



## Rocks around us / Exercise booklet for pupils

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### NEED project

This exercise booklet is made by the University of Eastern Finland and the Finnish Stone Center in the NEED project. NEED is a transnational cooperation project between Finland, Norway, Iceland and Ireland and is a part of the Northern Periphery Programme 2007-2013.

The main goals of the NEED project are the following: (a) to review geological knowledge, (b) to produce study modules and educational materials, and (c) to develop inspiring learning environments based on geo-scientific knowledge.

**The Finnish Stone Center** the meeting place of science, art and modern stone industry. The Center is a unique visiting place and a multifaceted learning environment. It offers a possibility to gain geo-scientific knowledge in an expertly build, experiential learning environment.

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### Page 3: **Rocks around us**

Welcome to a journey into the world of rocks!

Did you know?

A geologist Tiina Kivinen sees a lot of rocks and stones in her work. When she prospects for ore, she heads to the forest, walks in the terrain and explores rock exposures and boulders. She also takes samples using a hammer or a small drill. If the intended samples are situated deeper in the bedrock, she and her co-workers use rotary-drilling rigs to get some core samples.

Tiina examines the core samples, often using a microscope. She examines rock types, minerals, ore minerals and ore contents. She also measures ore sample's magnetism, takes a photo of it, labels it, and adds findings into a database.

Tiina thinks that her work is interesting and varied. She works with different databases and uses maps. Her class-mates from university examine earthquakes, volcanic eruptions and plate tectonics. They can also explain how lakes and mountains form.

### Page 4: **What rock is and where is it used?**

Make a mind-map about 'What rock is and where is it used'.

Page 5:

Observe the surroundings. Where are rocks used and which objects are made of rocks?

How could you classify the ways that rocks are used?

Page 6: Welcome to the Finnish Stone Center!

### **Rocks around the world**

Study the posters illustrating stone buildings and monuments around the world. Choose one that you find interesting. Which one did you choose?

Imagine that you stand in front of the chosen building or monument. What can you see and hear around you?

Seek information about the building or monument in the Internet. Find out, when and why it has been built and what rock it is made from. You can also draw a picture of it.

## Page 7: **Rocks in interior decoration**

Examine Finnish natural stones. Which one of them would you use for a kitchen countertop? Why?

Which surface processing type would you choose for your countertop? Why?

How can rocks be used in interior decoration?

Design an interior decoration product made of stone. Draw a picture of it.

## Page 8: **What kinds of rocks exist?**

When a geologist examines and identifies rocks, he/she pays attention to the structure and exterior features of rocks.

Examine rocks and fill in the table.

Rocks to examine: granite, vulcanite, gneiss, soapstone, sandstone.

Features to examine: grain size, stripes, layers.

## Page 9: **How are rocks formed?**

The structure and exterior features of rocks give clues as to how rocks are formed.

Fill in the table. Link each rock to the right rock type group.

Rocks: granite, vulcanite, gneiss, soapstone, sandstone.

Rock type groups: igneous rocks / plutonic or intrusive rocks, igneous rocks / volcanic or extrusive rocks, sedimentary rocks, metamorphic rocks.

Below Earth's crust, rock materials are liquid. The liquid rock material, magma, sometimes moves upward towards Earth's surface. In doing so, it cools. When magma solidifies and crystallises under the Earth's surface, it takes a very long time, millions of years.

Below Earth's crust, rock materials are liquid. As it erupts from a volcano, the liquid rock material, magma, cools and solidifies quickly into crystallised extrusive igneous rock.

In the process of mountain folding, sedimentary and igneous rocks are buried deep into the crust. Due to high temperature and pressure, their structure and texture form. This phenomenon is called metamorphosis.

Rocks that are exposed at the Earth's surface erode due to the forces of wind rain, snow and ice. The weathering rock particles migrate and stratify on the sea bed. The weight of the upper layers pressures the lower layers into sedimentary rock.

Did you know?

In the mountain folding process, high temperature and pressure transform granite to gneiss.

## Page 10: **What do rocks consist of?**

Rocks consist of \_\_\_\_\_

Geologists use different methods to identify minerals. They examine features of minerals, such as hardness, streak and color.

Did you know? Mineral is naturally occurring crystallised material, such as quartz. Minerals consist of chemical elements like silicon and oxygen.

## Page 11: **Examining minerals**

Examine samples of minerals A-F and fill in the table.

Features to examine: metallic luster, hardness, color, color of streak, magnetism, mark on paper.

Study the identification table. Name the minerals. (Minerals are the following: talc, quartz, feldspar, biotite, magnetite, graphite.)

Try to scratch the minerals with other minerals. What do you notice?

Equipment for examining minerals: a steel spike, a loupe or a magnifying glass, a magnet, porcelain, glass, paper.

## Page 12: **Granite's minerals**

Compare the minerals examined in the previous exercise. Conclude what granite consists of.

Granite is usually red, but it can be brown or dark or light gray. What causes the variation?

### **Use of minerals**

Where and in which products are minerals used?

Minerals: talc, quartz, feldspar, biotite, magnetite, graphite

## Page 13: **Where are granite and soapstone used?**

Where is granite used? Why?

Where is soapstone used? Why?

Where is granite mined? Why?

Where is soapstone mined? Why?

Did you know?

Granite is the national rock of Finland, and soapstone is the provincial stone of Northern Karelia.

### Page 14-15: **Use of geological materials**

Man uses geological materials widely. Everything that does not grow, is made of materials in the Earth's crust.

Link raw materials to their right uses.

Chemical elements: iron, copper, aluminum, zinc

Bedrock and soil: moraine, gravel, sand, bedrock

Materials on page 14: brick, glass, tile, plastic, granite, soapstone

Materials on page 15: steel, concrete, rubber, plastic

### Page 16: **How are raw materials used?**

What is common to these pictures?

Find out how many kilos of the following elements a Finn consumes in his/her lifetime: copper, iron, aluminum. In which products are these elements used?

What are symbols of these chemical elements?

Discuss the following topics:

Should the consumption of raw materials be reduced? Why?

How could the consumption of raw materials be reduced?

How can you reduce the consumption of raw materials?

### Page 17: **What do geologists do?**

Study the posters illustrating geologists at work. Also, read about the working day of Tiina Kivinen (on page 3).

What do geologists do?

What kind of equipment and tools do they use?

What kind of information do they need in their work?

What kind of environment do they work in?

Find out what other professions relate to stones?

Page 18: **Written in stone**

Rocks are also used in arts. Rock paintings are an ancient way to utilize rocks. Important things and events have been documented and illustrated on cliffs and rocks for thousands of years.

What message have the painters of this picture wanted to mediate?

Study the Finnish rock paintings. Where are rock paintings made? Why are they made? How are they made?

Page 19: **Rocks and geological materials in your locality**

What is the nearest quarry or mine to your locality?

What is quarried there?

What products are made from the quarried material?

What is the provincial stone of your locality?

What is it used for?

Why do you think it is chosen for a provincial stone?

Page 20: **What did I learn?**

Make a mind-map about what rock is and where it is used.

Compare this mind-map with the one you made in the beginning (page 4). What new you have learnt?

What helped you to learn?

What more would you like to learn about geology?

Page 21: **Summary**

Imagine that a delegation from planet ZYX66 has landed on Earth to explore the conditions. They are very interested to know how we use rocks and what is their significance for our planet. Write a report for them.

Page 22: Rock cycle and formation of rocks

Page 23: Bedrock of Finland

- Archaic bedrock; metamorphic and plutonic igneous rocks, age 3500–2500 million years
- Metamorphic sedimentary and extrusive igneous rocks, age 2400–1900 million years
- Plutonic igneous rocks, age 1930–1850 million years
- Young plutonic igneous rocks, age 1650–1540 million years
- Sedimentary rocks, age 1200–600 million years
- Rock types in the Kaledonides, age 450–400 million years