplorer ToolKit and measure the grain size of the selected rock samples.

ROCK SURFACE - Observe the surface of the rock and determine whether it is sharp, rough or smooth.

ROCK BUOYANCY - Take a container from the GeoExplorer ToolKit and fill it with water. Test if the selected rock samples float on water.

REACTION WITH ACID - Take hydrochloric acid solution (10% HCl), gloves, safety goggles, and a lab coat from the GeoExplorer ToolKit. Drop a few drops of hydrochloric acid onto each of the selected rock samples. Observe what happens on the rock surface.

FOSSILS IN THE ROCK - Carefully observe the rock samples. Do you notice any fossils in them?

ROCK TYPE - Determine the type of the selected rocks based on their formation. Are they igneous, metamorphic, or sedimentary rocks?

Worksheet for students

	Sample 1	Sample 2	Sample3
NAME OF THE ROCK			
ROCK COLOR			
NUMBER OF MINERALS			
GRAIN SHAPE			
GRAIN SIZE			
ROCK WEIGHT			
ROCK SURFACE			
ROCK BUOYANCY			
REACTION WITH ACID			
FOSSILS IN THE ROCK			
ROCK TYPE			

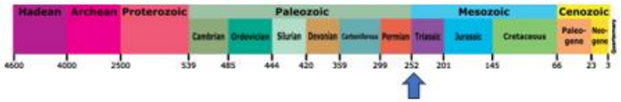
OOLITIC LIMESTONE

Description for teachers and upper secondary level

Oolitic limestone bear witness to life and environment **some 252 million years ago** (Lower Triassic) in a tidal or subtidal coastal environment and a morphologically diverse subtidal shelf (continental shelf = a submerged area around the continents, which is covered by a sea between 100 and 200 m deep. i.e. shelf sea).

Oolitic limestone consists of limestone grains less than 2 mm in diameter. We call them **ooids**, which are spherical-subspherical grains, consisting of one or more regular concentric lamellae around a nucleous. They were formed when a particle of sand or other nucleus is coated with concentric layers of calcite, wave-agitated marine water. The ooids could have remained in the coastal sea, or they could have been transported by sea currents to deeper parts of the sea shelf, where they were deposited with other rocks. If the rock consists mainly of ooids, it is called **oolite**, or **oolitic limestone**. Ooids can be observed in rocks with the naked eye, or more easily with a magnifying glass. Their structure is best seen under a microscope.

In Idrija area, they can be seen in the area from the Ledinska plateau to the Idrijca valley and in many places on both slopes above the Kanomljica valley and in smaller patches around Idrija.

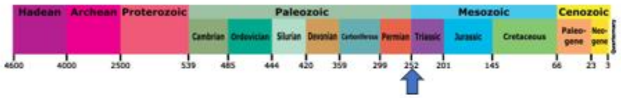


Numbers on the timeline above are million years and can also be measured as centimetres on the 50-meter measure tape of the GeoExplorer Toolkit!

OOLITIC LIMESTONE

Description for pupils

I was formed by the excretion of limestone (calcite) in the form of concentric layers (lamellae) around the core in agitated intertidal waters on the coastal belt **252 million years ago.** If I am composed of mainly limestone grains of less than 2 millimetres in diameter, I'm called **oolitic limestone.** The individual grains are called **ooids.** In the rock, you can see me with the naked eye, but to a greater extent with a magnifying glass or under a microscope (see photo on previous p.)



You can find me if you measure 252 cm on the GeoExplorer Toolkit's measure tape!

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EXERCISE 2: Determining the hardness of minerals and other materials using Mohs hardness scale

INTRODUCTION:

Assessing mineral hardness is essential in geology and material science. The Mohs hardness scale, devised by Friedrich Mohs in 1812, provides a simple yet effective method for determining the relative hardness of minerals. This scale ranges from 1 to 10, with talc being the softest (rated 1) and diamond the hardest (rated 10). By scratching one mineral against another and comparing the resulting scratches, geologists can quickly assess mineral hardness and infer valuable information about mineral composition and geological processes.

TOOLS:

- box with minerals
- piece of plastic
- wood
- glass
- copper coin
- hammer

INSTRUCTIONS:

1. Take the box of minerals from the GeoExplorer Toolkit and familiarize yourself with the levels of hardness. Test the hardness of each material in the box by attempting to scratch its surface with another material. Remember that each subsequent mineral scratches the previous one.
2. Based on the results, arrange the minerals in the box according to their hardness on the Mohs scale from 1 (softest) to 10 (hardest). You can verify the correct solution in the description of the Mohs hardness scale.
3. Now, focus on the prepared materials and substances: piece of plastic, wood, glass, copper coin, and hammer. Test the hardness of each material by attempting to scratch its surface with another material.
4. Based on the results, classify the materials according to their hardness on the Mohs scale from softest to hardest. Use the list below for classification.
5. Scratch each prepared material with minerals from the Mohs hardness scale (easiest done by starting with the softest, talc). The hardness of the material is the hardness of the last mineral that does not scratch the material.

The Mohs hardness scale:

Mohs relative hardness	Mineral example	Scratch test
1	Talc	Scratch with fingernail
2	Gypsum	Scratch with fingernail
3	Calcite	Scratch with copper penny
4	Fluorite	Easily scratch with knife
5	Apatite	Scratch with knife blade
6	Orthoclase	Scratch with steel file
7	Quartz	Scratch with window glass
8	Topaz	Scratches quartz
9	Corundum	Scratches topaz
10	Diamond	Scratches corundum

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Worksheet for students

Mineral or other material	DOES NOT SCRATCH THE MINERAL/MATERIAL	SCRATCH THE MINERAL/MATERIAL	HARDNESS OF MINERAL/MATERIAL
for example: glass	talc, gypsum, calcite, fluorite, apatite, orthoclase	Quartz, topaz, corundum, diamond	7

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Worksheet for students

Classify the materials according to their hardness on the Mohs scale from softest to hardest.

SOFTEST ⟷ **HARDEST**

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EXERCISE 3: Orientation with geografical compass

INTRODUCTION:

Embark on a thrilling adventure of exploration and discovery with the timeless art of orientation using a compass. A compass is more than just a simple tool; it's a gateway to understanding the world around us. In this journey, we'll learn how to navigate through unfamiliar terrain, deciphering the language of cardinal directions and unlocking the secrets of navigation. So, grab your compass and get ready to embark on an exhilarating journey of orientation and discovery.

TOOLS:

- Geographical compass
- Map of the Idrija Geopark

INSTRUCTIONS:

- From the GeoExplorer Toolkit, take the geographical compass and the map of the Idrija Geopark. Place the map on the table or another flat surface. Position the compass on the edge of the Idrija Geopark map. Rotate the map along with the compass until the arrow points north (N). At that point, the map will be oriented northward, and you will be correctly oriented.
- In the table, indicate the direction from the current point to the landmarks of the Idrija Geopark

Name of natural or cultural heritage	**Cardinal directions and intercardinal directions**
HABEČKOVO BREZNO (Habečk Chasm)	
DIVJE JEZERO (Wild Lake)	
DINOZAVROVE STOPINJE (Dinosaur footprints) HRVATOVA JAMA (Hrvat Cave)	
IDRIJSKE KLAVŽE (Idrija klavže - water barriers)	
JAVORNIK (highes mountain in municipality)	

6. RECCOMENDATION FOR OUTDOOR LEARNING WITH GEOEXPLORER TOOLKIT

6.2. What is outdoor learning?

Outdoor learning takes students out of their usual indoor environment and immerses them in the natural world. Whether it's a hike through the forest, a visit to a local park, or conducting experiments in a school garden, outdoor learning provides hands-on experiences that engage all the senses and foster a deeper connection with the environment.

> Outdoor learning is any organized learning that takes place outside of school buildings.
>
> Outdoor learning refers to the philosophy, theory, and practice of experiential learning and environmental education.

(Skribe Dimec, 2013)

Outdoor learning, also known as outdoor education or experiential learning, involves educational activities conducted outside of traditional indoor classroom settings. It utilizes the natural environment as a learning resource and typically involves activities such as field trips, nature walks, gardening, adventure activities, and environmental studies.

Outdoor education takes place outside the classroom in various locations (Skribe Dimec, 2013):

- in the vicinity of the school
- in nature
- in urban environments (streets, various institutions)
- on farms
- in institutions specializing in outdoor education (Forest School Network, geoparks, outdoor museums, etc.)

6.3. The advantages of outdoor learning

In recent years, there has been a growing recognition of the profound benefits that outdoor learning offers to learners of all ages. Stepping outside the traditional confines of the classroom opens up a world of opportunities, providing a dynamic and immersive educational experience unlike any other.

Firstly, outdoor learning fosters a deep connection with nature. By immersing oneself in natural environments, students develop a sense of appreciation and respect for the world around them. Moreover, outdoor learning cultivates holistic development. Unlike traditional classroom settings, outdoor environments offer diverse opportunities for physical, emotional, and social growth. From conquering challenging ropes courses to collaborating with peers on team-building exercises, students develop resilience, communication skills, and a strong sense of self-confidence. Moreover, outdoor learning stimulates experiential learning, allowing students to engage in hands-on experiences that bring academic concepts to life. Outdoor learning promotes adventure and exploration, offering a refreshing escape from technology overload and igniting a sense of wonder and curiosity. Overall, while classroom learning provides structure and theoretical foundations, outdoor learning offers a dynamic and immersive experience that fosters holistic development and deeper connections with the natural world.

Comparison of learning in the classroom and outdoor learning:

IN THE CLASSROOM	OUTDOOR LEARNING
Structured environment with desks, chairs, and whiteboards.	Takes place in natural or diverse environments.
Emphasis on theoretical knowledge delivery.	Encourages hands-on, experiential learning.
Limited physical movement and interaction with natural surroundings.	Opportunities for physical activity, exploration, and sensory engagement.
Often focuses on passive learning through lectures and textbooks.	Facilitates interdisciplinary learning and problem-solving in real-world contexts.
Controlled conditions with minimal exposure to real-world challenges.	Enhanced connection with nature and appreciation for the environment.
Potential distractions from technology and classroom dynamics.	Builds resilience, teamwork, and critical thinking skills through exposure to challenges.
	Allows for creativity and adaptability in learning approaches.

Povzeto po: Novak, N. et. Al. (2022)

6.4. Incorporating CLIL Methodology into Outdoor Learning

Content and Language Integrated Learning (CLIL) is an educational approach that integrates the learning of subject content with the acquisition of a second language. When applied to outdoor learning, CLIL methodology offers a powerful framework for engaging students in hands-on exploration while simultaneously developing their language skills.

Outdoor learning provides a unique opportunity for students to explore the natural world while enhancing their language skills. By immersing students in authentic outdoor environments, educators can create rich learning experiences that foster language acquisition in meaningful contexts. Whether identifying plant species, studying geological formations or conducting environmental experiments, students engage in language-rich activities that deepen their understanding of both subject content and language.

CLIL methodology encourages inquiry-based learning, where students are actively involved in asking questions, making observations, and investigating phenomena. In outdoor settings, students have the opportunity to explore real-world problems and phenomena, fostering curiosity and critical thinking skills. Through hands-on exploration and experimentation, students develop a deeper understanding of scientific concepts while honing their language skills through meaningful communication and collaboration.

Outdoor learning naturally lends itself to interdisciplinary connections, where students explore the intersections between different subject areas. By integrating science, mathematics, language, arts and other disciplines, educators can create holistic learning experiences that deepen students' understanding of subject content while promoting language development. Whether conducting ecological surveys, analyzing environmental data, or writing reflective essays, students engage in cross-curricular activities that enhance their knowledge and language proficiency.

Incorporating CLIL methodology into outdoor learning experiences fosters environmental awareness among students. By immersing students in nature and encouraging them to explore their surroundings, educators instill a sense of responsibility and respect for the environment. Through activities such as nature walks, ecological restoration projects and wildlife observation, students develop a deeper connection to the natural world while practicing language skills in authentic contexts.

6.5. The phases of outdoor learning

For quality outdoor learning several characteristics are essential. Ouality outdoor learning is (Moravec, 2024):

- **Well-Planned**: Outdoor learning activities should be meticulously planned, taking into account factors such as location, safety and the specific learning objectives to be achieved.
- **Meaningful**: The activities should be purposeful and directly aligned with the learning goals. They should aim to enhance understanding through direct observation and hands-on experience, ensuring that students gain insights and knowledge relevant to their academic development.
- **Evaluation and Transfer of Knowledge**: Evaluation of the outdoor learning experience is crucial to assess its effectiveness and identify areas for improvement. Additionally, the knowledge and skills acquired during outdoor activities should be transferable to other contexts, allowing students to apply what they have learned in different situations beyond the outdoor setting.

These characteristics ensure that outdoor learning is not only engaging and enjoyable but also effective in achieving educational objectives and fostering students' overall development.

The phases of outdoor teaching include the following steps (Moravec, 2024):

PLANNING

- In this phase, teachers thoroughly plan learning activities to be conducted outdoors. This involves setting learning objectives, selecting suitable locations, preparing necessary materials and equipment, and assessing potential risks and safety measures.

IMPLEMENTATION

- Once planning is complete, learning activities are carried out according to the prepared plan. Students go outside and engage in activities such as nature observation, exploration of the surroundings, conducting experiments, or fieldwork.

CONCLUSIONS AND EVALUATION

- After the activities are completed, a conclusion with evaluation takes place. Teachers and students reflect together on their experiences, achievements, and challenges, and assess whether the objectives were met. Evaluation also allows for identifying possible improvements for future outdoor learning sessions.

The phases of outdoor learning provide a structured framework for experiential education in natural settings. By following these phases, students can engage in meaningful exploration, develop a deeper understanding of the natural world and cultivate a lifelong appreciation for environmental responsibility.

1. Phase: Planning

DETERMINATION OF LEARNING GOALS, STANDARDS AND PERFORMANCE CRITERIA	• determining standards and objectives from the curriculum, • meaningfully planning cross-curriculum activities, • specifying which knowledge will be assessed and how.
DETERMINATION OF A APPROPRIATE TEACHING APPROACH, FIELD ACTIVITIES AND TEACHING METHODOLOGY	• teaching methods adapted to students' prior knowledge, • forms of work tailored to objectives and standards.
DETERMINATION OF DURATION AND LOCATION OF ACTIVITY, RISK ASSESSMENT	• determining the duration of actvity, • checking the location (distance from the school, suitability for implementation, anticipated hazards and risks).
PREPARATION OF DIDACTIC MATERIALS AND TOOLS	• meaningful incorporation of worksheets, filling out worksheets should not be the main activity of outdoor learning, • preparing the list of educational tools, apps etc.

2. Phase: Implementation

PREPARING STUDENTS FOR OUTDOOR ACTIVITIES	• assessesment of students prior knowledge, • teacher informs students about success criteria, • determination of instructions and tasks of students in the field • rules of behaviour in nature
IMPLEMENTATION OF OUTDOOR ACTIVITIES	• the teacher monitors, encourages, advises, and guides the students.

3. Phase: Conclusion with Evaluation

DATA ANALYSIS	• it takes place in the classroom, after the conclusion of fieldwork • students appropriately supplement the data and formulate conclusions from the field findings
DATA PRESENTATION AND FEEDBACK	• students present their findings and conclusions • students receive quality feedback from the teacher and their peers
EVALUATION	• the teacher and students verify whether they have achieved learning goals and success criteria. • Students self-evaluate their work and identify areas for improvement

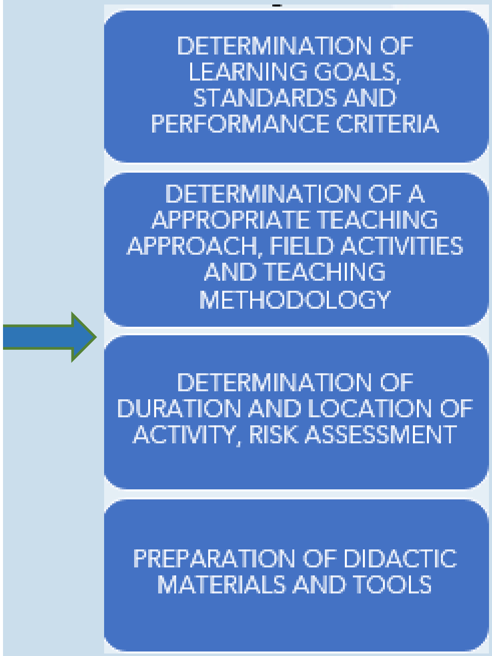
6.6. Example of outdoor learning with using the GeoExplorer Toolkit

Below is an example of an outdoor lesson using the GeoExplorer Toolkit, which follows the recommendations for high-quality outdoor learning. For lesson preparation, the template "Development of GeoExplorer exercises for outdoor activities" was utilized, which was developed as part of the Young European GeoExplorer project. This template is intended for teachers, geopark staff, and all employees in organizations involved in conducting outdoor activities (Annex 1).

The described activities take place on the Karst Forest Educational Trail. The educational trail was formed years ago for learning about karst phenomena, getting familiar with flora, and forest management in our environment. The planned activities can be implemented with worksheets or with educational app TurfHunt (geolocation game which allows teachers to create their own exercises, add a number of multi-sensory contents and to enrich their usual classroom work with a classroom in nature).

1. Phase: Planning

Selected theme	X_ **Geology** __ Ecology __Men and biosphere
Subthemes	Rocks and fossils, (karst) landforms
Class	6., 7. Class (Primary school) 11- to 13-year-old pupils
Learning goals (English and natural science/biology/geography).	- Observing nature and the environment - Learning to recognise typical karst landforms - Learning to recognise sedimentary, metamorphic and igneous rocks according to their typical features - Learning about the rock cycle - Learning the processes of changing rocks - Learning about fossils - Learning new English words
Working methodology	X_ **Frontal** X_ **Group Work** __ Pairwork __ Individual work
Learning methodology	X_ **Observing** X_ **CLIL (Content and Language Integrated learning)** X_ **Listening to the teacher or a guide** __ Taking pictures X_ **Experimental** __ Playing educational games, role play __ Self-learning __ Contest X_ **Orientation** X_ **Collecting samples and analysing** X_ **Use of maps and navigation** X_ **Investigative performance** __Other. Please, specify:
Additional knowledge, skills and competences	X_ **Teamwork** __ Problem solving __ Decision making X_ **Development of independent thinking** __ Other. Please, specify: ______________
Multi-sensory contents	Visual, auditive, kinaesthetic
Teaching aids	Map, working list, magnifying glass, rock samples, rock ID key, geological cycle, ruler, gloves, helmet, meter stick, microscope, hammer, 10% HCl
New English vocabulary items	Fossil, limestone, dolomite, acid, sedimentary, metamorphic and igneous rocks, rock cycle, erosion, weathering, heat and pressure, karst landforms (caves, dolines, stalagmites, stalactites)



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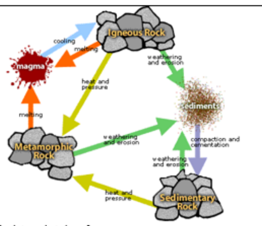
2. Phase: Implementation

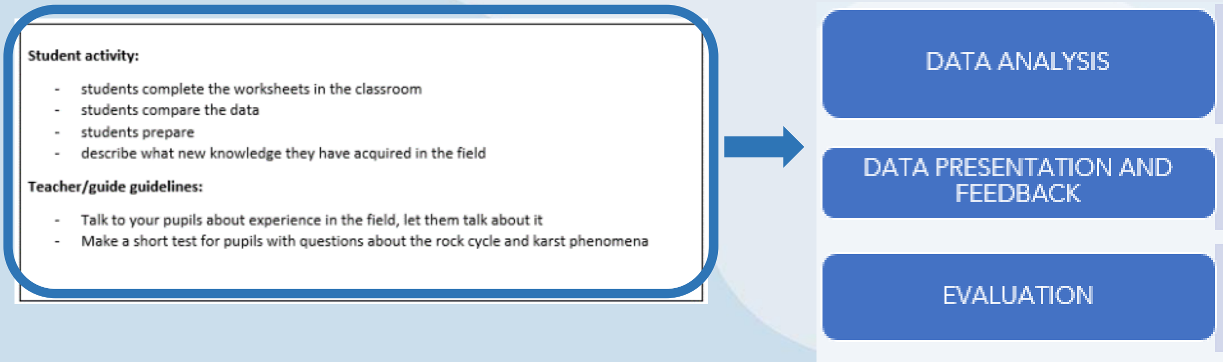
Pre-fieldwork activities	**Students' activity:** - In the classroom, pupils review the GeoExplorer Toolkit and familiarise themselves with the items it contains. - Pupils review what they have already learned about the rocks, rock cycle and karst phenomena before. - Pupils examine the box with stone samples and describe each one. - Pupils find the start of the route on a map and decide how to get there. **Teacher/guide guidelines:** - Bring the GeoExplorer Toolkit into the classroom and go through what it contains with your pupils. - Aks the pupils which items in the GeoExplorer Toolkit they already know and whether they have used any of them. - Check what pupils already know about rocks, rock cycle and karst phenomena. - Together with the pupils go through the box with stone samples, let the pupils look at them, feel them, do the acid experiment. - Distribute the route maps to your pupils and help them find the right route. 

PREPARING STUDENTS FOR OUTDOOR ACTIVITIES

IMPLEMENTATION OF OUTDOOR ACTIVITIES

	Students' activity	Teacher/guide guidelines
Task 1: At the beginning of the Karst Forest Educational Trail **N 45°55'29''** **E 14°03'58''**	Look at the rock samples from your GeoExplorer Toolkit and try to classify them as sedimentary, metamorphic or igneous. Which rocks are dominant here?	Show rock samples from GeoExplorer Toolkit to pupils and explain to them how to classify rocks. Use the magnifying glass, microscope, hammer, 10% HCl and rock ID key.
Task 2: **At the beginning of the Karst Forest Educational Trail** **N 45°55'29''** **E 14°03'58''**	 A picture is taken from: http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html Answer the questions below (TRUE or FALSE): 1. Which of these statements is true? a.) Rocks never change. ____ b.) Rocks can change from one type to another. ____ c.) Rocks can only change on the Earth surface. ____ 2. Rocks affected by WEATHERING AND EROSION can change into: a.) Lava ____ b.) Magma ____ c.) sediments ____ 3. Which geologic process can change any type of rock into a sediment? a.) Cooling ____ b.) Weathering and erosion ____ c.) Heat and pressure ____ d.) Melting ____	Explain the rock cycle to your pupils and help them with questions. Solutions to questions: 1. a) F b) T c) F 2. a) F b) F c) T 3. a) F b) T c) F d) F
Task 3: **Along the Karst Forest Educational Trail** **N 45°55'24''** **E 14°04'07''**	How many karst phenomena do you know? Show them in your surroundings then draw them. Which karst phenomena is shown in the picture below? a) Stalagmite b) Cave c) Karren 	
Task 4: **Fossils of rudists** **N 45°55'20''** **E 14°04'16''**	Look at the picture below. Try to find a similar form in your surroundings. Do you already know what it is? a) Traces of trilobite b) Fossilised rudists c) Stromatolites (fossilized evidence of algae and cyanobacteria and carbonate particles) 	Explain to your pupils what fossils are and how they are formed. Help them find the fossilised rudists in their surroundings.
Task 5: **At the cave Hrvatova jama** **N 45°55'31''** **E 14°04'11''**	This limestone karst cave was formed where water seeped through a crack and dissolved the bedrock. Take a look inside the cave and find typical karst phenomena. Name the karst phenomena shown in the photos below:  ______  ______	Guide your pupils into the cave and help them recognise typical karst phenomena.

3. Phase: Conclusion with Evaluation



Student activity:

- students complete the worksheets in the classroom
- students compare the data
- students prepare
- describe what new knowledge they have acquired in the field

Teacher/guide guidelines:

- Talk to your pupils about experience in the field, let them talk about it
- Make a short test for pupils with questions about the rock cycle and karst phenomena

6.7. How to effectively incorporate the GeoExplorer Toolkit into outdoor learning experiences – RECCOMENDATIONS FOR GEOPARKS (Annex 2)?

1. **Environmental Knowledge and Expertise:** Ensure that geopark staff have a strong understanding of the local natural and cultural heritage of the area. Provide ongoing training and professional development opportunities to enhance staff knowledge and expertise.
2. **Interpretive Skills**: Develop staff's interpretive skills to effectively communicate complex geological concepts and environmental issues to diverse audiences. Offer training in interpretation techniques, storytelling, and interactive learning methods.
3. **Familiarize Yourself with the GeoExplorer Toolkit:** Before implementing activities with the GeoExplorer Toolkit, take the time to familiarize yourself with its features, functionalities, and capabilities. Familiarity with the toolkit will enhance your confidence and proficiency in facilitating outdoor learning experiences.
4. **Curriculum Development**: Support staff in the development of outdoor learning curriculum and educational materials that align with geopark objectives and educational standards. Encourage the creation of engaging, hands-on activities that highlight the unique geological features and cultural heritage of the geopark.
5. **Community Engagement**: Foster relationships with local schools, community groups and educational organizations to promote outdoor learning opportunities within the geopark.
6. **Visitor Experience Enhancement**: Integrate outdoor learning experiences into visitor programs and interpretive offerings within the geopark. Develop guided hikes, field trips, and workshops that provide visitors with opportunities to explore and learn about the geology and natural history of the area.
7. **Environmental Conservation and Responsibility**: Emphasize the importance of environmental conservation and responsibility in outdoor learning initiatives.
8. **Evaluation and Assessment**: Implement evaluation and assessment tools to measure the effectiveness of outdoor learning programs and gather feedback from participants. Use data and feedback to refine programs, improve educational outcomes, and inform future planning.
9. **Partnerships and Collaboration**: Seek opportunities for partnerships and collaboration with other geoparks, environmental organizations and educational institutions to enhance outdoor learning offerings.
10. **Professional Growth and Development**: Support staff's professional growth and development in outdoor education through access to training, conferences and networking opportunities. Encourage staff to pursue certifications and qualifications in outdoor leadership, interpretation and environmental education.

7. CONCLUSION

The Young European GeoExplorer project, co-financed by the EU Erasmus+ Programme, aims to improve high school education by integrating natural science and language learning through the Content and Language Integrated Learning (CLIL) method.

Through collaboration with UNESCO Geoparks, local schools and educational stakeholders, the project aimed to develop new services in geoparks and innovative teaching methods for teachers, geopark staff and other employees in the field of education. By harnessing the power of the CLIL methodology, we aim to address the evolving needs of schools and teachers, offering an engaging approach to science and language education.

The GeoExplorer Toolkit, main result of this project, provides educators with valuable resources and tools to enhance outdoor learning experiences. By following the guidelines outlined for effectively incorporating the toolkit into outdoor learning, teachers can create engaging and meaningful activities that foster exploration, inquiry, and hands-on learning. By embracing nature, prioritizing safety, aligning activities with curriculum objectives, and encouraging exploration and reflection, educators can create transformative learning experiences for their students.

Fostering effective outdoor learning experiences within geoparks requires a multifaceted approach. This includes ensuring staff possess strong environmental knowledge and interpretive skills and supporting curriculum development aligned with geopark objectives. Additionally, community engagement, visitor experience enhancement and a focus on environmental conservation are vital aspects. Continuous evaluation and assessment, alongside partnerships and collaboration, further contribute to program effectiveness. Finally, investing in staff's professional growth and development in outdoor education is crucial for sustained success and impact. By implementing these strategies, geoparks can enrich educational offerings and inspire a deeper connection to the natural world.

8. Literature

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9. Annexes

Annex 1: Development of GeoExplorer exercises for outdoor activities – template

Development of exercises for outdoor activities – Teachers, pupils and guides template

Selected theme	
Subthemes	
Class	
Learning goals (English and natural science/biology/geography).	
Working methodology	___ Frontal ___Group Work __ Pairwork __ Individual work
Learning methodology	__ Observing ___CLIL (Content and Language Integrated learning) ___Listening to the teacher or a guide __ Taking pictures ___Experimental __ Playing educational games, role play __ Self-learning __ Contest __ Orientation __ Collecting samples and analysing __ Use of maps and navigation __ Investigative performance __Other. Please, specify:
Additional knowledge, skills and competences	__ Teamwork __ Problem solving __ Decision making __ Development of independent thinking __ Other. Please, specify: ______________________________
Multi-sensory contents	
Teaching aids	
New English vocabulary items	

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Description of exercise:

Before fieldwork:

During fieldwork:

Task 1:		**Teacher/guide guidelines:**
		Student activity:
Task 2:		**Teacher/guide guidelines:**
		Student activity:
Task 3:		**Teacher/guide guidelines:**
		Student activity:

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After fieldwork:

Evaluation of the pupil's engagement and competence skills:

Feedback from the pupils about the activity:

Annex 2: How to effectively incorporate the GeoExplorer Toolkit into outdoor learning experiences? – leaflet

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How to effectively incorporate the GeoExplorer Toolkit into outdoor learning experiences?

RECOMMENDATIONS FOR GEOPARKS

ENVIRONMENTAL KNOWLEDGE AND EXPERTISE

Ensure that geopark staff have a strong understanding of the local natural and cultural heritage of the area.

FAMILIARIZE WITH THE GEOEXPLORER TOOLKIT

Before implementing activities with the GeoExplorer Toolkit, take the time to familiarize yourself with its features, functionalities, and capabilities.

COMMUNITY ENGAGEMENT

Foster relationships with local schools, community groups and educational organizations to promote outdoor learning opportunities within the geopark.

ENVIRONMENTAL CONSERVATION AND RESPONSIBILITY

Emphasize the importance of environmental conservation and responsibility in outdoor learning initiatives.

PARTNERSHIPS AND COLLABORATION

Seek opportunities for partnerships and collaboration with other geoparks, environmental organizations and educational institutions to enhance outdoor learning offerings.

INTERPRETIVE SKILLS

Develop staff's interpretive skills to effectively communicate complex geological concepts and environmental issues to diverse audiences.

CURRICULUM DEVELOPMENT

Encourage the creation of engaging, hands-on activities that highlight the unique geological features and cultural heritage of the geopark.

VISITOR EXPERIENCE ENHANCEMENT

Integrate outdoor learning experiences into visitor programs and interpretive offerings within the geopark.

EVALUATION AND ASSESSMENT

Implement evaluation and assessment tools to measure the effectiveness of outdoor learning programs and gather feedback from participants.

PROFESSIONAL GROWTH AND DEVELOPMENT

Support staff's professional growth and development in outdoor education.

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