

EXCAVATION KIT

DIGIT! ROCKS

REAL MINERALS

THAMES & KOSMOS

Contents

© 2012, 2013, 2017 Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart
This work, including all its parts, is copyright protected. Any use outside the specific limits of the copyright law without the consent of the publisher is prohibited and punishable by law. This applies specifically to reproductions, translations, microfilming, and storage and processing in electronic systems and networks. We do not guarantee that all material in this work is free from copyright or other protection.

Project management: Dr. Mark Bachofer
Text: Ruth Schildhauer, Dr. Rainer Köthe
Illustrations, layout, and typesetting: Frieder Werth, Horb
Photos: 123dartist (crystal background), Bertold Werkmann (crown), flytime (panning), lantapix (tumbled quartz), Digipic (aventurine), Edith Ochs (rose quartz), EGORK (jasper), jonnysek (amethyst), Umjb (limestone), theartofphoto (quartz crystal) (all previous ©fotolia.com), Creativ Collection (geode) all other photos F. Werth, Horb.

1st English Edition © 2017 Thames & Kosmos, LLC, Providence, RI, USA
Thames & Kosmos® is a registered trademark of Thames & Kosmos, LLC.
Editing: Camille Duhamel and Ted McGuire;
Additional Graphics and Layout: Ashley Greenleaf and Dan Freitas; Translation: David Gamon; Copy editing: Dorothy M. Taguchi, PhD, of The Linguistic Edge
Distributed in North America by Thames & Kosmos, LLC. Providence, RI 02903; Phone: 800-587-2872; Web: www.thamesandkosmos.com
Distributed in United Kingdom by Thames & Kosmos UK LP. Cranbrook, Kent TN17 3HE; Phone: 01580 713000; Web: www.thamesandkosmos.co.uk
We reserve the right to make technical changes.
Printed in Thailand / Imprimé en Thailand



1. Excavation block with gemstones hidden inside:

- a. Quartz
- b. Aventurine
- c. Rose quartz
- d. Red jasper
- e. Amethyst

2. Hammer

3. Chisel

4. Sponge

You will also need newspaper, water, a small bowl, paper towels, and a small ruler.

If any parts are missing or defective, please contact Thames & Kosmos customer service.

630447-02-241017

Dear Parents!

Please provide your child with assistance and support when excavating the minerals. Before starting the experiments, read through the manual together and be sure to follow it. That way, nothing will stand in the way of a successful dig. Please be careful not to let any parts of the kit get into the hands of small children, especially the plaster pieces that are left over after excavating. These can be disposed of in the household trash.

Safety Notes

WARNING. Not suitable for children under 7 years. For use under adult supervision. Read the instructions before use, follow them and keep them for reference.

This kit contains functional sharp edges or points. Do not injure yourself!

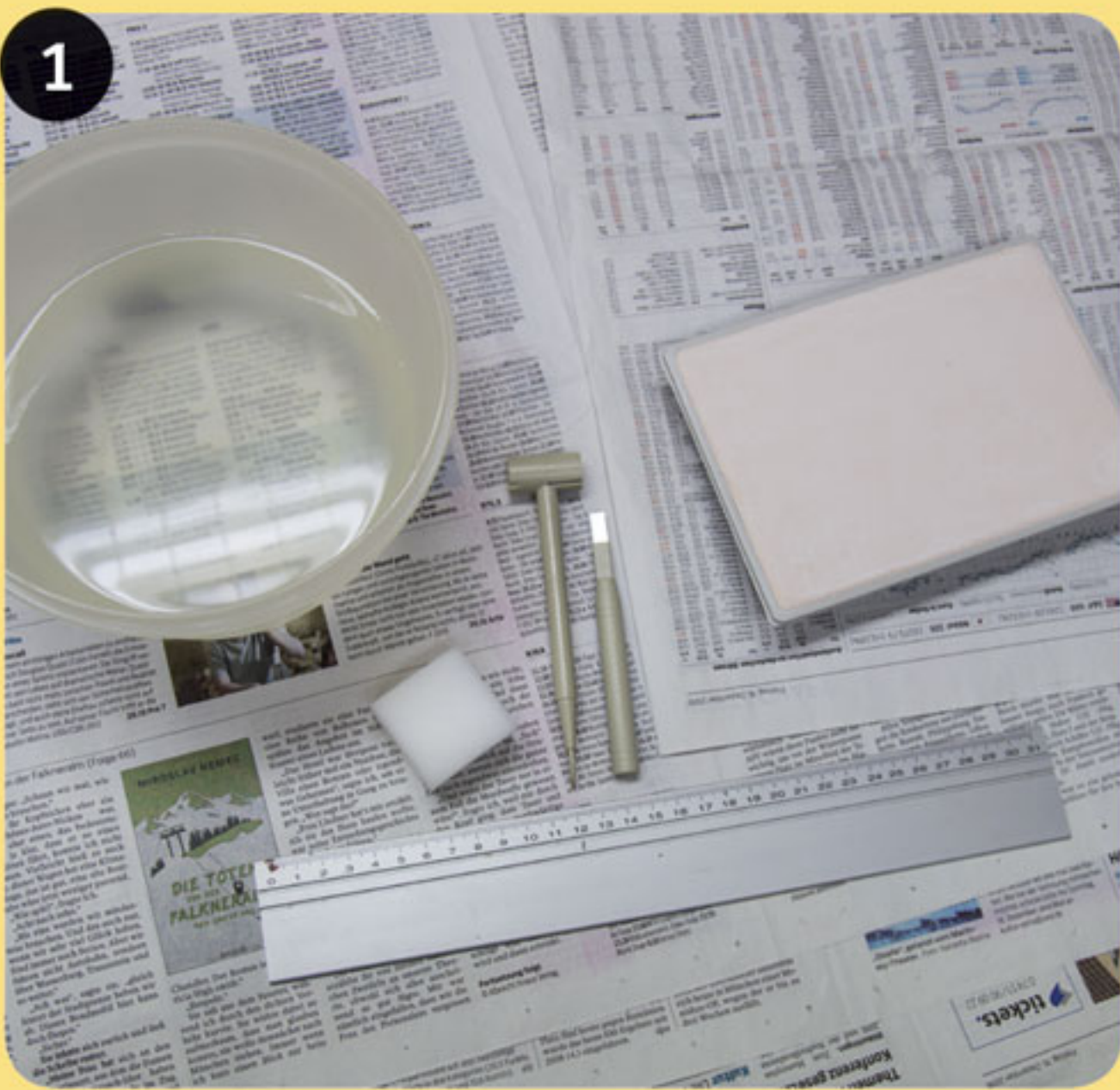
WARNING. Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.

Follow the instruction manual when performing the excavation. Keep small children and animals away from the experiment area. Do not eat or drink at the experiment area. Process the plaster block slowly and moisten it to prevent the formation of chips and dust. Do not place the plaster material in mouth or eyes. Clean all equipment and the work area after use. Wash your hands after the experiment.

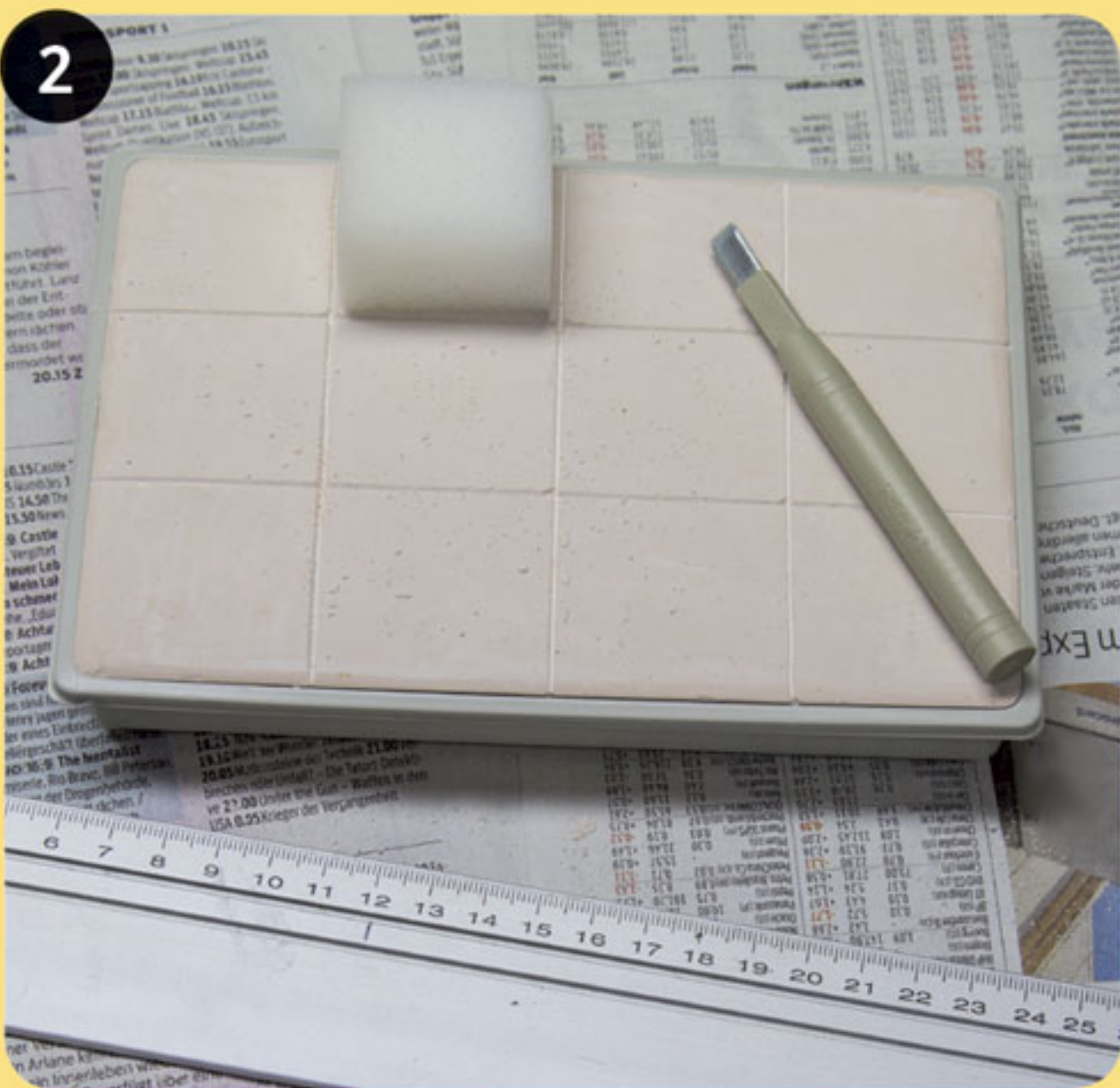
Keep the packaging and instructions as they contain important information.

Excavating

1. Start by looking for a suitable room where it won't matter if a few bits of plaster fall here and there, and that won't be harmed by a little dust and water. Make sure you have sufficient space available on a level, sturdy table, which you should cover with a few layers of newspaper to protect the surface. Get the excavation block and tools ready, along with a small bowl of water. You will also need a small ruler.

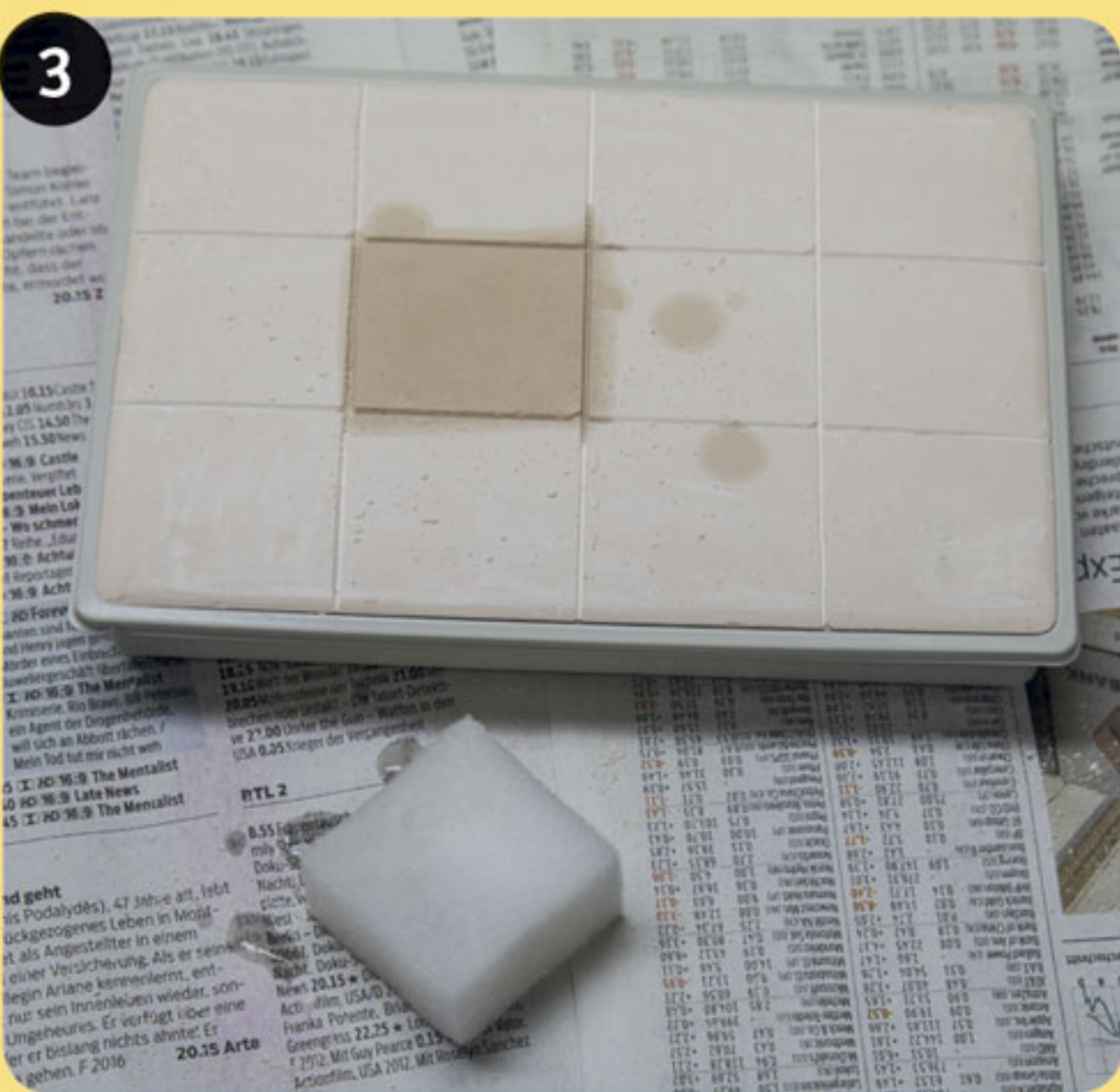
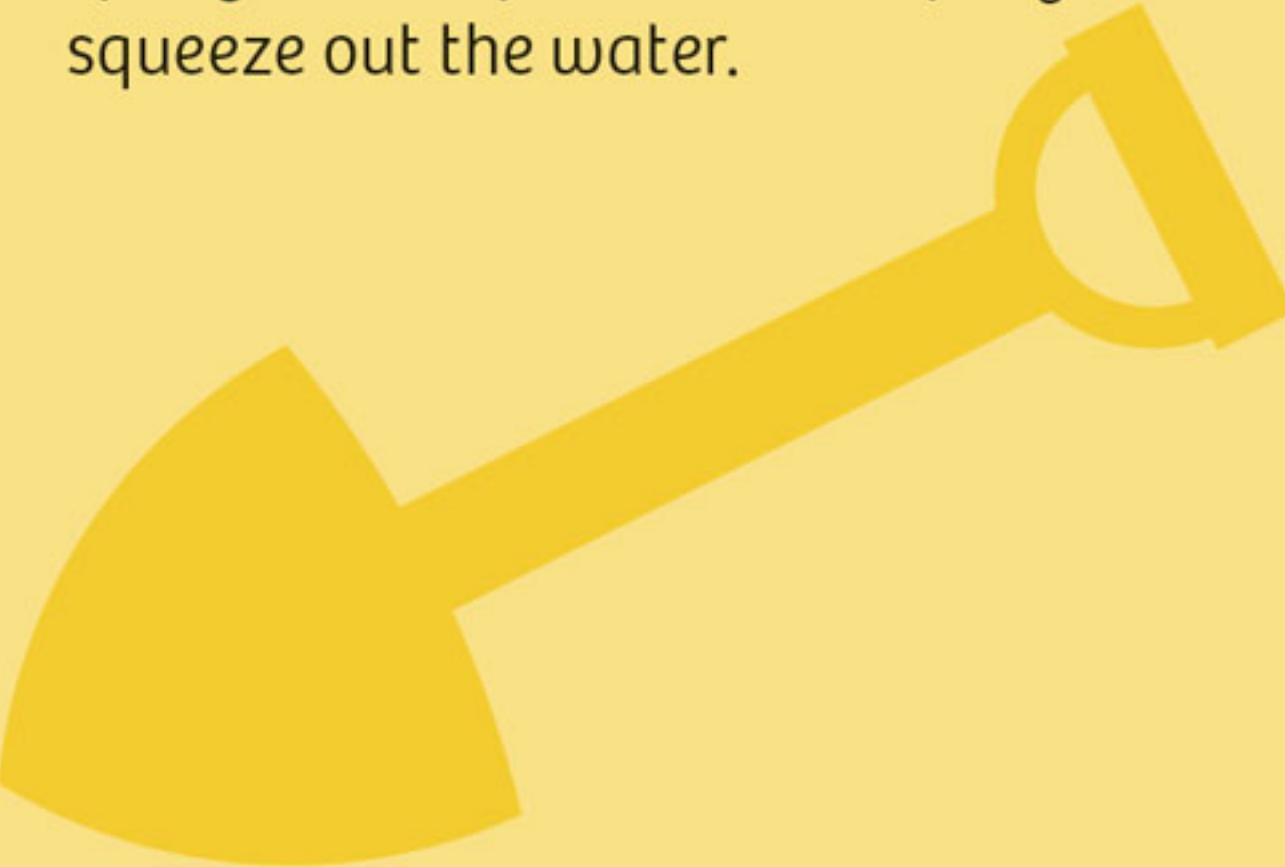


2. As you excavate, you can pretend to be a geologist, which is a kind of scientist who studies rocks. Divide your site into squares by placing the dry sponge on the plaster block. Use the chisel and ruler to carve a grid pattern into the surface. The individual squares should be about the size of the sponge.



Excavating

3. Start your excavation in any square that you like. First soak the sponge with water in the bowl. Then place the sponge on a square and carefully squeeze out the water.



4. The water will turn the plaster in the square quite soft, so you can easily scrape off the surface with the chisel. When you come to harder spots, keep digging carefully with the hammer and chisel. As soon as you come across a find, try digging gently all around it. You may have to moisten the layers of plaster again with the sponge.



5. Next, continue step by step in the same manner with the other squares — until you have excavated all the minerals.

6. Once you have dug up all the gemstones, clean off any plaster still clinging to them. Rinse them one by one under running water while rubbing their surfaces with the sponge. It's best to put the stopper in the drain so you don't lose anything. Finally, dry off your finds with a paper towel.



After excavating and cleaning your minerals, wash your hands thoroughly and clean the work area. Dispose of the newspaper along with any bits of plaster in the household trash.



TIP! Sometimes, you might encounter a few surprises as you excavate. For example, there might be two small pieces of one type of gemstone instead of one larger piece, maybe even covered with a seashell!

Check It Out

WHAT ARE MINERALS?

The solid crust of Earth on which we live consists primarily of rocks such as granite, basalt, sandstone, and limestone. These rocks are formed from materials with a certain chemical composition and are known as minerals.

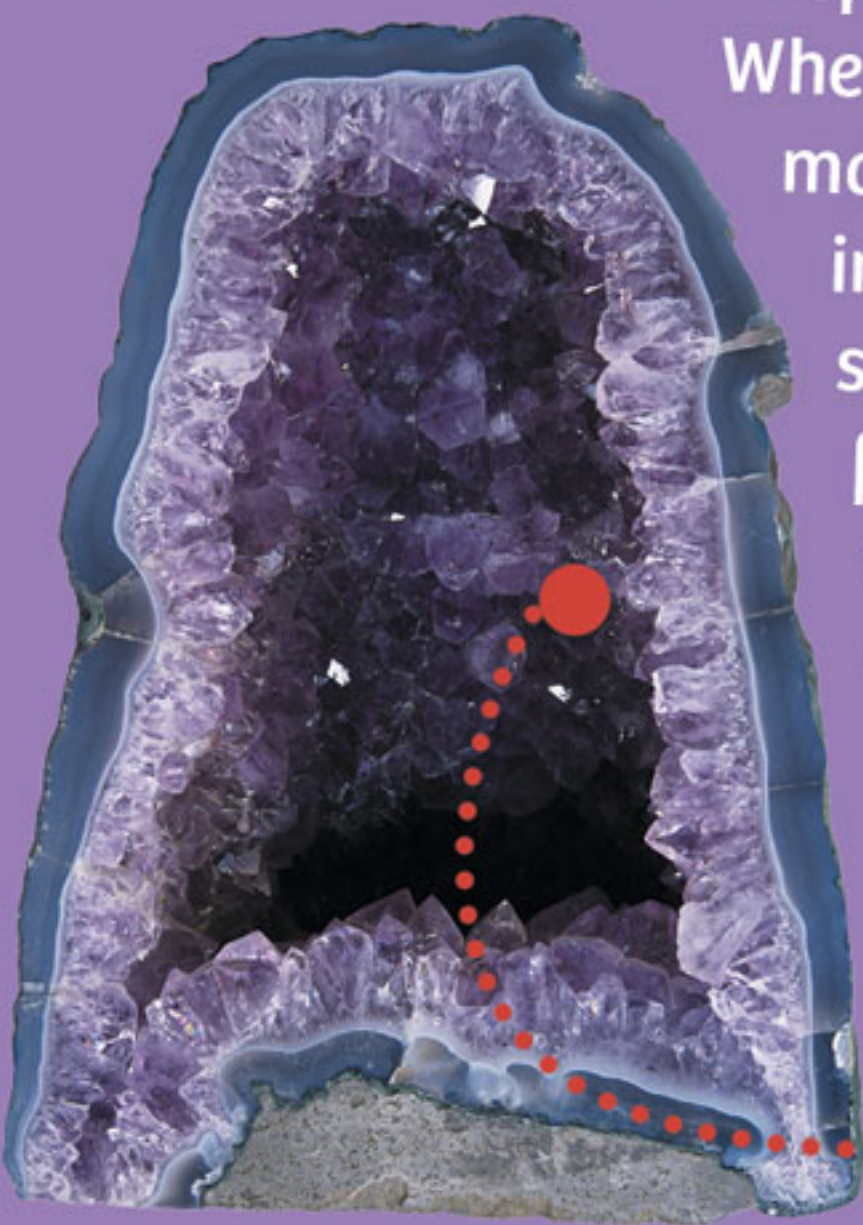
Some minerals, such as **limestone**, are very common. Others, such as diamonds, are exceptionally rare because they only form under certain unusual conditions. There are over 4,000 known minerals. Some contain important **metals**. For **ores** such as these, iron, copper, or aluminum can be obtained. Others serve as **raw materials** in the production of glass, computer chips, or lithium batteries, or in the chemical industry, for example.



HOW MINERALS ARE FORMED

Rock components can be transported through layers of earth in magma from volcanoes or hot subterranean **water currents**. When that happens, they may experience strong **changes in pressure** and **temperature** and come into contact with various other elements. This gives rise to chemical transformations.

When these mineral materials collect in hollow spaces such as fissures or crevices and come to rest and cool there, they can form beautiful **crystals**.



GEMSTONES

Many minerals are particularly collectible because of their beauty.

Some glow in bright colors. Especially beautiful stones are used to make jewelry and are known as gemstones.

Only the most rare, hard, and transparent minerals bear the name "precious stone." Since long before our time, these have filled the treasure chambers of great rulers and, when cut and polished, adorned the **crowns** of kings and queens.



WHERE MINERALS ARE FOUND

Sites where minerals can be found are often in the mountains. Wind, frost, and rain gradually weather the rocks there and carry them off. Fissures, crevices, and hollows appear at the surface, where the minerals can be discovered. If these stones and minerals are carried off by **mountain streams and rivers**, they may settle in quieter spots in the valleys below. These deposits may, over the course of millions of years, solidify into new rocks. When mineral deposits such as these are found, tools, machines, and sometimes even dynamite can be used to open and clear away the rock in order to get to the minerals lying beneath them.

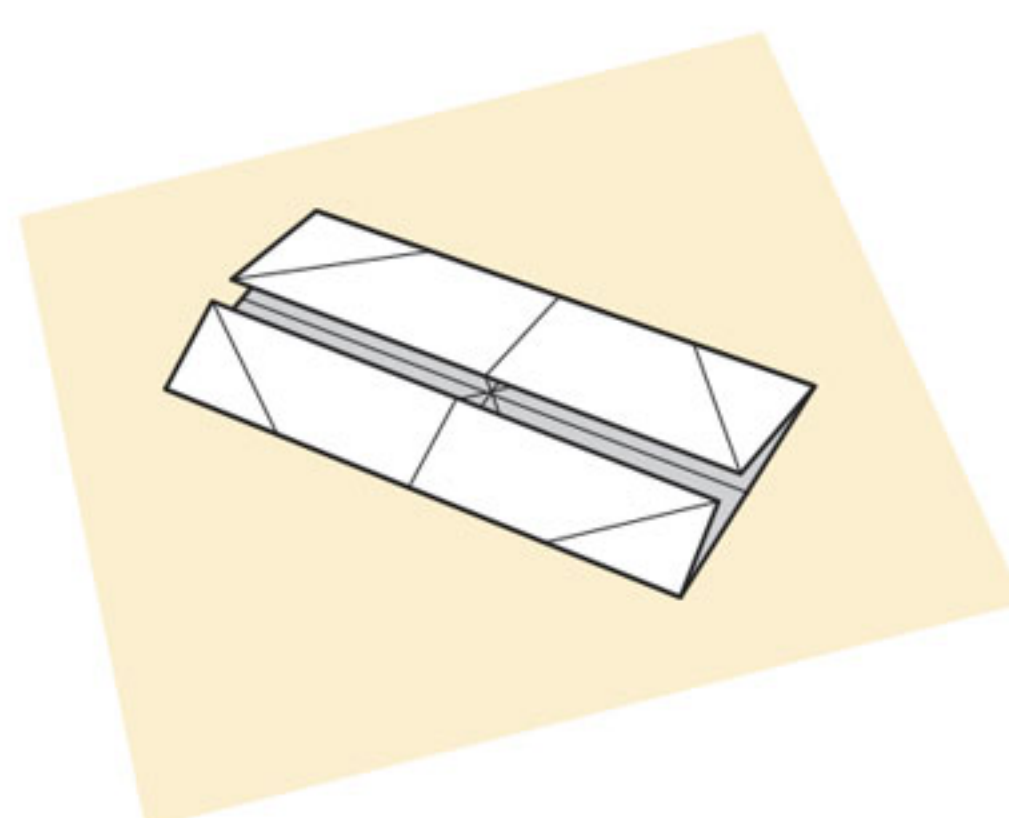
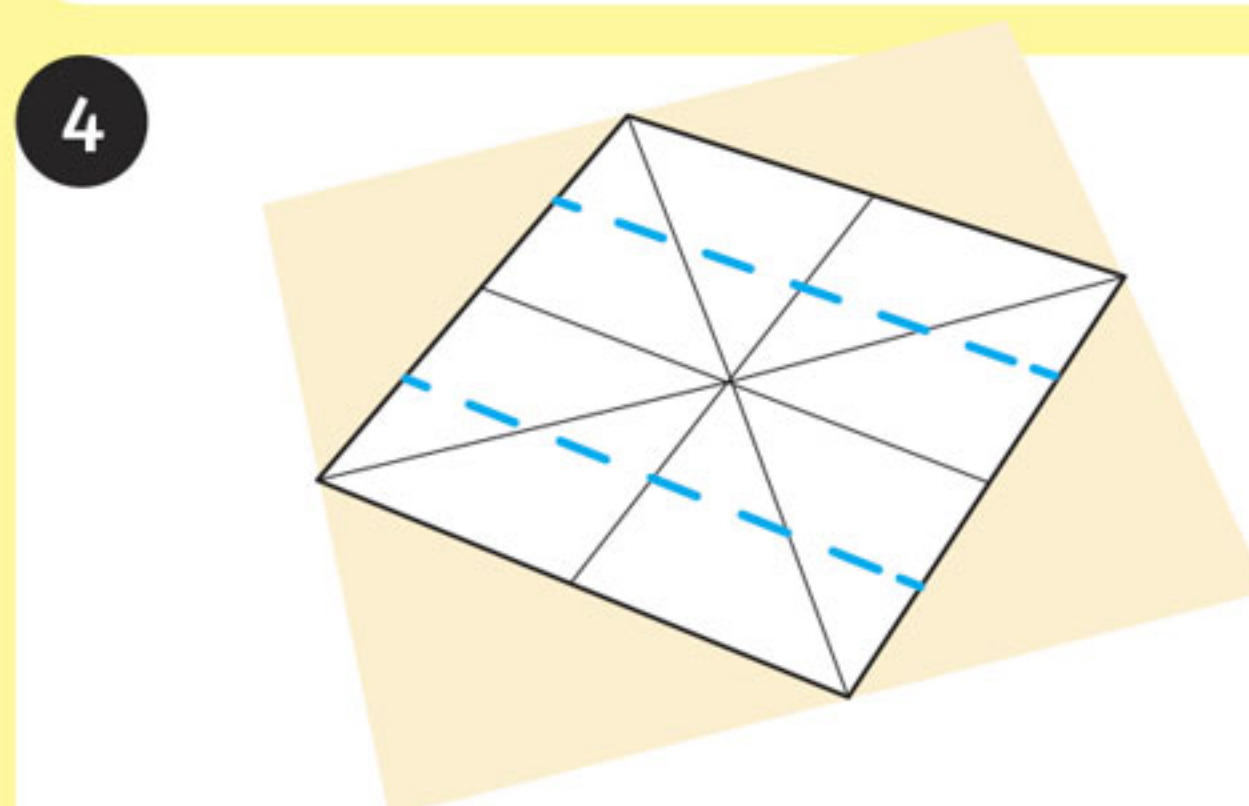
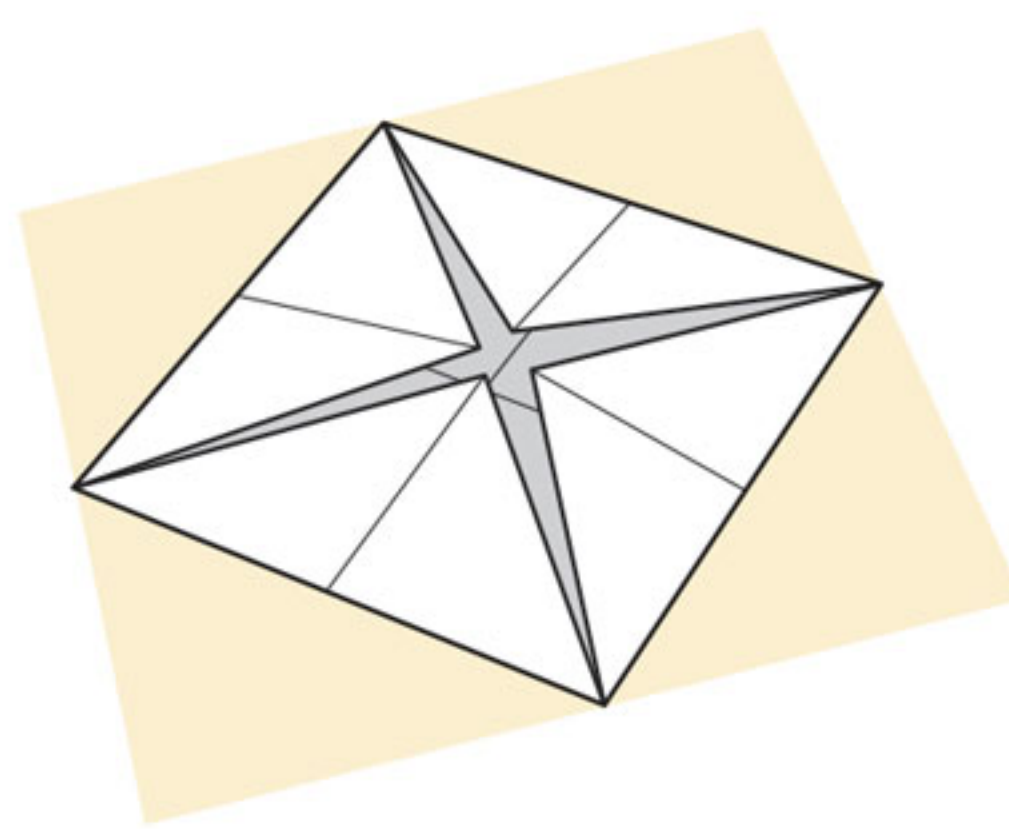
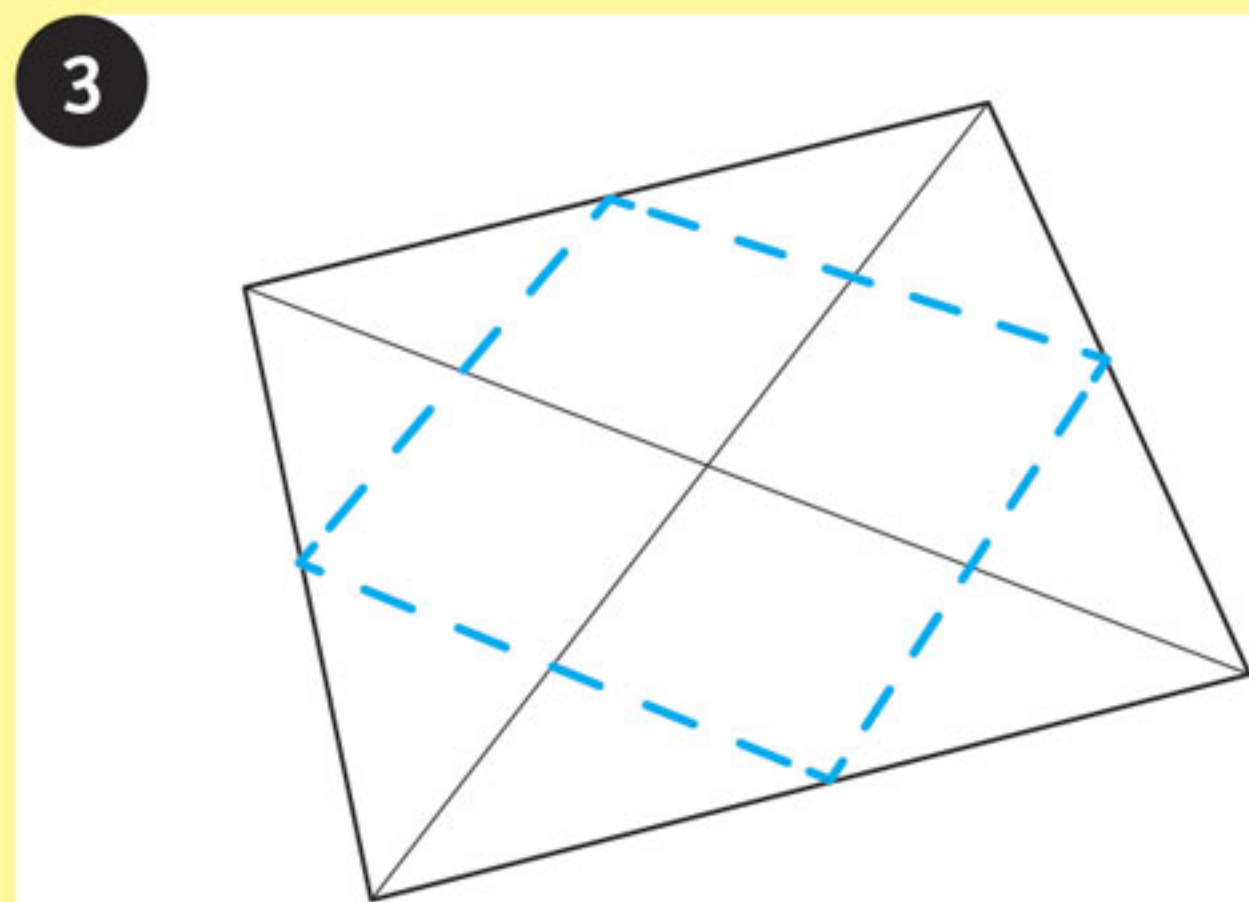
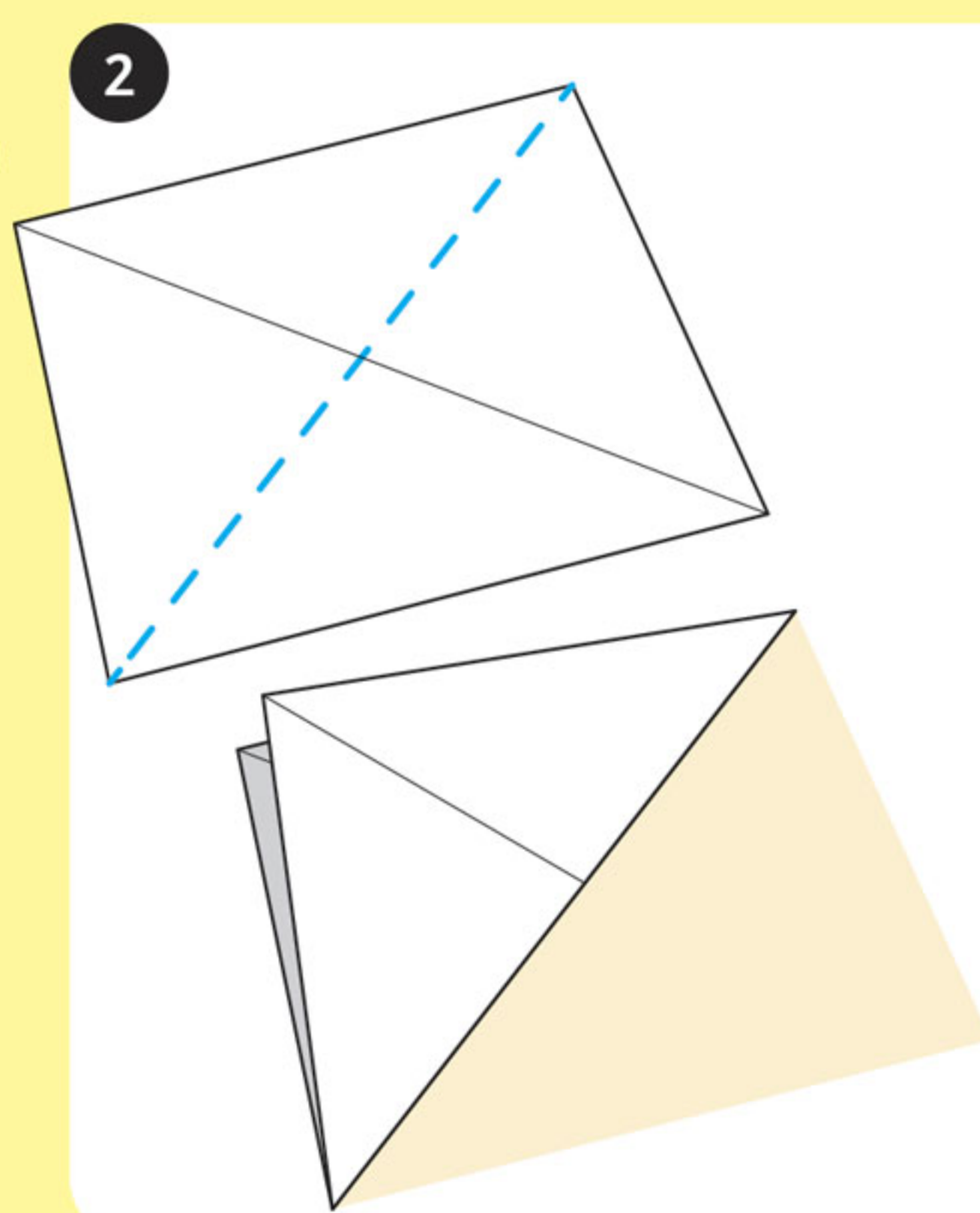
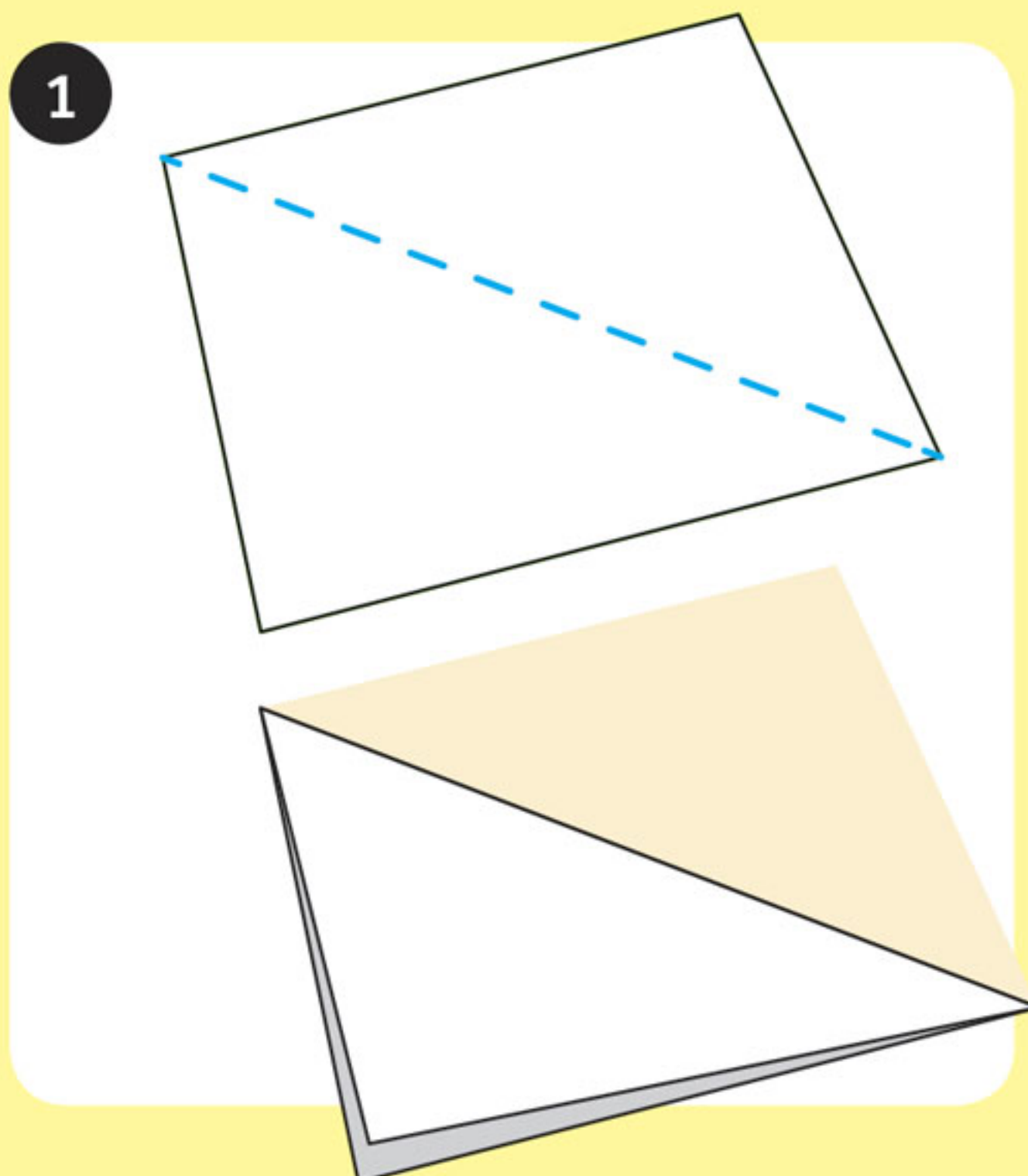


Keeping and Displaying Minerals

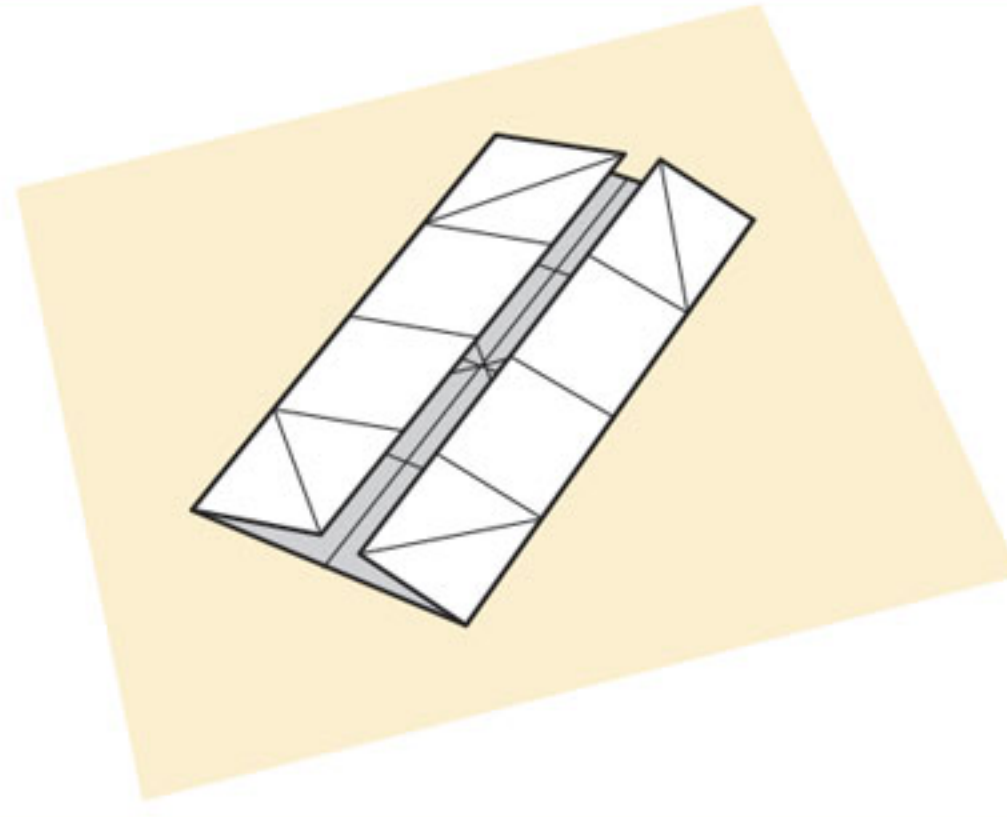
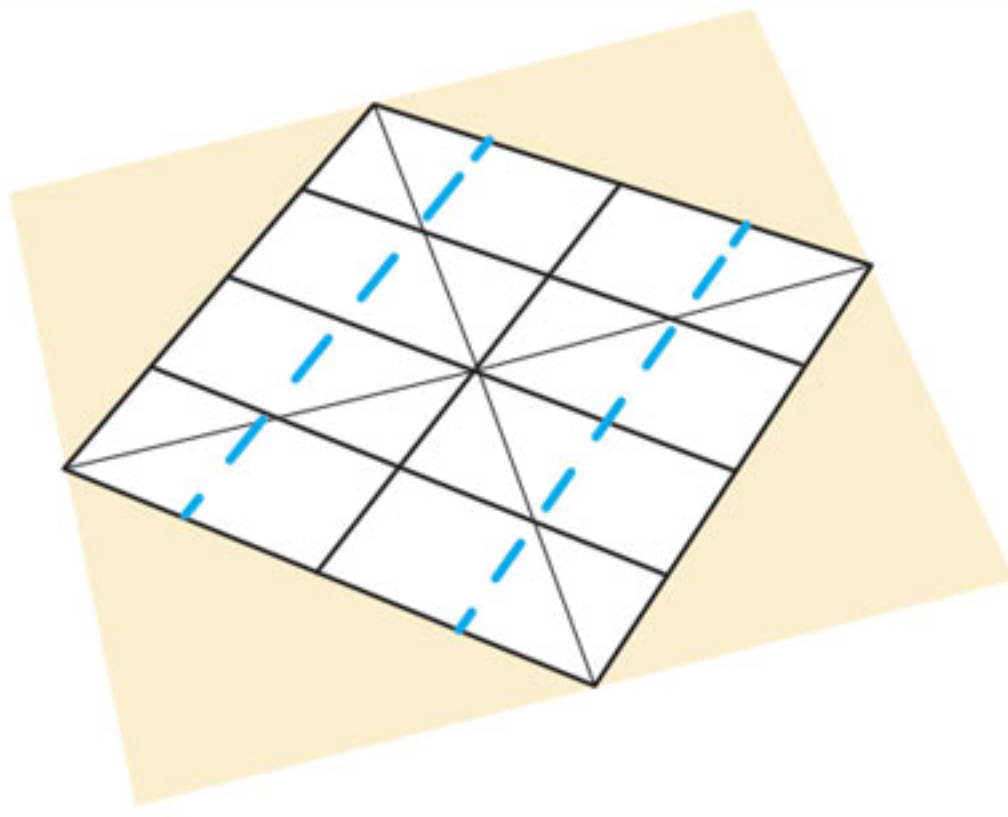
There are many ways of displaying the gemstones that you have dug up. For example, you can place them in a display case on a piece of black or white paper or a piece of black velvet. Real mineral collectors, though, save their treasures individually in small boxes and also label them with their correct names.

You can easily make boxes like these yourself. You just need a sheet of heavy paper (ideally 32-lb paper from the stationery store, although printer paper works too), scissors, and a ruler.

1. For each box, cut a piece of paper 10 cm by 10 cm (4 in. by 4 in.) in size.
2. Fold the sheet diagonally, or from one corner to the opposite corner, and then fold the paper back again.
3. Fold each corner to the center and leave folded.
4. Fold one side to the center and then do the same with the opposite side.



5



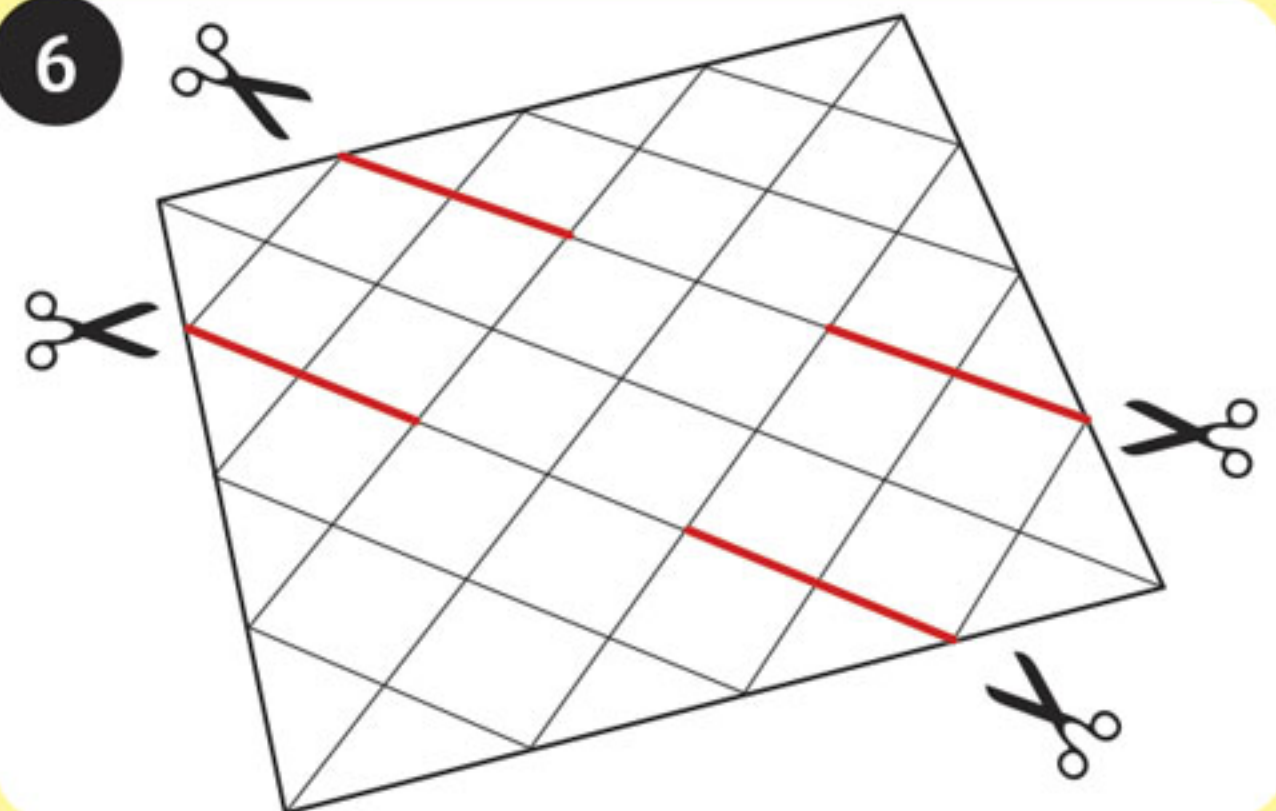
5. Unfold the two sides again and then do the same with the other two sides.

6. Unfold the sheet and cut along the lines shown in red.

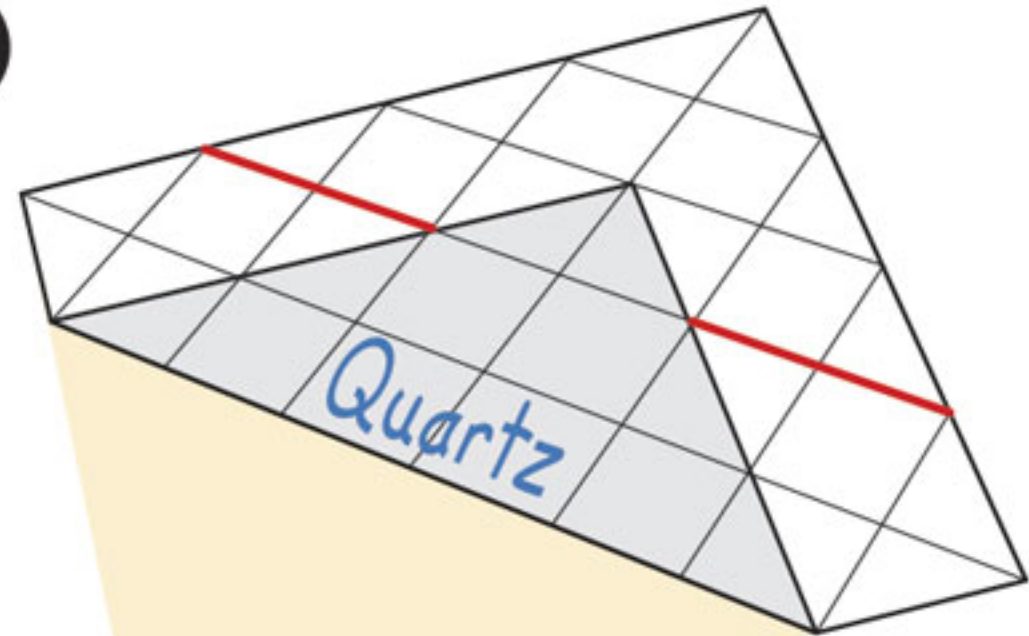
7. Now you can label the side section. Fold up the lower corner, and write the name of the mineral in the proper place as shown. If you prefer not to, of course, you can apply an adhesive label later on.

8. Lift the two triangular side pieces and fold the A sections inward, with their tips meeting in the middle of the box.

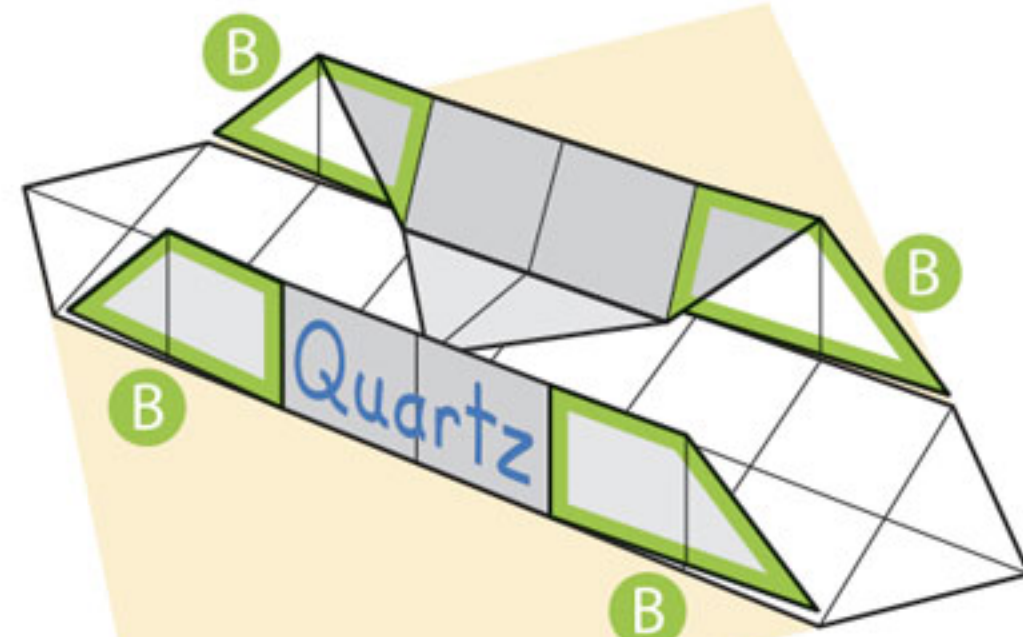
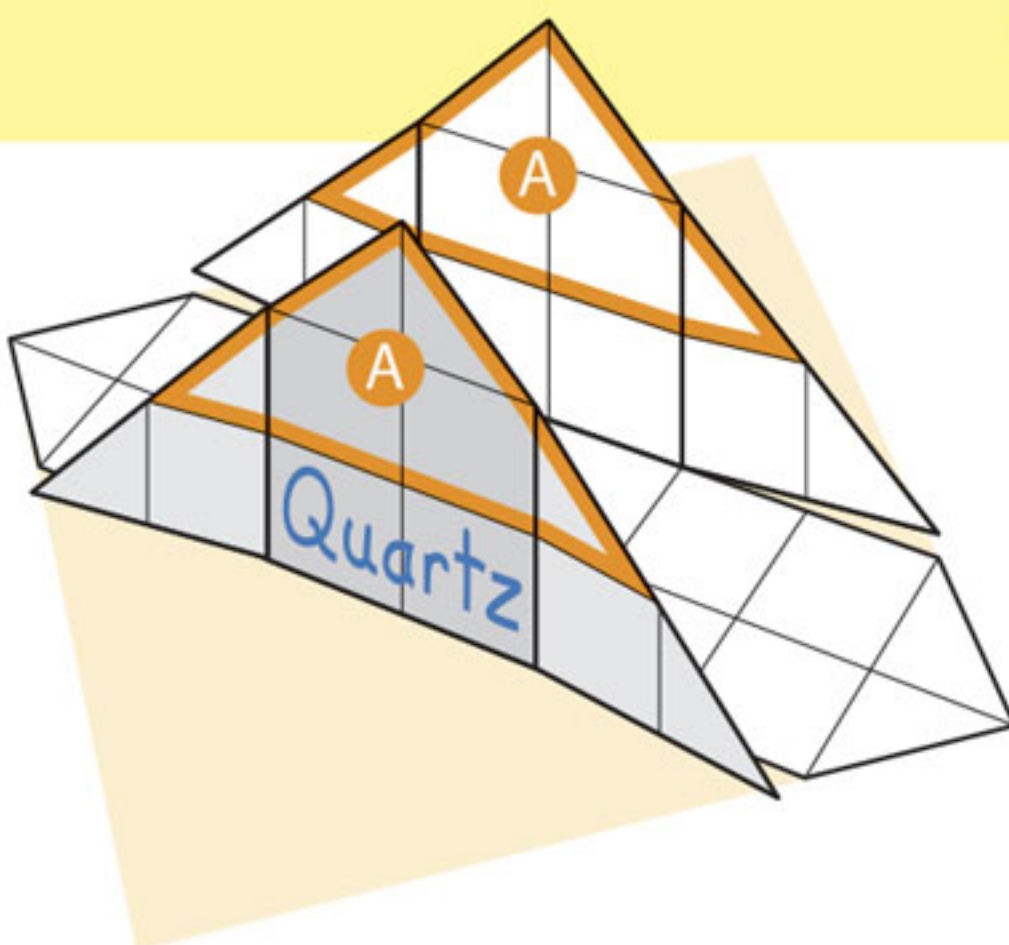
6



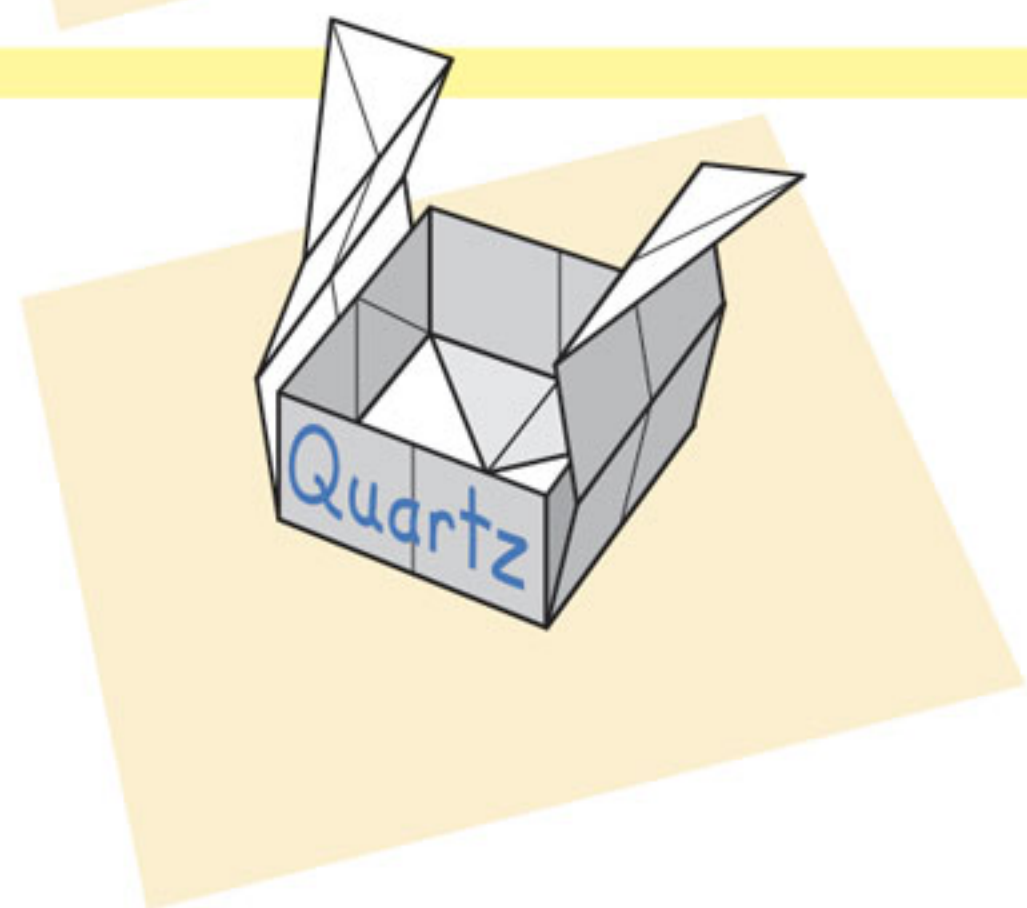
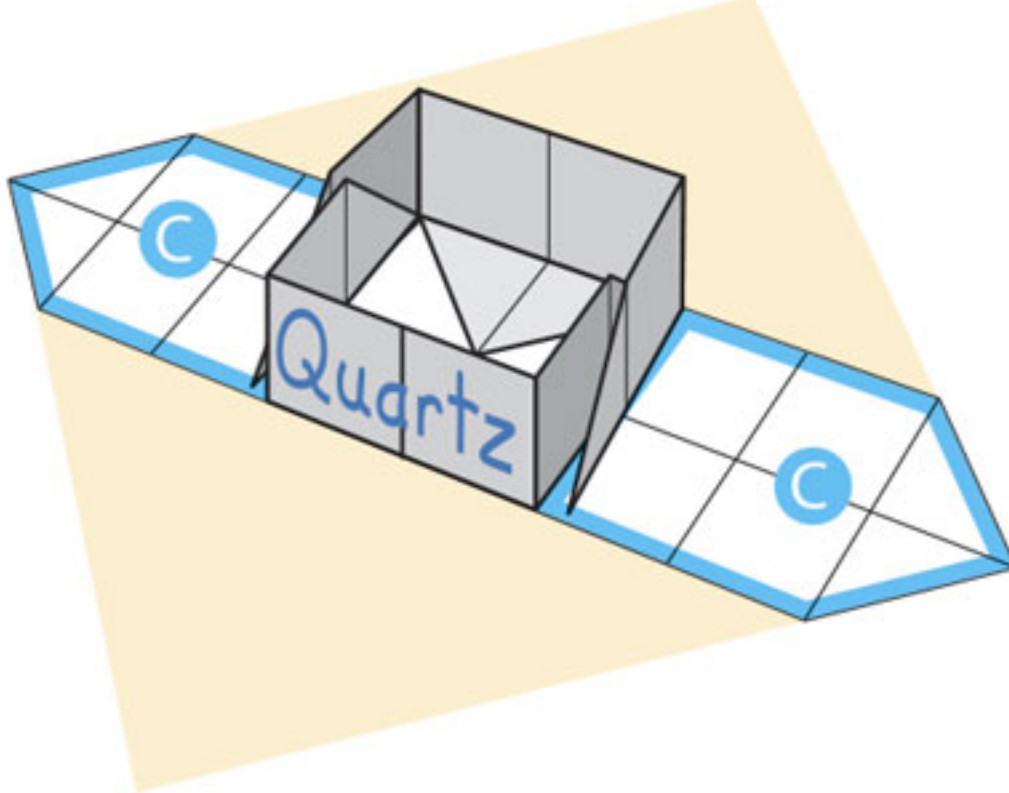
7



8



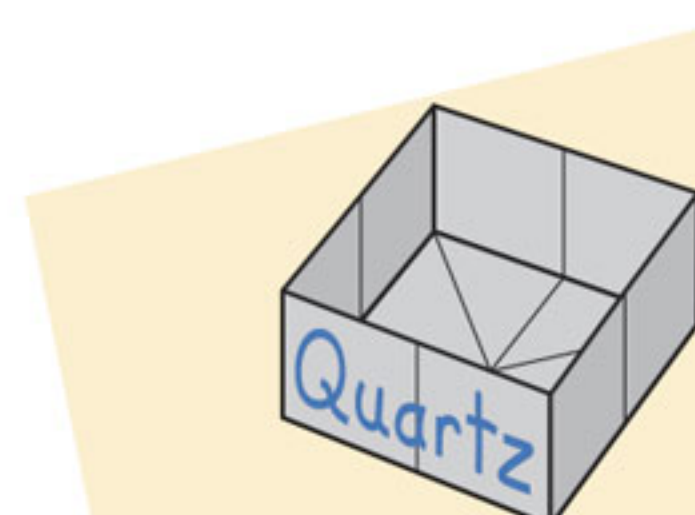
9



9. Then fold the B sections inward at a right angle, and fold the C sections in over the B sections.

10. This is how the box should look now. If it is not stable enough, you can help hold it together with a few drops of all-purpose glue. Place some cotton wool in the box, and rest your stone on top.

10



Check It Out

All of the minerals that you excavated come from the same chemical family, quartz. This is one of the most common minerals in Earth's crust and is a component in almost all rocks. Chemists know quartz as silicon dioxide — the chemical element silicon bonded with oxygen. Quartz has many uses. Even in the stone age, flint (a form of quartz) was much sought-after because this type of quartz breaks into extremely sharp-edged pieces when struck, which could be used as knives, drills, and axes.

Today the construction industry uses quartz in the form of sand and gravel, and it is indispensable in the manufacture of glass and porcelain. Silicon obtained from quartz serves as a raw material for transistors, computer chips, and solar cells. Specially grown quartz crystals are also at work in quartz watches and countless other electronic devices.

In nature, quartz is usually found in the form of tiny crystals, often also as white bands in other rocks or as gravel or grains of sand. The ocean floor is therefore composed largely of quartz, as are beaches and the soil on land. If quartz has a lot of time to grow undisturbed, it will often form beautiful **columnar crystals** crowned with a kind of pyramid.



Quartz plays an important role in the world of semiprecious stones, especially when it contains impurities that give it a special color. In addition to purple **amethyst** and the other gemstones in your kit, brown- to black-colored **smoky quartz**, blood-red **carnelian**, bluish-green **chrysoprase**, lemon-yellow **citrine**, mysteriously goldish-yellow glistening **tiger's eye** with its inclusions of tiny needles of crystal, banded **agate**, and **opal** glittering in all the colors of the rainbow all belong to the large quartz family.

FACT SHEET: QUARTZ CRYSTAL

Scholars in ancient Greece believed this crystal-clear mineral to be frozen water that had once been exposed to such extreme cold that it would never melt again. They therefore called it their word for "ice," which was *krsytallos*. That is where our word *crystal* comes from.

In reality, of course, they were just dealing with a particularly pure form of quartz. It is so hard that it can scratch glass, but it can in turn be scratched by a steel file. In nature, it is found in many places. One of the largest quartz crystals ever discovered weighs as much as seven adults, and the Riedenburg Crystal Museum in Germany boasts a quartz crystal aggregate weighing eight tons, or as much as six to nine cars.



The Gemstones from Your Kit

FACT SHEET: AVENTURINE



Aventurine occurs in the form of rock inclusions and can sometimes be found in large chunks in locations such as Russia's Ural Mountains. Tumbled and polished pieces of this mineral are typically characterized by a deep, dark green color, but aventurine can also come in reddish hues.

Aventurine, as you can see in your sample, often displays a metallic shimmer known as **aventurescence**, caused by tiny glittering components embedded within it. These components can be enclosures of various minerals including mica, which form fine crystals with light-reflecting facets. Due to this glittering effect, aventurine is a popular gemstone for fashioning into strings of beads, bangles, rings, and beautifully shaped vases and vessels.

FACT SHEET: RED JASPER

This mineral type is usually not monochromatic but often speckled. The word for "speckled" or "spotted" in ancient Greek was *iaspis*, hence our name for the stone. The color comes from impurities of iron and manganese compounds. The quantities of these compounds vary greatly from one part of the stone to another, which is the reason for the color pattern you see.

Because the stone is often found in huge chunks, correspondingly large objects can be fashioned out of it. In the Russian city of St. Petersburg, for example, there is a green-banded jasper bowl that, with its stem and base, stands three meters tall and spans over five meters in diameter. Weighing in at 15 tons, this magnificent work of art is as heavy as about 20 cars.



FACT SHEET: ROSE QUARTZ

This mineral is considered to be among the very most popular ornamental stones. Its delicate pink color, reminiscent of fresh peach blossoms, is often associated with love. It's no wonder that there are so many art objects and necklace beads made of rose quartz.

Rose quartz does not form pretty crystals. It is usually found in large chunks in certain rocks that hardened out of a molten mass. Depending on the location of the site, the color fluctuates between distinct pink and a reddish shimmer, but it is always more or less milky or cloudy.



FACT SHEET: AMETHYST

Amethyst is often found in the form of crystal geodes. This is the name for cavities in rock with crystals coating the walls that enclose the hollow space within. Large quantities of amethyst are mined in Brazil. Some specimens can be a meter tall and a ton in weight.

The purple color comes from tiny impurities of iron — just a few hundredths of a percent of the total mass. These iron atoms are altered by natural radiation. They can be analyzed to estimate how long the radiation affected them to produce the purple color — about 5 million years.

