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Earth Learning Ideas Made By Students

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Earth Learning Ideas is a fantastic resource for both educators and students, providing innovative, creative and practical ideas to support geoscience education. The page is filled with plenty of engaging activities envisioned to make learning about the Earth dynamic, fun, and educational.

The poster features the projects that were made by the students of American High School Skopje and presented during the annual event November - Month of Science, held at the Faculty of Natural Sciences and Mathematics in Skopje. The students have extensively used earthlearningidea.com to develop their projects while adding their personal touch to the production and presentation techniques. The simple and creative approach offered by these projects impressed the organizing committee, which resulted in 6 out of the 9 projects presented at the event being awarded.

The projects explored the rock cycle explained by Legos, a volcano made in a cup, a building resonating with seismic waves created by a drilling tool, a building being built on a fragile terrain made of jelly, coral atolls made by a sinking volcano, the rain created in a baking pot, a sinkhole made of dissolved salt, moon craters made by marbles in flour, and use of free online resources for global warming research.

The introduction of Earth Learning Ideas in the educational process proved to bring instant influence on students' motivation to dive into the secrets of geoscience. It turned the classroom into a small lab where each material is now seen as a resource for creating a model of a natural phenomenon. Whether it's a peeled tangerine and a glass of water, or bubble gum and a straw, the new mindset sees the Eart's core and an earthquake there.

This resonates with the main goal of Earth Learning Ideas, which is enhancing geoscience education by making it more enjoyable and accessible. The new teaching approach provided by this valuable resource creates highly engaged and curious students, which ensures a bright future for geoscience.

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Model the history of ocean sediment deposition from rift to trench

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Ocean sediments are often used to tell the story of oceanic lithosphere from the accretionary zone to the trench, including when it is embedded in orogens. Although the processes of littoral sedimentation are well developed in general education classes in France, oceanic sedimentation is only used to account for the age of layers or to provide information on the climatic parameters of paleoenvironments in classes of specialty in Life and Earth Sciences from the High School. This results in difficulty understanding the meaning of oceanic geological units' maps and the story they tell during the lifespan of the oceanic lithosphere. To remedy this problem and allow students to acquire for themselves the concepts of biostratigraphy, time, accretion and disappearance in the trenches of oceanic sediments, we have developed and manufactured models which allow students, while manipulating, to assimilate these concepts. We present here these models, their operating principle and the concepts they allow us to acquire.

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A date with an O.C.C. (Oceanic core Complex)

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For many years, the teaching of oceanic accretion processes in France has long focused on that of rapidly accreting ridges producing a Penrose-type lithosphere. Although often problematic in drawing a parallel with the structure of Alpine ophiolites (without real magmatic crust), themselves in the programs, it was nonetheless taught in high school. In the new high school programs of 2019, a small line has finally made it possible to include the teaching of the accretion processes of slow divergence zones. Although recognized for more than a decade by the scientific community, the key role of mantle exhumation, its serpentinization, detachment faults and the formation of complex oceanic cores can finally be taught. This finally lifts the veil on the absence in transatlantic seismic tomographies of low-velocity zones under the divergence axis. But also allows a better match between the field observations carried out by the classes during outings to mainland French ophiolitic spots and the concepts required for the baccalaureate (high school diploma). This presentation shows how it is possible to understand the functioning of a slow accretion zone by taking the very educational example of the complex oceanic cores of the mid-Atlantic zone. By crossing data from oceanographic campaigns synthesized in the form of kml (Keyhole Markup Language), ocean topography with G.I.S. visualizers (Geographic Information System) like Google Earth and data and samples (macro and microscopic) harvested from the sites, we show how high school students reconstruct the geodynamic and petrological mechanisms of slow accretion zones.

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Deep Blue Discoveries: Engaging Gifted Learners with the Secrets of the Oceans and Sea Floor

Kübra Bilik Demirel

Marine and ocean floors comprise the submerged parts of the Earth's surface, including deep-water basins and shallow continental shelves. These floors often feature diverse geological formations such as ocean ridges, deep trenches, volcanic cones, and seamounts. Their shape and composition vary significantly due to factors like pressure, temperature, and the lifestyles of various organisms at different water depths. These variations are crucial for Earth's ecosystem, contributing not only to oxygen production but also to biodiversity conservation, climate regulation, and the understanding of geological processes. Additionally, marine floors host geothermal resources, minerals, and petroleum, which are strategically important for human life and industrial activities. However, understanding these topics can be challenging for students.

To address this, the instructional strategies implemented during the educational process aim to help students comprehend the features and importance of marine and ocean floors. These strategies involve the use of visual and auditory materials. In the first stage, a drawing activity titled “What’s under the sea?” was carried out to assess students' prior knowledge of the topic. Following this, students was asked to illustrate marine organisms, transforming their drawings into teaching materials. A marine floor map was created, where students added components reflecting the layered properties of ocean and sea floors, culminating in the creation of a poster. BBC and National Geographic books and documentaries also supported the learning process. Moreover, interactive seafloor maps facilitated easier understanding and made learning more enjoyable for students.

Moreover, model and mock-up activities assisted students in grasping the physical characteristics of marine and ocean floors. Likewise, These activities encouraged them to utilize their creativity to better understand the shapes, depths, and biodiversity of marine floors. Selecting eco-friendly materials further underscored the importance of sustainability. Such activities both improved students' craftsmanship and reinforced their knowledge of marine sciences.

Among the difficulties encountered in training related to this study, the most important is that the subject is often abstract and distant. The inability of students to physically explore marine and ocean floors exacerbates this difficulty. To overcome these challenges, technology-based solutions such as virtual field trips and real-time observations using underwater robots can be employed. Additionally, providing students with compelling examples that link the topic to current issues is crucial.

This study comprehensively examines educational practices related to marine and ocean floors. It delves into their characteristics, instructional strategies, student projects, experiments for natural science classes, educational materials and resources, challenges, and proposed solutions. The

results of this study aim to enhance school education on marine and ocean floors, enabling students to better understand and engage with the topic.

This study explores educational practices related to marine and ocean floors in school curricula, aiming to deepen students' understanding of marine ecosystems, geology, and sustainable use. Conducted during science classes at Bilecik Borsa Istanbul Science and Art Center (Turkiye) with 54 students, the study revealed that it not only enhanced students' interest in natural sciences but also increased their awareness of environmental consciousness and sustainability.

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"Exploring the Sea Floor: Understanding Albania’s Marine Environment"

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Title: ***Exploring the Sea Floor: Understanding Albania’s Marine Environment"***

This project aims to introduce 8th-grade students (ages 13–14) to the fascinating world of the sea floor, focusing on Albania’s Adriatic and Ionian Seas. Through interactive lessons and hands-on activities, students will explore the physical features of the sea floor, the unique marine ecosystems it supports, and its vital role in our environment.

The project includes mapping the sea floor using models, learning about marine biodiversity, and discussing the impact of human activities such as pollution and overfishing. Students will also create awareness campaigns to promote the protection of Albania’s seas and their ecosystems.

By connecting classroom knowledge with real-world applications, this project seeks to inspire curiosity, foster environmental responsibility, and provide students with a deeper understanding of the seas that surround them.

Keywords: Sea Floor, Marine Ecosystems, Albania's Seas, Environmental Preservation, Marine Life, Climate Regulation, Biodiversity, Pollution Awareness, Sustainable Practices, Sea Floor Geology, Marine Conservation

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Speleology, Hiking and Botanical Exploration: Enhancing Environmental Awareness through Field Activities and new technologies.

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Keywords: biodiversity, botanical identification, digital herbarium, field education, environmental education, geodiversity, hiking, technology integration, speleology.

For over five years, the “Galileo-Curie” High School, under the leadership of Professor M. Cazzorla and the Department of Sciences guided by Professor S. Valletta, has been organizing the “Speleo-Hiking Course,” aimed at promoting environmental awareness and the preservation of local biodiversity through theoretical lessons, hiking activities, and speleological and botanical fieldwork.

Past initiatives have involved approximately *20 students*, combining theoretical knowledge with hands-on experience in natural environments. These activities were carried out with the participation of *Natural Sciences teachers* and supported by experts from the tourist promotion agency *Puglia Escursioni* and the *Italian Society of Environmental Geology (SIGEA-APS)*, an environmental protection association recognized by the Ministry of the Environment.

Starting from the current scholastic year, the course will introduce free software for plant recognition, the collection of field photographs to be shared in a common online repository and a final computer-based laboratory session to create digital products, which will be published on the School’s website. The integration of digital tools and technologies represents a crucial innovation, allowing students to collect, analyze, and share environmental data more effectively.

The course will be organized in three main sections:

- **Laboratory lessons**: four two-hour lessons focused on the main geological features of the territory, equipment and safety during hiking activities, ecological interactions, biodiversity conservation and the use of new technologies for environmental research. Practical exercises will include using speleological equipment in the school gym, downloading and using mobile apps for plant and bird species recognition and capturing representative field photographs with detailed annotations.
- **Field trips**: our excursions involving hiking and cave exploration, allowing students to observe karstic phenomena, rock formations, and cave ecosystems. Students will also practice species identification using mobile applications and collect data for their digital herbarium.
- **Computer Laboratory Sessions:** Students will research species information, contribute to an eBook illustrating the shared digital herbarium, create a logo using AI-enhanced generative

software, and write short articles describing the sites visited and their field experiences. All digital outputs will be embedded on the school website.

Through these activities, students will develop skills in ecological observation, geological analysis, botanical classification, digital content creation, and collaborative learning, enhancing both scientific knowledge and soft skills.

As part of the school's Educational Offer Plan, this initiative highlights the potential of an interdisciplinary approach in fostering sustainable values among younger generations. Moreover, the integration of digital tools and AI technologies ensures that the knowledge and experiences gained are not confined to the classroom but are shared widely, promoting a culture of environmental responsibility beyond the school community.

Students who attend all planned activities will be awarded formative credits.

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Discovering the sea floor

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The project "**Discovering the sea floor**" aims to analyze and discuss the importance of science and technology for understanding the sea floor, a topic covered in the 7th grade, in the Natural Sciences subject.

The arguments presented by Alfred Wegener to defend the Continental Drift hypothesis were clear and well-founded, but the idea of continental mobility was the target of much criticism. It was only after 1960 that advances in science and technology made it possible to study the ocean floor and understand the mechanism capable of moving the continents. It was through the use of techniques such as sonar, robot vehicles and drilling processes (Deep Sea Drilling Project) that it was possible to explore the sea floor and discover its morphology. The sea floor is generally made up of a thick layer of sediment. This layer is made up of sand, silt, limestone and microfossils, and can be up to 2000 meters thick and rests on basalt rock.

To introduce the topic, an enrichment activity was carried out using Google Earth to better understand the dynamics and expansion of the sea floor. The students were able to relate the age of the rocks that make up the sea floor with the distance from the axis of the mid-ocean ridge, concluding that they are older the further away they are from that ridge. A video was also presented explaining the topic covered "Morphology and expansion of sea floors", which served as a starting point for the construction of the proposed project.

The students were separated into working groups, to which a script was distributed with guidelines for the work to be developed. The methodology used by the working groups was the construction of models that allowed a three-dimensional view of the morphology and expansion of the sea floor. To do this, they used various reusable materials such as Styrofoam, cardboard boxes, cardboard, among others. To complement the information on the models, the students carried out research on the instruments and technologies used in the exploration of the sea floor, such as the ROV Luso, a remotely operated vehicle, acquired by Portugal in 2008, within the scope of the Extension Project of Continental Platform of Portugal.

We can conclude that the project work methodology, where students use various materials, instruments, digital tools, relating technical and scientific knowledge, contributes effectively to the development of their learning and skills.

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Exploring the Ocean Floor in the Classroom Through Benthic Organisms

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Exploring the ocean floor by studying benthic organisms offers a unique opportunity to understand marine ecosystems. Benthic organisms, which live on the ocean floor, play a crucial role in maintaining biodiversity, the food chain, and the balance of the marine environment. In the classroom, students can study the unique characteristics of these organisms, such as their morphology, their adaptations to the environment, and their importance to life on Earth.

Additionally, benthic organisms serve as natural records of geological and ecological history. By examining fossils or the chemical markers they contain, scientists gain valuable insights into the Earth's past, such as climate changes and the evolution of life. At the same time, studying their current adaptations to environmental pressures provides evidence about future challenges and changes in ecosystems. Through activities such as simulations, microscopic observations, and data analysis, students develop environmental awareness and scientific thinking, while enriching their understanding of the dynamic relationship between the past, present, and future in the oceans

Keywords: Benthic organisms, Ocean floor exploration, Geological history, Climate change, Environmental education, Scientific thinking, Ecological balance, Marine biodiversity conservation, Classroom simulations

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Water projects for the Year of Geosciences 2024-2025 in DREUX

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Every scholar year, France's national education system joins forces with the National Center of Scientific Research (CNRS) for a themed year in the sciences. 2024-2025 is the Year of Geosciences, and aims to highlight the crucial role of the Earth sciences in our society. The purpose is twofold: to raise public awareness of the importance of the geosciences in the classes (teachers and students), and to inspire the next generation of scientists, professionals and enlightened citizens.

A wide range of activities are offered to teachers and students in all regions: competitions, online conferences, meetings with researchers, teacher training, resources, etc. In the Orléans-Tours academy, our proximity to the Geological and Mining Research Bureau (BRGM) has led to water-related activities in my classes at the Lycée E. Branly in Dreux.

As a first step, we invited a hydrogeologist from BRGM, Dr Géraldine PICOT-COLBEAUX to talk about groundwater in the 10th classes (15-16 years-old). She presented models to show the interactions between surface water, groundwater and the oceans. Students carried out hands-on experiments to understand how groundwater flows, how aquifer are recharged and how groundwater are impacted by our activities. They then turned their attention to their immediate environment, the town of Dreux, and worked on a water-related issue in their region (“Where does my tap water come from?”, “Why were there water restrictions in summer 2023?”)

With the “European” 11th classes (16-17 years-old), where lessons are given in English, we signed up for the “Adopt a Float” project run by the Oceanology Laboratory of Villefranche-sur-Mer. This multi-disciplinary educational program offers students the chance to explore the world's oceans and the importance of studying them to better understand and protect them. By adopting a “profiling float” type underwater robot, students can track the evolution of the ocean's physical, chemical and biological parameters over the course of a school year.

Students from the Lycée Branly have adopted the “Surfin' Dolfin”, which drifts between Australia and New Zealand. With the help of Jack Williams, a PhD student specializing in plankton at the National Oceanography Centre (UK), the students are currently studying the physics and chemical parameters (temperature, pH, pressure, nutrients…) that control the vertical location of chlorophyll plankton over the seasons.

These two projects will be presented as posters in the academy Pos'Terre competition, which aims to decorate the University of Orléans campus with scientific productions from local primary and secondary school students.

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BLUE-Z: Bold Leaders Uniting for a Zero-Carbon Ocean

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The BLUE-Z project aims to engage students in hands-on learning experiences that promote ocean literacy, aligning with the objectives of the EU Mission Ocean. The project focuses on educating participants about critical environmental issues such as water acidification, the importance of analyzing local water bodies, building a Remotely Operated Vehicle (ROV) for underwater exploration, and developing strategies to reduce carbon footprints. Through a series of laboratory experiments, engineering design processes, virtual workshops, and field trips, we aspire to foster critical thinking and real-world applications of science. By emphasizing community involvement and collaboration with local stakeholders, BLUE-Z seeks to cultivate informed global citizens, ultimately making a lasting impact on environmental stewardship, carbon neutrality, and the promotion of sustainable practices within the community.

The project aims to educate students on the causes and effects of water acidification while conducting research to analyze local water bodies' acidity levels and carbon footprints. By building a ROV, students will gain practical experience in engineering and technology, which will be instrumental in collecting water samples for analysis.

Our activities will include a carbon footprint awareness campaign, sustainable transportation initiatives, and the integration of climate education into the curriculum. By engaging local stakeholders such as families, community groups, public authorities, and local businesses, we aim to create a supportive environment for project implementation.

The project is characterized by its innovative approach, employing an integrated learning model that combines academic subjects such as science, math, and engineering with hands-on environmental activities. By empowering students to take the lead in projects and initiatives, we cultivate leadership skills and a sense of ownership over their learning. Additionally, we will implement various communication strategies to promote the project at local, national, and European levels, ensuring visibility and community involvement through social media, newsletters, and local media outlets.

The expected project outcomes include increased ocean and water literacy among students, enhanced collaboration across disciplines, and the promotion of sustainable practices within the school community. By involving multiple classrooms and engaging a diverse group of students, including migrants, we aim to foster inclusivity and highlight the global nature of environmental challenges.

Through BLUE-Z, we envision a generation of students equipped with the knowledge and skills

necessary to address pressing environmental issues and contribute positively to their communities, ultimately aligning with the broader objectives of the European Climate Pact and the Mission Ocean.

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Discovering the sea floor of Atlantic Ocean in Santa Maria island, Azores, Portugal.

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One of the main challenges of practical geology teaching lies in the fact that this scientific area works with very broad temporal and spatial scales, which makes it difficult to observe natural geological processes in a laboratory context and can limit students learning (Agreiro, 2022). In this sense, and in line with the unifying theme of the conference, it is imperative to develop didactic proposals related to the dynamics of sea floor that can be used in practical geology lessons and/or as preparatory activities for a potential field trip, outside the classroom context.

Santa Maria Island, in Azores UNESCO Global Geopark, in Portugal, is one of the prime locations for the study of sea floor outcrops, particularly pillow lavas formed in a geotectonic context of a triple junction – Eurasia, Nubia, and North America – in a magmatic province generated by a hotspot or wetspot underlying the Mid-Atlantic Ridge.

This work proposal is a contribution to promote practical geology activities in the classroom and/or optimize the preparation of an outdoor activity on Santa Maria Island, according to the practical work philosophy of Nir Orion (1993), which advocates the execution of pre-field trip activities (preparation unit) to minimize the so-called “novelty space”, meaning, the impact related to visiting an unknown territory, with many factors leading to distraction and loss of attention, particularly cognitive component, through laboratory experiences simulating natural phenomena that occur in the field (e.g., simulating the genesis of pillow lavas), and geographical component, with information about the geological context of the area to be visited.

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"Samudra Manthan: Exploring the Depths of Knowledge and Responsibility in Indian Education"

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The vastness of the oceans and the mysteries of the sea floor have always captivated the human imagination. At our Cambridge Board School in Jodhpur, Rajasthan, India **"MSS World School",** which currently caters to students from KG to Grades 7, we have embraced this intrigue by designing an interdisciplinary module, "Discovering the Oceans and the Sea Floor." This module integrates concepts from Environmental Science, Geography, and Space Science, fostering curiosity and critical thinking among students.

Our pedagogic approach combines classroom learning with hands-on activities, encouraging active participation and real-world application of concepts. Through interactive lectures and multimedia resources, students explore topics such as ocean currents, marine ecosystems, and the geological features of the sea floor, including mid-ocean ridges and deep-sea trenches. Practical activities, such as constructing ocean floor models using clay and creating simple simulations of ocean currents, allow students to visualize complex phenomena.

Field trips form an integral part of our program. For instance, a visit to a nearby coastal area enabled students to observe tidal patterns and collect samples for further examination. These experiences are supplemented by laboratory activities where students analyze salinity, temperature, and other physical properties of water, fostering a deeper understanding of oceanographic processes.

One of the highlights of our module is the incorporation of technology. Using digital tools and virtual reality applications, students embark on virtual dives to explore coral reefs and hydrothermal vents, bringing the wonders of the deep sea to the classroom. Additionally, collaborative projects, such as creating a digital presentation on marine conservation, instill teamwork and research skills in our students.

This initiative aligns with our school's commitment to holistic and inquiry-based learning, inspiring young minds to engage with environmental issues and appreciate the interconnectedness of Earth systems. By nurturing a sense of wonder and responsibility, we aim to cultivate future stewards of the planet.

The "Discovering the Oceans and the Sea Floor" module not only enriches our students' understanding but also provides a platform for them to present their findings to peers and the community. We look forward to sharing our innovative teaching practices at the GIFT workshop in Vienna and exploring opportunities for international collaboration with educators and researchers.

This abstract is intended to contribute to the EGU meeting's objective of fostering pedagogic exchange and will serve as the basis for a visually engaging poster presentation. Post-conference, the poster will be showcased at our school to highlight these educational activities for colleagues, parents, and students, thereby celebrating the dynamic learning environment we strive to create.

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Discovering the ocean floor: using Earth Learning Ideas

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Ocean waters cover about 71% of the Earth's surface, but with only 25% of the seafloor explored in any detail, scientists claim to know more about the surface of the Moon and Mars than they do about the seafloor of our own planet. And yet the plate tectonic revolution, which relies so much on evidence from the ocean floor, has flourished since the 1960's despite what is 'hidden' beneath the waves.

Our poster provides an insight into some of the free classroom resources from the online ***Earthlearningidea*** website that simulate those technologies used to map the ocean floor and provide the evidence for plate tectonic theory. (https://www.earthlearningidea.com/English/Investigating_the_Earth.html#ocean). It is designed to complement the GIFT 2025 workshop run by our EGU Geoscience Education Field Officers (GEFO) team and to demonstrate the ***Earthlearningidea*** activities that play an important part in the workshops undertaken in our respective countries. It is also presented in fond memory of Professor Chris King who was the instigator and inspiration of this and so many other geoscience education projects in the UK and abroad.

These, and other activities, are available on the ***Earthlearningidea*** website (https://www.earthlearningidea.com/), a free repository containing more than 450 ready to download activities that have been translated into different languages. All are designed to develop students' critical thinking and research skills, while developing their knowledge and understanding of Earth processes and products.

EGU Geoscience Education Field Officers (GEFO) are a team of geoscience teachers and researchers who provide professional development to schoolteachers with elements of geoscience in their teaching curricula, through interactive hands-on workshops. The team is supported by the European Geosciences Union Education Committee and is active in eleven countries around Europe. (https://www.egu.eu/education/).

EGU Geoscience Education Field Officers (GEFO) Team: Pete Loader, Pane Perunovski, Dragos Tataru

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Science for All: Three Years of Promoting Scientific Literacy at EB 2,3 Cego do Maio

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Founded three years ago, the *Clube Ciência Viva Cego do Maio (CCVCM) - the school´s science club* - has served as a dynamic platform to foster scientific literacy among students and the broader educational community. Participation is voluntary, welcoming all students aged 10 to 16, regardless of academic performance, who are curious and eager to learn through collaboration. Students benefiting from specific educational measures are also encouraged to join.

The club's sessions are designed to stand apart from traditional classroom experiences while following a structured weekly schedule. Freedom of expression and creativity are key components, guided by classroom rules and the objectives of planned activities.
The club adopts a project-based learning approach, integrating the STEAM framework (Science, Technology, Engineering, Arts, and Mathematics). Students actively contribute to defining the stages of problem-solving processes. A wide variety of activities enrich their learning experience, including laboratory experiments, hands-on workshops, themed celebrations, educational trips and project development.
This poster showcases highlights from the club's diverse activities over the past three years, illustrating its impact on cultivating curiosity, critical thinking, and teamwork among participants.

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Climate change education in schools of Crete, Greece

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The raise of awareness for the present-day climate change has encouraged schools to undertake actions. This has led to the creation and implementation of education and awareness programs for all ages. This study focuses on the integration of environmental education with a focus on climate change within school curricula, focusing on how effectively climate issues are addressed and the engagement of students in climate action initiatives. Additionally, the study investigates the effectiveness of various teaching methods, such as classroom activities, including hands-on experiments, discussions, simulations and educational visits to the centers of environmental education of Crete (Greece). Moreover, educational activities were taking place at the Research, Innovation and Dissemination Hub at Finokalia (Crete, Greece), where students had the opportunity to participate in the project Teaching and Learning about Climate Change (EDU4clima) carrying out experiments that demonstrate in a simply way the basic concepts that define anthropogenic climate change. This work has been supported by the projects: Climademy (Erasmus+ Climate Change Teachers' Academy) and EDU4Clima (Hellenic Foundation for Research and Innovation), to provide a comprehensive framework where educators can learn how to teach future generation of European citizen on climate change issues.

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A lesson plan for studying natural disaster risk using GIS□Using the perspectives of both natural and human geography□

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Geography is a subject included in the Japanese high school curriculum and must be studied by all students. Japan experiences more natural disasters than any other country in the world, as demonstrated by the Great East Japan Earthquake of 2011. Therefore, the education curriculum in Japan includes the instruction of natural geographical concepts and their utilization in the consideration of natural disaster risks together with a human geographical perspective. In Japan, GIS are available for anyone to use. This allows students in high school geography classes to use computers to consider natural disaster risks in their own areas. In this lesson plan, students first learn about where floods, landslides, earthquakes, tsunamis and volcanic disasters occur. Then, students learn about the mechanisms by which they occur from actual examples. Finally, based on geographical concepts, they use GIS to analyze the disaster risks in their immediate area. Through this lesson plan, students will gain competency in natural disaster generation mechanisms and disaster prevention. We would very much appreciate your thoughts on this lesson plan.

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Lake Ohrid eel “LOVE JOURNEY” to the Sargasso Sea

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Abstract proposal for

GIFT - Geoscience Information For Teachers

Discovering the oceans and the sea floor in class

(poster session)

Esteemed colleagues,

I am pleased to submit my proposal for a poster under the “Discovering the oceans and the sea floor in class” session at EGU25. This work would illustrate how Lake Ohrid’s eel population can serve as a powerful educational tool for explaining marine biology, ocean currents, and key aspects of seafloor topography. By tracing their journey from a secluded freshwater lake Ohrid in N. Macedonia to the Sargasso Sea, my poster will highlight critical ecological processes and foster innovative classroom strategies that deepen students’ understanding of global marine environments. I appreciate your consideration and look forward to the possibility of presenting this compelling study.

Thank you in advance for considering my proposal!

a proposal by:

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January 2025

Title:

Lake Ohrid eel “LOVE JOURNEY” to the Sargasso Sea

A magnificent 5.000 kilometers honeymoon trip from one of the oldest and deepest freshwater lakes in Europe to open depts the Atlantic Ocean in order to procreate!

Abstract:

The Lake Ohrid, having ancient origins and an exceptionally diverse ecosystem, is a sanctuary for numerous European eels. It is in this crystal-clear freshwater environment that they mature into large adults, but from here they begin a journey encompassing sea after sea until eventually they reach the North Atlantic and spawn in Sargasso. The eel's life cycle is the subject of this poster; the route they take- which extends from coastal shelves through submarine ridges and deep basins- provides a clear, real-life model for teaching schoolchildren about sea and Seafloor oceanography.

Through the corridor of eel migration, we can describe key oceanographic processes to students, such as changes in water salinity caused by currents or the diversity of seabed types encountered. In particular, the topography of the seafloor encountered by eels along this route-- from relatively shallow Mediterranean waters to the deep Atlantic basins--offers an interesting context for examining plate tectonics, sediment behavior, and marine biodiversity.

The poster would show major seafloor structures on the route of these eels, depicting how geology, biology, and oceanography are all interlinked in this extraordinary migration. Alongside the factual account, this presentation offers an explanation of how storytelling can improve classroom teaching. By using the migration of eels -- and the seabed they travel over--as a single focus, educators can raise interest in marine geology, species constellations, conservation challenges and indeed the larger connection between freshwater ecosystems and the world's

oceans. This approach embodies the thrust of our meeting by connecting small freshwater landscapes (such as Lake Ohrid in Macedonia) with the broad marine world thus allowing an all-round understanding of how Earth works.

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Teacher on board the deep sea vessel Pourquoi pas ? for SUPER MOUV campaign in Ecuador

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As a biology and geology teacher, I have followed virtually, with some of my students, the HIPER campaign off the coast of Ecuador in 2022-2023, and from the 28th of january 2024 to the 23rd of february 2024, I had the honnor to take part in the SUPER MOUV campaign on the french oceanographic ship *Pourquoi pas ?* off coast of Ecuador.

The scientists left me an additional place on one of the most innovative ship in the Ifremer fleet, in order to spread geology tools use on board in destination to teachers and their students in college and highschool, not only in France but also all over the world in the french schools abroad or the french classes abroad : *http://edumed.unice.fr/data-center/oceano/supermouv.php*

During this campaign, the aim was to prepare some challenges connected to SUPER MOUV activities for schools :

- students can indeed discover geodynamic in Ecuador west coast which is located in the ring of fire, and shaken by several earthquakes due to the subduction of Nazca tectonic plate under south-america tectonic plate,

- they can also discover how rocks or fluids are collected by Nautile submarine, how sediments are collected by coring, how highligths geo-mechanical properties of rocks or methods for fluids analysis,...

- and furthermore, they can learn about life on board a deep sea vessel (way of life, different jobs,..) during videoconferencings between the ship and the pupils in their classrooms !

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Awareness Activities About Ocean Creatures in The Classroom

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The depressions on the bottoms of the seas and oceans contain significant wealth, even though they are far from the continents and are full of plants.Mineral resources such as oil and natural gas can be found in these areas.It can be thought that there is no life in these areas. Because there is no sun there, the temperature is very low and dark. Researchers state that deep sea environments are important. Lava and gases emerging from magma in the deep seas mix with ocean water and contribute to the material cycle. Remote, deep areas that are difficult to reach affect our lives somehow. Researching these areas well helps us understand our planet's formation processes. Hydrothermal vents discovered in these areas are areas on the ocean floor where hot water sources that spurt water and gas are located. These vents, originating from cracked areas on the Pacific Ocean floor, were first discovered in 1977 around the Galapagos Islands. Hydrothermal vents are formed as a result of crustal movements, and the seawater that seeps into the cracks and fissures close to the magma heats up under the influence of the magma.Due to the high pressure at the bottom of the ocean, the temperature reaches several hundred degrees Celsius. When the hydrothermal fluid encounters the colder ocean water, the minerals in the hydrothermal fluid solidify by cooling and begin to accumulate. These minerals, which are deposited in this process, take the form of a vent. These vents contain a wide variety of minerals. The temperature inside these vents can reach a 350-400 degrees Celsius. These vents are significant for heat transfer in the oceans. Perhaps one of the most important outcomes of hydrothermal vents is the existence of deep ocean Creaturess. Thanks to their physical and chemical properties, these vents create suitable environments for chemosynthetic bacteria to thrive. Ocean Creaturess such as crabs, shrimps, starfish, and mussels, which feed on chemosynthetic bacteria, are found in cold and dark areas that are otherwise too deep to support life under normal conditions. In our lessons, we conduct general studies on ocean environments and the diversity of Creaturess living in their depths. We show videos on this subject in the classroom. We have our students draw pictures of ocean Creaturess., and illustrate various marine life. We aim to enhance our students knowledge and curiosity about this fascinating deep-sea ecosystem.

Key Words: Ocean Creaturess, Gifted and Intelligent Students, Class Activities

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STEAM approach for the Climate Change

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Climate change, often referred to as the climate crisis, is a critical factor shaping our modern world. It is vital that the next generation is equipped with a thorough understanding of its causes and potential solutions. In response, our school has developed an interdisciplinary approach that integrates geology-geography, and technology courses to provide students with a comprehensive perspective on the climate crisis.In the Geology-Geography course for B class, students will explore ocean circulation and its influence on global climate, including the role of the seafloor. They will also collaborate with scientists to learn about physical phenomena occurring in the ocean and how these impact climate patterns. Additionally, in the Technology courses for B and C classes, students will utilize advanced tools to track and analyze climate data over time.The goal of this integrated approach is to equip students with a diverse set of learning tools, fostering greater awareness of the climate crisis and its global implications.

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Characteristics of the water in the Adriatic Sea and Lake Ohrid and their comparison

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The Adriatic Sea and Ohrid Lake are located in South Europe. Ohrid Lake belongs to the Republic of North Macedonia and the Republic of Albania. The distance between these water bodies is 110 km. The river Crn Drim flows out of the Ohrid Lake and flows into the Adriatic Sea, connecting the two water bodies.

Pupils from the cities Ohrid and Skopje (North Macedonia), at the age of 10 years, have made investigations about water characteristics of the Adriatic Sea and Lake Ohrid. Pupils from Skopje investigated the water properties of the Adriatic Sea, whereas pupils from Ohrid investigated the water characteristics of Ohrid Lake. There were analyzed several parameters for the two water bodies: physical and chemical characteristics of the water (water temperature, conductivity, pH, transparency, chemical composition) and water movements (waves, currents). The results of the pupil's investigations were presented at the meeting in Ohrid.

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Architects of STEM Ecosystems

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Architects of STEM Ecosystems create unique blueprints that allow educators to explore new strategies and engage all stakeholders in Earth Science. Imperative to these blueprints are STEM collaborations with university/business/industry sectors. These strategies embed research education models, best engineering practices, workforce development, and culturally responsive externships. An exemplary STEM program called *STEM Research and Design* utilizes these foundational strategies. The program provides students with opportunities to explore geologic research methods by analyzing data from the Great Lakes region in the United States. Teacher-student cohorts have worked closely with local universities and businesses to interpret Lake Michigan seafloor mapping data from NOAA Great Lakes Environmental Research Laboratory/Teaching Great Lakes Science. As a result, students developed a relationship between geologic profiles of the seabed, sinkhole data, the amount of chemosynthesis, and the dramatic effects of climate change on Great Lake water levels, impacting a broad range of ecosystems. Moreover, the architectural plan has started to address innovative water clean-up techniques of our Great Lakes in hopes of establishing workforce development for the region's "blue" economy.

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Exploring the sea environment of the Gulf of Patras

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The study of the sea environment is very important for an awareness of environmental issues. With this as a goal, we accomplished an educational project concerning the study of seawater and the pollution from microplastics in the Gulf of Patras in Greece. This study was carried out to the Experimental Junior High School of Patras University in 2021 in the context of the Erasmus Program “Save Water- Save Life”.

The activity was divided into two parts. At the first part our students collected sea water samples from four different sea regions (shore, 30m from the shore, river-mouth, 30m from the river-mouth). The sampling was actualized in four different time periods (autumn, winter, spring and summer) and the students analyzed the samples at the laboratories of Patras University’s departments with the help of stuff members.

At the second part our students began with a literature survey for microplastics and the consequences to the sea environment and proceeded with field activity concerning collecting plastic litter at the seaside of the Gulf of Patras. At the end the students classified the collected plastics according to their type at Patras University’s laboratories and learned more about this topic from university stuff members.

With the above program students obtain knowledge by exploring, analyzing and collaborating but mainly they acquired environmental awareness.

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Teaching Geosciences with open data resources: The Mediterranean Sea

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Geoscience teachers should employ active teaching strategies in their class as they have been shown to improve student learning. Students' performance is enhanced when they can assess their understanding with a variety of activities (Freeman et al., 2011, 2014). Geoscience teachers should encourage the introduction of online components and open data resources (i.e. computational models and simulations, virtual fieldtrips, games/activities) to support geoscience teaching which increases students' ability to visualize and understand complex geologic structures, features, and spatial relationships.

One of these open data resources that offers a vast variety of information on the Mediterranean Sea is the European Marine Observation and Data Network (EMODnet). EMODnet is the European Commission (EC) *in situ* marine data service of the EC Directorate-General Maritime Affairs and Fisheries (EC DG MARE) and offers a data layers catalogue within the European Atlas of the Seas. Therefore, the European Atlas of the Seas displays numerous data layers and thematic portals such as Bathymetry, Biology, Chemistry, Geology, Human Activities, Physics and Seabed habitats among others.

The European Atlas of the Seas and the EMODnet thematic portals have been employed in teaching students in Junior High School about the Mediterranean Sea. The students are arranged in teams and guided through activities in worksheets to access the European Atlas of the Seas and discuss about the Physical Geography of the Mediterranean area (i.e. location, major peninsulas, islands, coastlines). Then, they are directed to access the Bathymetry map of the sea floor and discuss about the morphology and depth of the sea compared to other European seas. With the help of the Tectonic lines map, in the Geology thematic portal, the students are asked to identify and consider the consequences of the movement of the tectonic plates in the lives of the people who live in the Mediterranean area (earthquakes, volcanoes). The students can then be engaged in activities that lead to a deeper understanding of the characteristics of the countries that border the Mediterranean Sea, discuss about the climate and vegetation, find the openings to other water bodies (seas, oceans) and justify the appearance of major ancient civilizations located around the Mediterranean. Thus, a multidisciplinary approach of the topic can be introduced, engaging in activities and discussion about: mediterranean nutrition, climate, Mythology, History, music and even Marine Biology (fish, seagrass meadows), sea temperature and oxygen, water quality and pollution according to the students' interests and needs.

In general, geoscience educators should incorporate computational models and open data

resources in their teaching strategies as students learn better when they are actively engaged in a variety of activities and teamwork instead of traditional teaching methods.

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Introduction to the study of the oceans, at the lower secondary level

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The topic *Discovering the oceans and the sea floor in class* is an exciting one, but challenging in the context where at the lower secondary level it is quite difficult to achieve, taking into account the previous knowledge of 11-12 year old students. And in accordance with the Romanian school curriculum, time is an obstacle, the topic being contained in a maximum of 4 hours. In 5th grade: Chapter *Lithosphere* - lesson *Relief of ocean basins and joints of the shores*, Chapter *Lithosphere* - lesson *Planetary ocean - components and location*, part in lesson *Hydrosphere - characteristics and importance*. And tangentially, the theme is touched on in the 6th grade in the *Natural Resources* lesson.

In the didactic activities carried out in the classroom, I follow 4 directions of work with the students: the ocean - atmosphere interface, the relief of the ocean basins, the joints of the shores, the ocean - a primordial resource for mankind.

The ocean – atmosphere interface: the ocean, the largest element of the Earth's surface, comes into direct contact with the atmosphere, the most extensive geosphere. Even if the ocean remains an enormous uninhabited environment, through the complex and permanent interrelationships between water - air - energy, it is a space of resources that conditions life Earth: it is the very field of emergence and support of life, with an essential role in storing and redistributing solar energy, shaping the climate, the basis of the water cycle in nature and precipitation formation, plus a huge source of food and biodiversity.

Relief of ocean basins can be presented as the mirror of the continental relief. The emphasis is placed on the similarities of the surface appearance and geomorphological evolution, between the underwater and the land relief; but also in completely different forms – ocean trenches, hydrothermal springs, hot spots.

Joints of the shores it represents the water - land interface, with a great diversity of forms, being the consequence of complex tectonics and erosion, but also of accumulation processes - deltas, lagoons, beaches and coastal strips, atolls.

The ocean - a primary resource for mankind: currently the continental shelf is the main hydrocarbons exploitation region, but the ocean is also a deposit of dissolved salts, polymetallic nodules, wave and tidal energy, respectively a huge source of food. To these, is added the role of the ocean in facilitating and developing global transport and trade, as well as coastal tourism.

In the process of discovery - study - understanding, didactic methods must vary from passive ones,

but necessary for understanding the theoretical basis, to active ones, especially brainstorming, problematization method and interdisciplinary comparisons in the field of STEM (Knowledge of the environment, Biology, Physics, Technological education). An important role is played by the use of maps, photos and suggestive figures, satellite images, but also by practical activity - worksheets.

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Sedimentation and erosion on the Aquitaine coastline

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With pupils in Year 10, we carried out a study of erosion and sedimentation processes on the sandy coast of Aquitaine. To understand the phenomena of erosion, the pupils took samples of sand which they then sieved. The collected sediments were then weighed at the lycée in order to study certain characteristics of sediment transport and deposition (dimensions and proportions of different sediment sizes; origin of sediments; sediment accumulation zone and impact on watercourses). They also identified recent evidence of erosion phenomena affecting the Lacanau region (erosion and retreat of the dunes) and current and future developments (construction of dykes, riprap, planting) designed to protect the coastline. This work complemented the activities carried out in class and demonstrated the fragility of the Aquitaine coastline, especially in sandy areas. It also highlighted the need to think about the developments that are essential in the current context of global warming and rising sea levels.

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From Atmosphere to Ocean: Understanding the Chemistry and Consequences of CO Emissions

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Rising atmospheric CO levels significantly contribute to the greenhouse effect and ocean acidification. This rapid increase, unparalleled in geological history, poses a major threat to marine organisms such as corals and mollusks, whose calcium carbonate-based shells and skeletons are highly sensitive to changes in pH.

Ocean acidification is driven by excess atmospheric CO, largely resulting from human activities like fossil fuel combustion and deforestation. While the oceans absorb approximately 25% of this excess CO, helping to mitigate global warming, this process negatively impacts marine ecosystems by altering chemical balances essential for marine life.

Our project aims to investigate the factors influencing pH variation in ocean waters, the methods for accurately measuring these changes, and their biological consequences. To achieve these objectives, we will conduct a series of hands-on experiments in the school laboratory to simulate acidification effects. Additionally, we will delve into the historical study of pH and CO concentration changes over geological timescales, providing students with a comprehensive understanding of the interconnectedness of human actions, environmental changes, and marine ecosystems.

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Some of The Many Roles that Sponges Play in Marine Ecosystems

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Sponges (Phylum Porifera) have adapted to a wide range of ecological niches, from shallow coastal waters to deep-sea environments, where they influence nutrient flow in the environment and the complexity of their habitat. These sedentary species are filter feeders, and affect the water quality by removing suspended particles, bacteria, and plankton via continuous filtering of large volumes of water. This process helps regulate nutrient levels and improves water quality by preventing overgrowth of algae and maintains homeostasis in marine ecosystems, which will consequently affect the productivity of the ecosystem. In addition, the local nutrient dynamics is influenced by the symbiotic relationships between sponges and microorganisms (such as bacteria and algae), which provides essential nutrients or helps break down organic matter. Sponges also provide structural complexity to marine habitats. Their porous structure creates microhabitats for a wide variety of marine organisms. Small fishes, some crustaceans (such as crabs and shrimps) and numerous invertebrate species often seek shelter in sponge colonies, particularly in environments like coral reefs or deep-sea ecosystems, where hiding spaces are crucial for evading predators.

Another role that sponges play in a marine ecosystem is in stabilizing the seafloor. Their ability to attach to hard substrates, like rocks or coral skeletons, helps stabilize benthic environments. The phenotype of sponges helps maintain sediment stability and minimizes the effects of sedimentation, a vital role in preventing habitat degradation.

Sponges play many essential roles in marine ecosystems, but they face many threats from climate change, ocean acidification, pollution, and habitat destruction. These threats can diminish the populations of sponges which can result in disruption of the ecosystem. Protecting sponges is crucial for maintaining the health and resilience of marine ecosystems, as they provide numerous ecological benefits that support the balance of life beneath the surface. Further research into sponge ecology and conservation is essential for sustaining these important organisms and their critical functions in the ocean.

The first step one should take in conservation biology of sponges is education. In the classroom I am taking the approach of learning through research. For this purpose, in the beginning of the lesson, the students are first introduced to the structure and anatomy of the sponges using 3D

models or virtual tours of sponge anatomy to give students a more interactive experience. Then we start with a brief review of their taxonomy. Then the students are divided into groups with the task of creating posters. The posters are about the connection of sponges with other organisms, their role in the ecosystem as well as the challenges and threats (like climate change, pollution, or overfishing) these organisms face and the mechanisms that should be taken to preserve their habitats.

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Study of Marine Fossils from Siberia Extremeña

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The study of fossils from the ocean floor provides valuable information about geological history, past climate changes, and the evolution of marine ecosystems. Extremadura boasts extraordinary geological potential, where fossils play an important role. Their interest and importance are key to understanding the history and paleogeographic evolution of the Iberian Peninsula during the Neoproterozoic and Paleozoic eras.

Siberia Extremeña has fossil records dating back to the Precambrian, specifically the Ediacaran period.

Our research focuses on studying the remains of marine organisms preserved in oceanic sediments. On the fossil beaches of Siberia, we find the earliest metazoan reef builders: *Cloudina carinata*, belonging to the Ediacaran fauna, burrowers like *Daedalus*, arthropods such as trilobites, and brachiopods.

Through the analysis of these fossils, we can reconstruct the environmental conditions of the past. The findings complement paleontological studies of Extremadura, providing insights into the conservation of current marine ecosystems.

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The Role the Iapetus Ocean played in the formation of the Shetland Islands

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Students at Anderson High School have been learning about the formation of different rocks and where these rocks can be found in the Shetland Islands. Many of the rocks found in the Shetland Islands were formed due to the opening and closing of the Iapetus Ocean. A section of this ocean floor can be seen in the eastern parts of Unst and Fetlar. This is an ophiolite where part of ancient oceanic crust and upper part of mantle rocks has been uplifted and exposed above sea level. Shetland is one of the best places in the world to see one, as you can walk through the different layers of the ancient oceanic crust. Therefore, the students at Anderson High School have learnt about the importance of this ancient ocean and how the rocks tell the story of formation of the Shetland Islands. Using the local geology has helped the students to understand complex concepts of plate tectonics.

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Palaeomagnetism at the MOR

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When investigating deep sea environments there are many subjects that are yet to be discovered and as such, creating an enthusiasm for this area of study for students is vital in creating the next generation of explorers and researchers within Earth Sciences. The sea floor plays a prominent role within the curricula of Geology, from discovering marine environments and the formation of sedimentary rocks, the tectonic activities leading to seafloor spreading which in turn contribute to slab and pull and tectonic plate theories, as well as the creation of new rock beds through igneous processes, to name a few.

The seabed creates a story of past eras of Earth's vast history to be interpreted, one of which includes the reversal of the poles. The poster accompanying this abstract provides a hands-on method of demonstrating to students the stripes which appear on the sea floor at the Mid Ocean Ridge and allows students to understand the physical processes which occur for this phenomenon to happen.

Further activities can then follow on from this, allowing students to explore the data and calculate average rate of sea floor spreading for a particular set of data, link to what is happening at the Mid Atlantic Ridge and how this will shape the world in the future.

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Application of knowledge acquired about Tectonic Plates using a Digital Escape Room

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The use of Escape Rooms in teaching helps create a more immersive, interactive and engaging learning experience, which promotes the development of a wide range of skills in students. Escape Rooms are based on challenges that require critical thinking and problem-solving skills. By incorporating them in the educational context, students are encouraged to think analytically and creatively, developing effective solutions within a certain time limit. To overcome the challenges of an Escape Room, students must collaborate and share ideas, skills and knowledge. This promotes teamwork, communication and cooperation-essential skills for the school environment and the job market. By facing challenges in groups and under time pressure, students improve their socio-emotional skills, such as emotion management, empathy and resilience. They learn to deal with frustrations and look for alternatives when faced with obstacles.
The playful and dynamic format of Escape Rooms makes learning more engaging and enjoyable. The game creates an environment of healthy competition, awakening students' intrinsic motivation and increasing their willingness to learn. Instead of absorbing content passively, students are encouraged to engage in active and participatory learning, applying concepts and knowledge in practical and challenging scenarios. This can promote a deeper and lasting understanding of the content.
Escape Rooms require students to analyze information, identify clues, make quick decisions, and adjust their strategies as needed. These skills are fundamental to the learning process, as they foster logical reasoning and the ability to adapt.
Escape Rooms offer an innovative form of assessment, allowing teachers to observe student performance in practical activities, providing a formative assessment that takes into account both knowledge and interaction skills, considering decision-making and problem-solving.
In the poster session I will present a digital Escape Room developed for 7th grade students alluding to the theme of tectonic plates. Here is an example.

Escape Room: "The Mystery of Tectonic Plates"

History: The students are part of a team of geologists who have been given an important mission: discover the cause of a devastating earthquake that occurred in a region close near a geological fault. To do this, they need to uncover clues, solve puzzles and apply knowledge acquired in classes to find the key that will unlock the solution to the mystery before time runs out.

Objective: Students must solve a series of riddles about plate tectonics to find the key that will open the safe containing the solution to the cause of the earthquake and understand how plate tectonics have affected the region.

Digital tools that can be used: Google Forms, Genially e Google Earth

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Fostering Water Literacy and Green Skills through STEM: A Multidisciplinary Approach to Embedding SDGs in Education

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This study investigates the impact of a multidisciplinary project aimed at enhancing water literacy, digital competencies, and STEM skills among secondary school students while promoting Sustainable Development Goals (SDG 6: Clean Water and Sanitation, SDG 14: Life Below Water). The primary research question explored how participation in this project influenced students' knowledge, skills, and attitudes toward water conservation and ocean protection.

A mixed-methods approach was used to evaluate the project's effectiveness. Pre- and post-tests were administered to assess water literacy, consisting of five open-ended questions addressing water resources, oceans, water pollution, and environmental attitudes. Students' outputs, including posters, digital maps, and robotics coding tasks, were analyzed to gauge skill development. Observational data from collaborative activities with European partner schools through eTwinning, along with feedback from teachers and stakeholders, provided additional qualitative insights.

The pre- and post-test analysis showed a significant improvement in students' water literacy, with an average increase of 35% in test scores. Students exhibited an enhanced understanding of the water cycle, water resources, and strategies for mitigating water pollution. Their project outputs demonstrated creative and practical applications of STEM and digital skills, particularly in coding virtual robots for underwater litter collection and designing DIY water filtration systems. Collaborative activities with Blue Schools enriching students' global awareness of ocean-related challenges.

Qualitative findings indicated a notable positive shift in students' attitudes toward water conservation and environmental responsibility. Many students adopted water-saving practices at home and actively promoted conservation messages within their school and community. Activities such as mapping local water quality through sampling and analysis reinforced the importance of addressing local water issues, while robotics coding tasks highlighted the relevance of technology in solving environmental problems.

The results underscore the effectiveness of integrating STEM education, hands-on learning, and international collaboration in fostering water literacy and environmental stewardship. Partnerships with professional organizations, such as the İSKİ Water Filtration Center, provided authentic learning experiences and strengthened the project's impact. Future projects could expand to involve more schools and focus on sustained community engagement to amplify the outcomes.

This project demonstrates the potential of interdisciplinary approaches to embed SDGs into school culture. By equipping students with green skills, fostering collaboration, and inspiring action, it serves as a scalable model for integrating water literacy into education to address global sustainability challenges.

Key Words: Water and Ocean Literacy, STEM. Sustainable Development Goals, Education

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Experimental Investigation of the Effects of Bioplastic Consumption on Living Organisms and Humans in Freshwater

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Introduction: Freshwater ecosystems are of vital importance in supporting the world's biodiversity. However, increasing plastic pollution and uncontrolled use of bioplastics have serious effects on these sensitive ecosystems. This study was designed to investigate the potential effects of bioplastic consumption in freshwater on aquatic organisms and humans with 6th grade students. In line with the "Life in Water" target of the UN 17 Sustainable Development Goals, this project aims to protect aquatic ecosystems and raise scientific awareness.
Purpose: The main purpose of this study is to understand the effects of bioplastic on species in freshwater and to develop students' experimental thinking skills. This study, designed with the STEM approach, allows students to understand the connections between ecology, chemistry and biology.
Development of STEM and Life Skills: This study develops students' scientific research, critical thinking, problem solving and group work skills. While they gain data collection and analysis skills in the experimental process, they develop their communication competencies during presentation. Students also gain sensitivity to environmental issues and develop individual and social responsibility awareness.

Conclusion: This experimental study increases students' environmental awareness by emphasizing the importance of protecting freshwater ecosystems. At the same time, it promotes sustainability awareness in line with the UN 17 Goals. Students are equipped with scientific knowledge and skills and grow up as individuals who have the potential to develop solutions to global environmental problems.
Keywords: Freshwater Ecosystems, Bioplastic, STEM, Sustainability, 6th Grade.

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Analyzing water level changes in Prespa Lake with geospatial tools

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The Ohrid-Prespa lake system, dating back over 4 million years, is the oldest permanent lake system in Europe. This study focuses on Lake Prespa, a transboundary tectonic lake shared by North Macedonia, Albania, and Greece, which has experienced significant water loss in recent decades due to its sensitivity to external factors such as climate change. Historically, Lake Prespa had a mean depth of 14 m and a maximum depth of 48 m prior to the observed decline in water levels. This research examines changes in the surface extent of Lake Prespa and surrounding vegetation from 1984 to 2023 using satellite imagery, including Landsat 5 and 8 (USGS) and Sentinel-2 (Copernicus Programme). Advanced geospatial analyses were conducted to assess water occurrence, change intensity, seasonality, and maximum water extent. These data provide insights into the spatial and temporal dynamics of surface water, capturing inter-annual variability and long-term trends. An integral component of this research involved a practical project conducted with 10th-grade students. Through collaborative efforts, we explored water-level changes in Lake Prespa over multiple periods, applying GIS and satellite technologies to create thematic models of seasonal water variations over time. This initiative not only enriched the educational experience of the students but also demonstrated the capacity to monitor Lake Prespa effectively and analyze the potential causes of its water-level decline. Hence, the analysis shows that Lake Prespa lost 18.87 km² of surface area, or 6.9% of its total surface, decreasing from 273.38 km² (June 1984) to 254.51 km² (July 2023). The most recent imagery from August 2024 shows a surface area of 252.9 km². The rate of water loss was higher in the periods 1987–1993 and 1998–2004, while the lake's surface area has not varied in the last decade. It is crucial for us, as geoscience educators, to integrate advanced geospatial technologies such as GIS, geoinformatics, and remote sensing into our teaching in the geosciences field. By employing these tools, we can provide our students with hands-on experience in applying cutting-edge methods while deepening their understanding of geosciences through analytical and practical approaches. This project proved highly motivational for my students, as it enabled us to utilize new technologies to explore geoscience topics, learn innovative methods, and uncover original data previously unreported. The process not only inspired the students to engage in scientific discovery but also underscored the value of using modern tools to produce new and meaningful research outcomes. Key findings include a simple mapping of persistent water surfaces, areas with intermittent water presence, and the intensity of changes between two distinct time periods (1984–1999 and 2000–2023). Results reveal notable patterns of water reduction, seasonal shifts, and localized variability.

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Education from Before to After Disaster

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FBADEF aims to create disaster awareness and consciousness among children studying in schools affiliated to the Ministry of National Education, to develop measures against disasters and emergencies and to reduce disaster risks.

Organizing informative activities for students, teachers and parents about disasters and emergencies, ensuring their participation in disaster and emergency trainings, drills and supportive practices,

To ensure the development of in-class and extracurricular educational and social activities such as disaster preparedness, health and safety, etc. in schools,

To ensure the development of disaster awareness and awareness by using effective educational materials and methods (Storybooks, Box games, digital materials, etc.) in order to increase disaster awareness in students and raise awareness about the importance of first response

It was aimed to organize a workshop to evaluate the content and program of 'Disaster Trainer with Stories and Games' training. The target audience was determined as pre-school and primary school students. By reaching indirect families, social awareness and change were targeted.

Process,

A ‘GAME CHEST’ consisting of 10 disaster-themed board games was prepared. An ‘Application Guide’ containing achievement-guidelines for the games was prepared.

5 disaster-themed (earthquake, flood, fire, avalanche, landslide) ‘STORYBOOKS’ were prepared. Scenarios of the storybooks were fictionalised through animals and pedagogical tests were conducted. The storybooks were published after receiving approval from publication review institutions and organisations.

The training/seminar content and programme to be used for Storyteller and Game Player Trainer Training was prepared by expert teachers and academicians. The training programme and training content were turned into a guide.

‘Disaster Education with Stories and Games’ programme training was given to 82 representative teachers in all provincial centres in the country. The programme and implementation guide were sent to the teachers.

Through 2460 teachers 198.000 students were directly provided with ‘Disaster Education with

Stories and Games'. Training hours were planned with pre-school and primary school students. Interactive-active participatory book reading and game playing activities were completed in the classrooms.

Each teacher ensured the use of interactive materials with approximately 80 students in 2460 schools across the country. Trainings were organised in 330 schools in earthquake zone provinces.

Less printed materials and more digital materials were used for the preparation, implementation and sustainability of the project. Thus, the project contributed to the national economy and sustainable environmental understanding. Recycled paper and wood materials were used in the preparation of board games.

With the use of project outputs; it is aimed to develop individual disaster awareness about the dangers and risks that individuals may face in disasters that we frequently experience in our country and in the World.

Ensuring the sustainability of the project Project activities are carried out continuously in order to develop disaster preparedness culture. Feedback from students and parents is very positive. Our country has experienced severe earthquakes. As a result, even our earthquake survivor children have implicit gains from storybooks and board games. Children were distanced from disaster traumas in a fun way and gained disaster awareness. Having an implementation manual ensured unity and objectivity in trainings.

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Deep-sea ecosystems under school's radar: linking human increased connectivity with diminished ocean biodiversity

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Given the extensive impact of human activities on the marine environments during the last decades (e.g. climate warming, pollution, and habitat degradation), remote areas such as the little-explored deep-sea ecosystems need protection and long-term stewardship of their goods and services. Deep-sea ecosystems play a crucial role in global ecological balance by connecting with shallow-water and continental productivity, mirroring humanity's increasing dependence on ecosystem services at both, local and global scales. Therefore, to foster a sustainable future, it is essential to educate younger generations about their connection to ecosystems that extend beyond local geographies, e.g. deep-sea biome, its resources, and its services. This can raise awareness about our global limits to growth and inspire a commitment to protecting the legacy of pristine environments.

To address this need, I developed a project with my students to explore humanity's connections to the deep-sea environment. The project aimed to examine the fundamental components and processes that govern deep-sea ecosystems (biological, chemical, physical), and their links to cultural and economic interests (e.g. scientific research, archaeology, deep-sea mining). Students were trained to use Google Earth, GIS resources, data repositories, and virtual imagery to investigate the biodiversity of deep-sea ecosystems in a dynamic and changing ocean environment. They analyzed distribution patterns and assessed the impacts of pollution and global warming on these ecosystems.

The project included independent research, group collaborations, and hands-on tasks focused on marine biodiversity distribution, endangered species, habitat conservation, and the effects of ocean pollution and climate warming on deep-sea life. Students were encouraged to use critical thinking to analyze data, make predictions, create graphs, and draw inferences on the probability of endangered species' short and long-term survival. Students became familiar with the methods and technology used in deep-sea exploration and collaborated effectively to propose innovative solutions to environmental challenges. This multidisciplinary approach integrated knowledge from biology, chemistry, physics, geography, and math with creative activities like role-playing, drawing, 3D modeling, and designing informational leaflets. These activities illustrated humanity's connection to the deep sea, even in areas far from coastlines.

To enhance their communication skills, students used Canva and Prezi platforms to create engaging presentations. They also developed artistic outputs such as posters, leaflets, and models, and engaged in scratch coding and role-playing activities. Knowledge assessments involved

students presenting their findings to peers, emphasizing soft skills like public speaking and collaboration. Projects were evaluated based on the accuracy of scientific information, creativity, originality, and potential community impact. The initiative culminated in a showcase event, where parents, friends, and peers reviewed the students' work and participated in discussions. This experience not only deepened students' understanding of human-driven impacts on deep-sea ecosystems but also equipped them with the skills to become informed advocates for environmental stewardship.

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The discovery of a megalodon tooth on a ferromanganese nodule: An interdisciplinary *Study and Research Path* on the data derived from seafloor exploration.

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A remotely operated vehicle (ROV) has collected a megalodon (*Otodus megalodon*) tooth coated with a manganese crust from a depth of 3090 m in the Pacific Ocean. This surprising find of remains from this iconic prehistoric predator provides a captivating real-world case study to engage students and inspire inquiry into deep-sea exploration.

We present the design of an inquiry-based proposal for a Grade 11 Geology and Environmental Science class, inspired by this recent discovery. The project is based on the *Study and Research Paths* (SRP) as developed within the Anthropological Theory of the Didactic (ATD). This methodology leverages the dynamics of scientific inquiry to foster the learning process. The proposal begins with an open and complex scenario, prompting students to investigate an initial guiding question. This generating question leads to the emergence of derived questions, whose exploration requires students to study and construct new knowledge, as well as develop tools to formulate answers. Furthermore, the proposed SRP adopts an interdisciplinary perspective by integrating mathematical and chemical skills into the geological research process.

By focusing the investigation on the data and knowledge gained from analysing the megalodon tooth and its deep-sea context, students will develop research skills while enhancing their understanding of seafloor geology. In particular, the petrological and radiometric analysis of the surrounding pillow basalts of Early Cretaceous age will lead them to work on the evidence supporting the plate tectonics theory. Other contextualized information, as the tooth's location on the Mid-Pacific Mountains range or the chemical analysis of the ferromanganese crust, will have them inquire about the topography of the oceanic crust and the precipitation of trace elements on these deep ocean environments. Finally, students are expected to critically debate on the potential economic, scientific, and environmental impacts of the exploitation of the mineralogic richness of the seafloor.

In this research, we examine on one hand the conditions that facilitate interdisciplinary collaboration between scientific disciplines, understanding this as a genuine integration rather than mere superposition. On the other hand, we aim to identify the teaching tools that best support this interdisciplinary approach.

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Virtually navigating the ocean using ArcGIS Online and other VR tools

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Integrating ArcGIS Online into the geography curriculum offers a transformative approach to teaching that enhances student engagement, collaboration, and hands-on understanding of geographic concepts. This integration not only modernizes the learning experience but also aligns with contemporary educational needs. While using GIS in education offers numerous benefits, some educators may face challenges in implementing these technologies due to resource limitations or lack of training. Addressing these barriers is essential to maximizing the potential of GIS in geography education.

Bringing the ocean into the classroom, using GIS technology, is just the beginning. The European project "GIS FOR GIST OF EUROPE", a KA220 partnership running from December 2022 to May 2025, aims to revolutionize science teaching by integrating GIS and a holistic approach to climate change. Our project has demonstrated that learning about climate change can be not only informative, but also engaging and relevant to everyday life. Through GIS, we have opened up new horizons in education about our oceans.

Interactive learning with ArcGIS Online promotes an active learning environment where students can explore real-world data, encouraging critical thinking and problem-solving skills. Authentic applications of GIS in marine geography include marine habitat analysis, fisheries management, and climate change monitoring, providing students with valuable opportunities to apply theoretical knowledge in practical contexts. The goal is to cultivate a generation of young people who understand the complexity of global issues and are prepared to take action. GIS provides opportunities to explore credible climate science content and age-appropriate hands-on activities that can be designed to focus on local perspectives rather than just global environments. *https://gis-t.eu/*

StoryMaps allow students to analyze maps based on recent data, improving understanding of coral bleaching, ocean acidification, underwater landform dynamics. Practical applications in the curriculum have at the end of this project for use lesson plans for hydrology, case studies related to climate change in the oceans and on shores and a major course for learning ArcGIS, etc. Geospatial analysis using climate change and urban planning, both from ArcGIS Online and Map Maker generates practical applications of geography. ArcGIS offers comprehensive tools for mapping and examining spatial data, which can be overlaid with AR to illustrate delivery trajectories and environmental parameters.

However, some educators may articulate concerns about the reliance on technological tools in the educational setting. They argue that conventional pedagogical approaches cultivate critical

thinking and interpersonal skills that can be negatively affected in a technology-dominated environment. However, incorporating ArcGIS Online can enhance traditional methodologies by presenting a harmonized strategy that combines both technological resources and critical analytical skills, ultimately enhancing the geographic educational setting.

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Seafloor Mapping and 3D watching Teaching activities

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Starting from the NMEA (National Marine Educators Association) principle *"The ocean covers 70% of Earth, but less than 20% of it has been mapped, observed, and explored"*, I propose to my 9 -11 grade students an education theme from NOAA Ocean Exploration about seafloor mapping. In these lessons, students develop and use models to explore seafloor features; analyze and interpret data to explain how multibeam sonar is used to identify patterns of ocean floor structures; construct three-dimensional maps; and learn how multibeam sonar technology extends the measurement and exploration capacity of modern ocean exploration.

My students could explore in a specific learning activities, underwater feature while combining interactive tools like maps, videos, and expedition logs, and provides opportunity to practice observation and critical thinking skills.

The results of the learning activities and students' assessments will be included in an online collaborative Padlet space.

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Making Climate Change Connections: An Inquiry Into High Resolution Ice Cores and Ocean Marine Sediment Records

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There is little debate that student engagement is essential in the development of lifelong learners — hands-on activities and models play a crucial role in helping students internalize science lessons, especially in the context of earth science. These activities make learning more engaging and when students actively participate in analysis of real scientific data or manipulate models, they are more likely to be curious, to be motivated to explore the subject matter and feel more a part of the scientific process. Models provide a tangible representation of abstract concepts and complex processes. In this exercise, students are exposed to actual data from legacy ocean sediment cores from the International Ocean Discovery Program (IODP) which can then be correlated to major climatic shifts alongside the GISP2 ice core. Promoting collaboration and communication skills, students work together to analyze data, discover relationships and discuss findings — mirroring the teamwork that is involved in scientific research.

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We and the ocean... 209 kms apart.

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Environmental education in Portuguese schools aims to promote awareness and increase the sensitivity of children and young people to environmental and sustainable issues, encouraging their active participation in decision-making and in solving environmental problems. It also aims to encourage the adoption of sustainable practices in everyday life, both individually and collectively. Children and young people are encouraged to develop skills, attitudes and values that enable them to adopt responsible and sustainable behavior towards the environment. To this end, projects are developed, often interdisciplinary, which aim to train aware and responsible citizens, capable of contributing to building a more sustainable and ecologically balanced society.

In the Portuguese educational system, in the subject of Natural Sciences, 7th grade students study the external dynamics of the Earth, describe the landscape around the school, identify some minerals in hand samples of rocks and minerals and relate the action of external geodynamic agents to the shaping of different landscapes, focusing on the Portuguese context. They also study the structure and internal dynamics of the Earth, summarizing information on the Theory of Continental Drift, describing the morphology of the ocean floor and relating the expansion and destruction of the ocean floor to the Theory of Plate Tectonics and the constancy of the Earth's volume and mass.

In the 8th grade, the subject of Natural Sciences covers aspects related to the conditions necessary for the existence of life on Earth, exploring the dynamics between the Earth's subsystems, allowing for a plural and unfinished scientific interpretation of the evolution of life on the planet and recognizing the importance of scientific knowledge in promoting the sustainability of planet Earth. The aim is for students to become aware of the impact of human intervention on the Earth and the need to adopt active and fair citizenship behaviors that are consistent with sustainable development. Another aim is to interpret the influence of some polluting agents on ecosystems, starting from local or regional problems and critically analyzing the results obtained.

The D. Afonso III School Group in Vinhais and the Abade de Baçal School Group in Bragança, are located in the north of Portugal, more than 200 kilometers from the coast. The students in these schools have sporadic contact with the ocean, often restricted to the summer holidays and when they go on field trips to the coast. The 7th and 8th graders were challenged to think locally in order to act globally: to what extent are they really aware that their actions, in a region so far from the coast, actually have an impact on the ocean? Does sea pollution have any impact on the daily lives of residents in the municipalities of Vinhais and Bragança?

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Educational Resources from The Geological Society: helping learners understand key geoscience concepts to discover the ocean and sea floor

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The Geological Society's Education team are dedicated to inspiring the next generation of geoscientists through innovative educational resources as well as creative and welcoming outreach initiatives. This poster presentation will highlight the range of free, accessible resources designed to support teachers engaging students with key geoscience concepts, focusing on new and improved resources that illustrate the oceanic carbon cycle and plate tectonics.

Our digital resources, curriculum-aligned teaching materials, and hands-on activities aim to foster inquiry-based learning and critical thinking skills. Through our educational resources we strive to nuture a deeper understanding of geoscience among young learners while also empowering teachers with the tools and knowledge they need to inspire their students in the classroom.

This presentation will showcase the breadth of relevant teaching resources available to educators across Europe and open the discussion of strategies for integrating them into classrooms to continue to build a more geoscientifically engaged generation.

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Simulatión of crystallization on the Mediterranean sea floor in the Messinian:

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Introduction

A crystal is characterized by a highly ordered internal structure, which manifests itself externally in flat and well-defined faces [1]. This internal order is the result of a repetitive arrangement of atoms, ions or molecules.

Approximately 5 million years ago, the Mediterranean Sea experienced a drastic reduction in its level, an event known as the Messinian Crisis [2]. During this period, large thicknesses of salts were deposited on the sea floor, the result of the evaporation of water and the subsequent crystallization of dissolved minerals (carbonates, gypsum and soluble salts).

It is well known that a practical method to obtain crystals in the laboratory is through the drying of a brine [3, 4]. In this work, an experimental activity is proposed to simulate, on a laboratory scale, the conditions that led to the formation of these saline deposits present in the Mediterranean Sea. Through this practice, high school students will be able to understandthe principles of crystallization and the methods of crystal synthesis in a deeper way, some of which are evaporation crystallization, crystallization from a solution and gel crystallization [4]. In addition, the relevance of crystallization in large-scale geological processes will be studied.

Objectives

· To understand the process of crystallization in nature

· To simulate and learn about extreme sedimentary environments

Secondary objectives

· To practice obtaining pure substances in solution.

· To separate substances in the form of crystals

· To prepare students for undergraduate studies

Materials and methods

Materials: oven, stove, hot plate, microscope, binocular magnifying glass, precision balance, stirrer, beakers, crystallizers, watch glass, glass rods, thermometers, mortars, bunsen burners, distilled water, calcium carbonate, calcium sulfate, anhydrite, common salt, Himalayan salt, magnesium,

iron, potassium and gels.

Methods: Use of different techniques to crystallize substances soluble and insoluble in water: Crystallization by evaporation, crystallization from a solution and gel crystallization [5]. To carry out the crystallizations, the following procedure is generally followed: Preparation of the solution: the desired amount of substance is weighed on a scale based on its solubility, and is added together with the necessary volume of water to a container to heat the mixture with intermittent stirring.

Conclusion

By using different crystallisation techniques, materials and working conditions, different substances will be created and they will reflect the deposits that originated in the Mediterranean Sea 5 million years ago. In addition, the influence of certain factors such as the density of the nuclei, the degree of supersaturation, the presence of impurities, the available space or the cooling speed on the shape and size of the crystal will be studied.

Likewise, through the study of the most relevant evaporite rocks of Andalusia, with special mention to the Pulpí Geode in Almería and the gypsum of Sorbas, their economic importance will be revealed.

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Exploring sea-floor by means a live video broadcast from the Joides Resolution research vessel: a unique experience for middle school students.

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This study examines the educational effects of live video broadcasts from the JOIDES Resolution research vessel as a means of engaging middle school students in ocean exploration. By providing real-time footage of sea-floor investigations, students were immersed in an experience that broadened their understanding of marine science, geology, and scientific methods. The broadcast enabled students to observe fieldwork, ask questions, and interact with scientists, sparking curiosity and advancing STEM education. The findings underscore the potential of live-streaming technology as an innovative tool to bring complex scientific research into classrooms, offering students a hands-on learning experience without leaving their schools. The results suggest that such experiences can inspire the next generation of scientists and strengthen their connection to global scientific efforts.

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Discovering the Floor of Lake Van

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Lake Van ranks fourth in the world and first in Turkey in terms of surface area. It is also the largest soda lake globally, with a surface area of 3,614 km² and a volume of 607 km³. The lake, which is 600,000 years old, has a pH of 9.8. Due to its vast size, locals often refer to it as the "sea" rather than the "lake." Only a few organisms inhabit the saline-soda waters of Lake Van. Among them, the endemic pearl mullet is the most well-known. A limited number of plankton species also live in the lake.

Another fascinating feature of the lake is its large formations resembling coral reefs, called "microbialites." These rock-like structures are formed by photosynthesizing cyanobacteria and certain microalgae that precipitate calcium carbonate from the surrounding water. While microbialites were once widespread on Earth millions of years ago, they are now found in only a few locations. The microbialites in Lake Van are the largest in the world, ranging in size from 30 cm to 18 meters and located at depths of 1.5 to 22 meters. Prof. Dr. Mustafa Sarı and his team from Van Yüzüncü Yıl University have documented water discharge from the microbialites, a phenomenon previously only theoretically known.

In 2018, a new fish species measuring 5 cm in length was discovered living on a microbialite in Lake Van. Named "Lake Van Small Coral Fish," this species was first identified by the Van Provincial Gendarmerie Command Underwater Teams.

Other notable discoveries include a Russian shipwreck and submerged cities on the lake floor. Lake Van has also been impacted by global warming and a reduction in its surface and groundwater inflows. Recent years have seen significant water receding, revealing microbialites and underground cities.

In a project under my supervision, we are studying the effects of global warming on Lake Van, with ongoing research as of this date. Additionally, the basin where Lake Van is located, the Nemrut Caldera, has the potential to become a UNESCO Geopark, with related efforts currently underway. My students are also conducting SWOT analyses regarding this potential.