# Activity 4 Create a Remote Sensing Device

**Educator Preview**

**Overview**

Youth work in groups to *plan, create*, and *test* remote sensing devices that can collect information about the Mystery Moon.

**Note to Educator:**

Before beginning this activity, make sure you have finished preparing the Mystery Moon model landscapes and Space Screens. There should be two models each of Site A and Site B, one behind each Space Screen, so multiple groups can access them during testing. Save groups' designs and any remaining materials for the next activity.

## Activity Timing

| | |
|---|---|
| Introduction: | 5 min |
| Imagine and Plan: | 10 min |
| Create and Test: | 30 min |
| Reflect: | 10 min |
| | **55 min** |

## 21st Century Skill Highlight

Critical Thinking
Collaboration

## Activity 4 Materials

**For the Mystery Moon Sites and Space Screens**

- ☐ *Mineral Paper*, pp. 53–73 in this guide
- ☐ 1 bottle of white glue
- ☐ 1 roll of masking tape
- ☐ 1 utility knife
- ☐ 4 tri-fold boards
- ☐ 4 shoeboxes with lids, approx. 7" x 5" x 12"
- ☐ 6 styrofoam sheets, 12" x 12" x 1"
- ☐ 20 paper cups, 3 oz.
- ☐ 20 pieces of felt
- ☐ optional: 1 set of pattern blocks
- ☐ optional: 4 blindfolds

**For the whole group**

- ☐ *Engineering Design Process* poster
- ☐ 12 sheets cellophane, blue
- ☐ 12 sheets cellophane, red
- ☐ 20 mirrors
- ☐ 25 manila folders
- ☐ 25 paper cups, 8 oz.
- ☐ 25 sheets of construction paper
- ☐ 25 sheets of craft foam
- ☐ 25 sheets of felt
- ☐ 60 binder clips, medium
- ☐ 100 rubber bands
- ☐ 2000 straws, regular
- ☐ 2000 straws, thin

**For each group of 3**

- ☐ 1 pair of scissors
- ☐ 1 roll of masking tape
- ☐ 1 ruler

**For each youth**

- ☐ Engineering Notebook

## Activity 4 Materials Preparation (50 min)

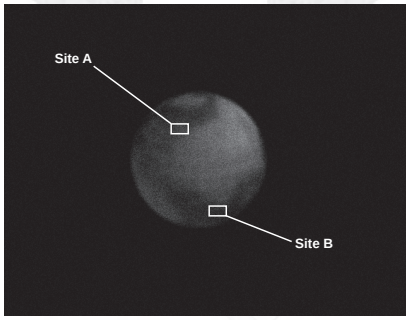
1. Post the *Engineering Design Process* poster.
2. Post the *Remote Sensing Definition* chart paper and *Optical Filter Investigations* chart paper from previous activities.

## Notebook Pages for Activity 4

*Mystery Moon*, p. 12

Activity 4 — Mystery Moon

This is the only picture we have of the newly discovered moon, taken through a telescope. There are two sites that scientists have decided to explore further with remote sensing technologies.




**Remote Sensing Engineering Challenge:**

Your final design challenge is to engineer a remote sensing device (or devices) to collect information about the surface of the Mystery Moon for one of the three scientists.



*Scientist Cards*, p. 13

Scientist Cards — Activity 4

Scientist: **Jaime, planetary geologist**

*"I am interested in the landscape of the moon. What color is the surface? Are there any mountains, valleys, or craters?"*

| Criteria | Constraints |
|---|---|
| Identify the landforms (mountains, valleys, craters) at Site A and Site B. | You may only use the available materials to complete your design. |
| Identify the colors at Site A and Site B. | You will have two sessions to engineer your remote sensing device(s). |

Scientist: **Caris, planetary geologist**

*"I am interested in landing a rover on this moon. Sending a rover will allow us to collect samples and more closely examine what the moon is made of. Is there a flat, open space where the rover could land safely?"*

| Criteria | Constraints |
|---|---|
| Identify an area for the rover to land. | You may only use the available materials to complete your design. |
| The landing area must be large enough for the rover to land safely (3" x 4"). | You will have two sessions to engineer your remote sensing device(s). |



*Scientist Cards*, p. 14

Activity 4 — Scientist Cards

Scientist: **Alex, biologist**

*"I want to know if this moon can support life. One of the most important elements to support life is water. Are there any sites that show evidence of water?"*

| Criteria | Constraints |
|---|---|
| Identify places on the Mystery Moon where water (represented by a triangle shape) is present. | You may only use the available materials to complete your design. |
| Look for landforms, like canyons, that suggest the presence of water. | You will have two sessions to engineer your remote sensing device(s). |

**Did You Know?** Many animals can see a different range of colors than humans can, including the mantis shrimp, which has eyes that are like the color sensors NASA uses in spacecraft!

**Did You Know?** NASA planetary scientists have telescopes that can tell us about solar systems far beyond our own.



*Remote Sensing Plan*, p. 15

Remote Sensing Plan — Activity 4

Sketch a *plan* for your remote sensing device(s) in the space below. After you *test*, mark areas of your design that you would like to *improve*.

**What information is your scientist interested in?**
**What technologies will help you collect the data they need?**

**Scientist:** _____ **Criteria:** _____


**How will you *improve*?** You can use new materials, try a different resolution, make your devices smaller and more compact, or *improve* in another way!



*Guidelines for Collecting Data,* p. 16

Activity 4 — Guidelines for Collecting Data

When collecting data with your remote sensing device...

**DO:**
1. Only put your hands through the opening in the Space Screen to push down on straws.
2. Move device from left to right.
3. Be careful when using the Space Screen so it does not fall over or break.

**DO NOT:**
1. Peek around the sides or into the Space Screen opening.
2. Put your face closer to the Space Screen than the edge of the table.
3. Try to touch the inside of the model landscapes through the Space Screen.

Some of the scientists are interested in the minerals on the surface of the Mystery Moon. Use the key below to help decode your findings:

| Minerals | Symbol |
|---|---|
| Water, ice | ▲ |
| Iron | ● |
| Magnesium | ★ |

**Did You Know?** NASA scientists and engineers can sometimes make mistakes, so they plan, test, and re-plan all human missions several times, to make sure that the astronauts involved are kept as safe as possible.



*Data Collection*, pp. 17–18

Data Collection — Activity 4

Use this page to record any data that you collect using your remote sensing device(s). Be sure to visit Site A and Site B.

**Site A**

**Did You Know?** Some of NASA's first spacecraft sent their data to Earth so slowly that engineers could color in the image by hand, dot-by-dot.



## Activity Preparation (continued from p. 45)

# Activity 4 Materials Preparation (continued)

3. Prepare the Mystery Moon sites and Space Screens by following the instructions on pp. 51–53 in this guide.
4. Create a Materials Table with the materials above.

# Activity 4 Create a Remote Sensing Device

Activity Guide

**Youth will learn:**

- Using the steps of the Engineering Design Process can help guide them to a successful solution.
- Engineers use what they learn in the *identify* and *investigate* step to inform their design decisions.
- Engineers often collaborate with scientists to determine the criteria and constraints of a project.

## Introduction (5 min)

1. Let youth know that today they will start the final design challenge with their groups. Have them turn to *Mystery Moon,* p. 12 in their Engineering Notebooks, to read about the challenge and the two sites that scientists have identified for further exploration.
2. Invite youth to look at the Space Screens and explain that the closed shoeboxes behind the screens contain model landscapes of the two sites on the Mystery Moon, Site A and Site B. Ask:
   - **Why do you think these Space Screens are important? What might they represent?** *Remind youth that remote sensing allows us to collect information from places that are far away or inaccessible. Explain that youth will explore Site A and Site B from the opposite side of the Space Screen, to represent the distance between the Earth and the Mystery Moon, using only the remote sensing devices they* create.

**Tip**

If youth have struggled with previous activities or concepts, consider starting them with the first scientist, Jaime. Once successful, youth can select a more challenging mission to engineer for.

## Imagine and Plan (10 min)

1. Split youth into groups of 3.
2. Give groups a chance to read the *Scientist Cards*, pp. 13–14 in their Engineering Notebooks, and choose a scientist to work with.
3. Have youth turn to *Guidelines for Collecting Data*, p. 16 in their Engineering Notebooks to *imagine* how they might use their remote sensing devices before they *plan*.
4. Remind youth about the materials they can use in their designs and the types of technologies they learned about: periscopes, optical filters, and LiDAR. Let them know that scientists often combine different remote sensing devices in a single spacecraft to collect all the information they need.
5. Give groups a few minutes to *imagine* and *plan* their designs,

keeping the scientist's criteria and constraints in mind. Youth can record their ideas on *Remote Sensing Plan*, p. 15 in their Engineering Notebooks.

6. As groups are *planning*, circulate around the room and ask:
   - **What types of information will you look for on the Mystery Moon?**
   - **Which remote sensing technologies will help you collect the data your scientist needs?**

## Create and Test (30 min)

1. After groups have finished *planning*, have them gather materials from the Materials Table and begin *creating* their remote sensing devices. Make sure youth know their device should be able to fit through the opening in the Space Screen.
2. When groups are ready to *test* their remote sensing devices, remove the lids from the shoeboxes so that they can collect information from Sites A and B.
3. Have groups record what they learn about the sites on *Data Collection*, pp. 17–18 in their Engineering Notebooks. While they are working, ask:
   - **Is your remote sensing device working the way you *imagined* it would?**
   - **What types of data can you collect?**
   - **Are you meeting your scientist's criteria?**
4. Let groups know when they have 10 and 5 minutes remaining.

**Tip**

Youth can use pattern blocks from Activity 1 to *test* their device's ability to collect data before testing on Sites A and B.

**Tip**

It is OK if groups need more time to collect data from both Site A and Site B. They will have time to finish working on their designs in the next activity.

## Reflect (10 min)

1. Have groups come together to share their remote sensing technologies. Ask each group:
   - **Was there anything that surprised you about collecting data with your remote sensing device?**
   - **How might you *improve* your design?**
2. Let youth know that they will have time to *improve* their remote sensing devices in the next activity.
3. Have groups gather around the Engineering Design Process poster and ask:
   - **Which steps of the Engineering Design Process did you use today?** *We* imagined, planned, created *and* tested *our designs to collect data about the Mystery Moon.*
4. Label and store groups' designs in a safe location so they can *improve* them in the next activity.
5. Congratulate youth on their excellent engineering work!

# Activity 4 Mystery Moon Assembly

The final design challenge requires the educator to prepare model landscapes so youth can test their remote sensing devices on the surface of a Mystery Moon.

## Site A. *Prepare two shoeboxes for Site A, each with the following features:*

| Must Have | Consider Adding |
|---|---|
| Lots of mineral paper printed with triangles, the symbol for water | Mountains or varied terrain using styrofoam sheets |
| No flat, open spaces | Paper cups to create landforms |

- Each page of mineral paper contains triangles, which is the symbol for water. You can be strategic about where you cut and place them in each site.

## Site B. *Prepare two shoeboxes for Site B, each with the following features:*

| Must Have | Consider Adding |
|---|---|
| Flat, open space, at least 3” x 4” | Mineral paper, different colors |
| | Craters, dips in terrain using styrofoam sheets |

- Use a utility knife to cut foam sheets and build layers, or stack objects from around the room.

# Activity 4 Space Screen Assembly (p. 1)

***You will need to assemble 4 Space Screens in total, 1 for each model of Site A and 1 for each model of Site B.***

Materials: tri-fold board, ruler, utility knife, felt, scissors, duct tape

**Step 1**

Use a utility knife to cut a 9” x 20” rectangle approximately 10 inches from the bottom of the trifold board.

**Step 2**

Cut a 1-inch-wide fringe across four pieces of felt, leaving enough space around the edges to tape each piece to the board.

**Step 3**

Tape the two pieces of felt to each side of the board so the hole is completely covered.

**Step 4**


Label two of the screens “Site A” and two of the screens “Site B.”

If time allows, decorate all screens using paint or stickers. Decorating the screens will provide a visual reminder that the screen represents a significant distance between Earth and the Mystery Moon.

# Activity 4 Space Screen Assembly (p. 2)

1. Position the Space Screen at the edge of a table so youth can easily access it and reach inside.

2. Tape one of the model landscapes to the table directly underneath the hole in the Space Screen. Keep the lid on the shoebox until groups are ready to test.

3. Tape the Space Screen to the table for extra stability.

4. Repeat to complete the remaining three Space Screens.

5. Position the Space Screens back to back or against a wall, so the model landscapes remain hidden as much as possible.

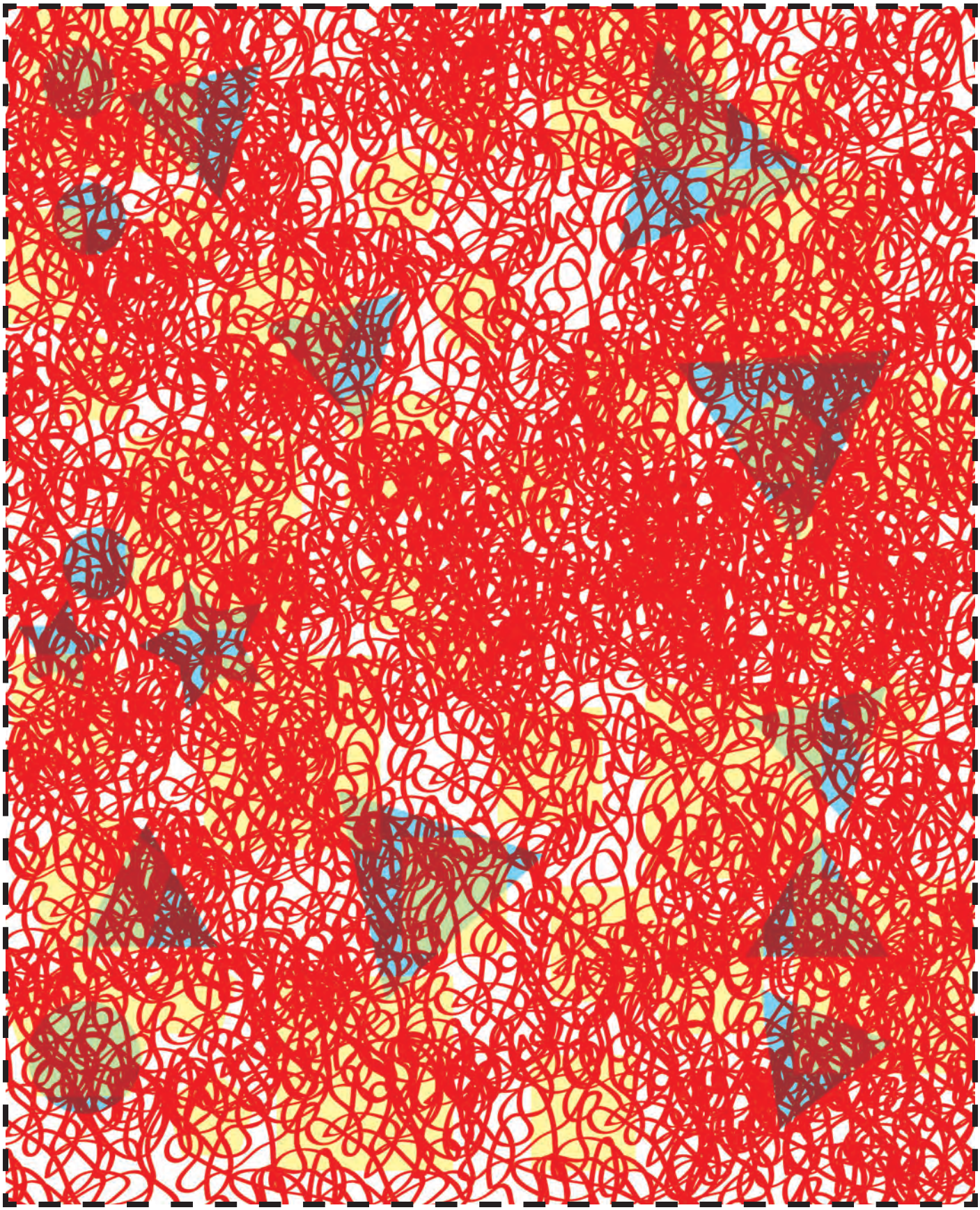
6. Optional: Place a blindfold at each Space Screen to encourage communication between the person operating the remote sensing device and the rest of the group, and prevent peeking into the model landscapes while testing.

Behind the Space Screen

The model landscapes are positioned correctly if youth are able to reach through the Space Screen and collect data from the surface of each site.

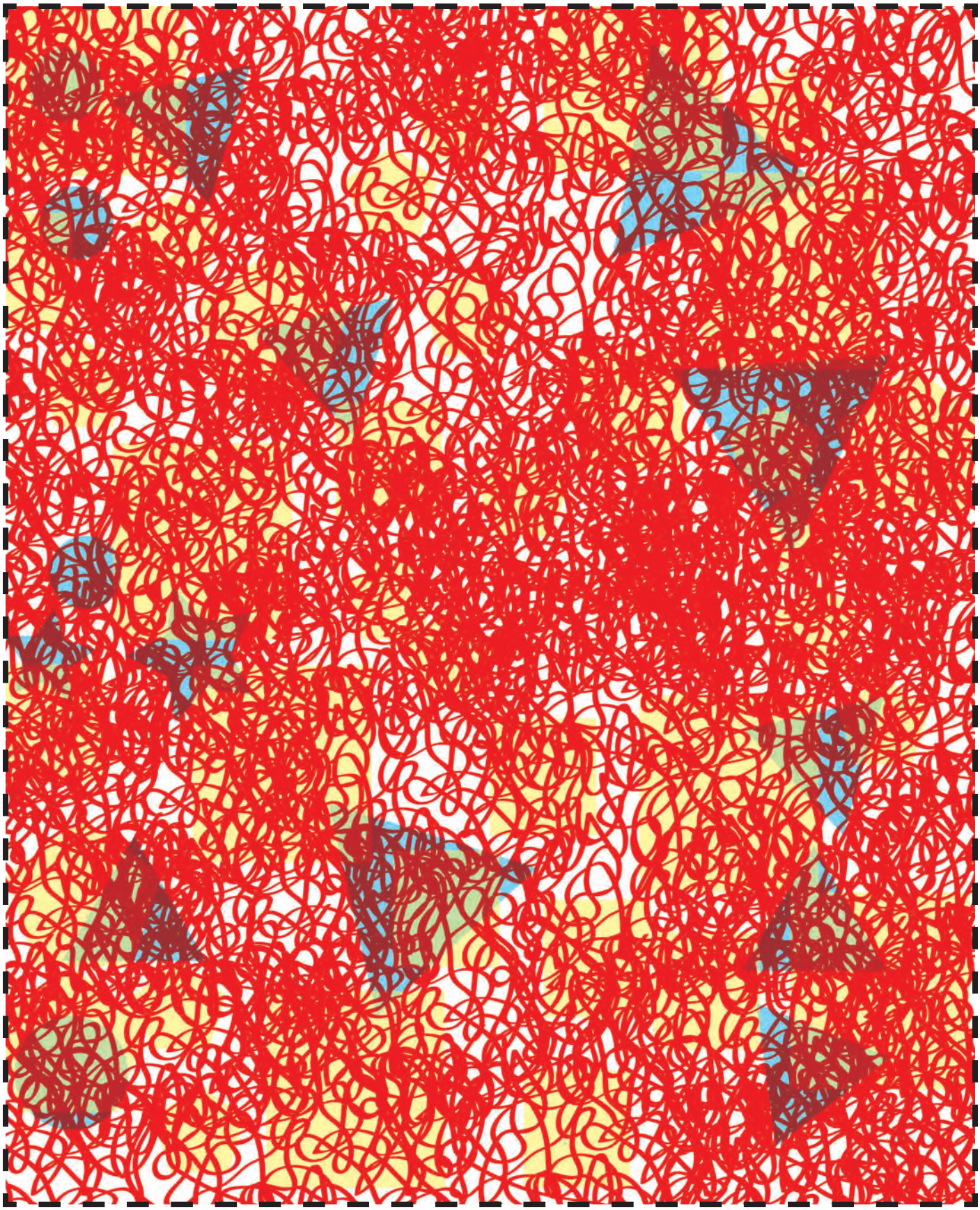
Activity 4

# Mineral Paper: Site A, Model 1 (p. 1)



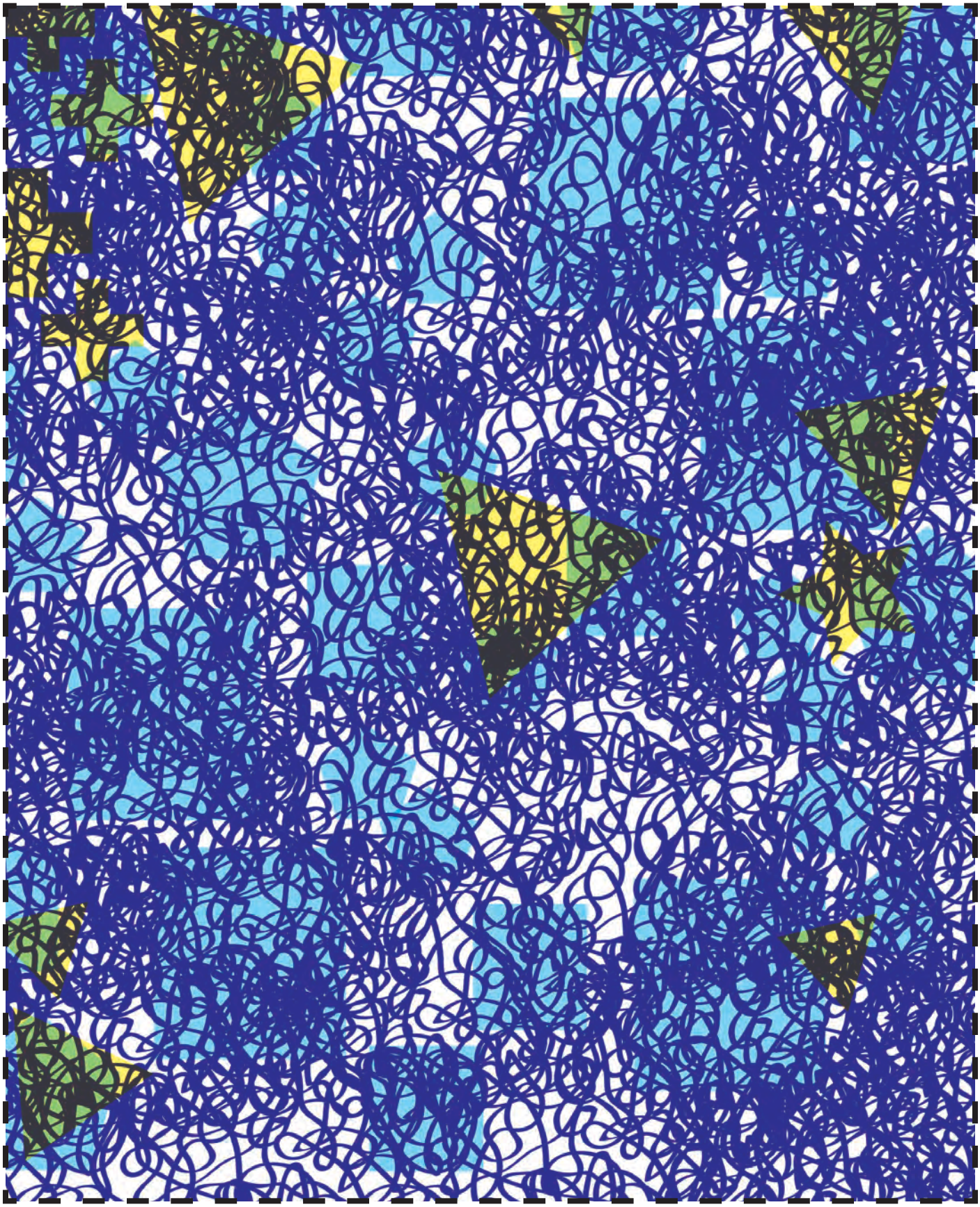
Activity 4

# Mineral Paper: Site A, Model 2 (p. 1)

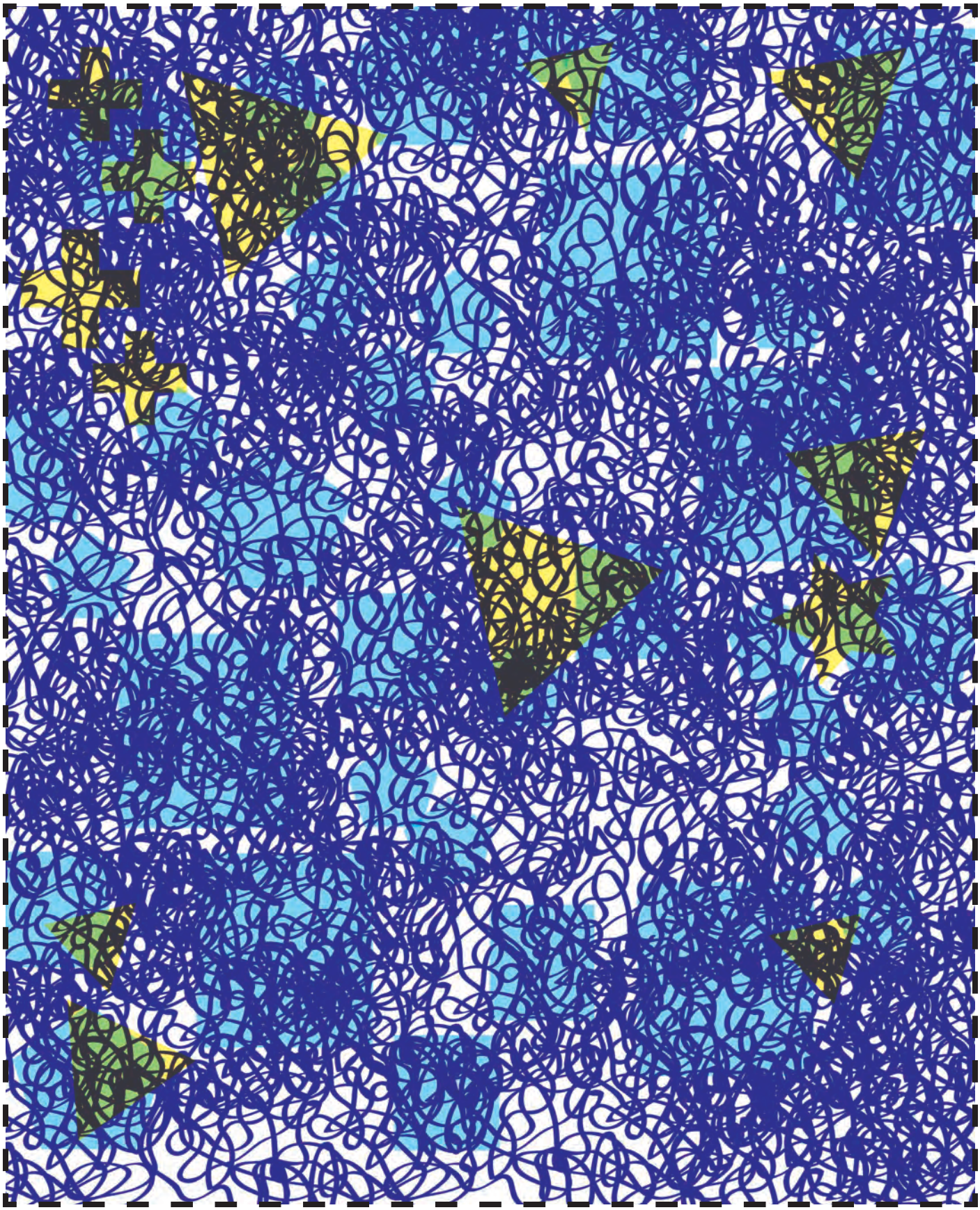


Activity 4

# Mineral Paper: Site A, Model 1 (p. 2)

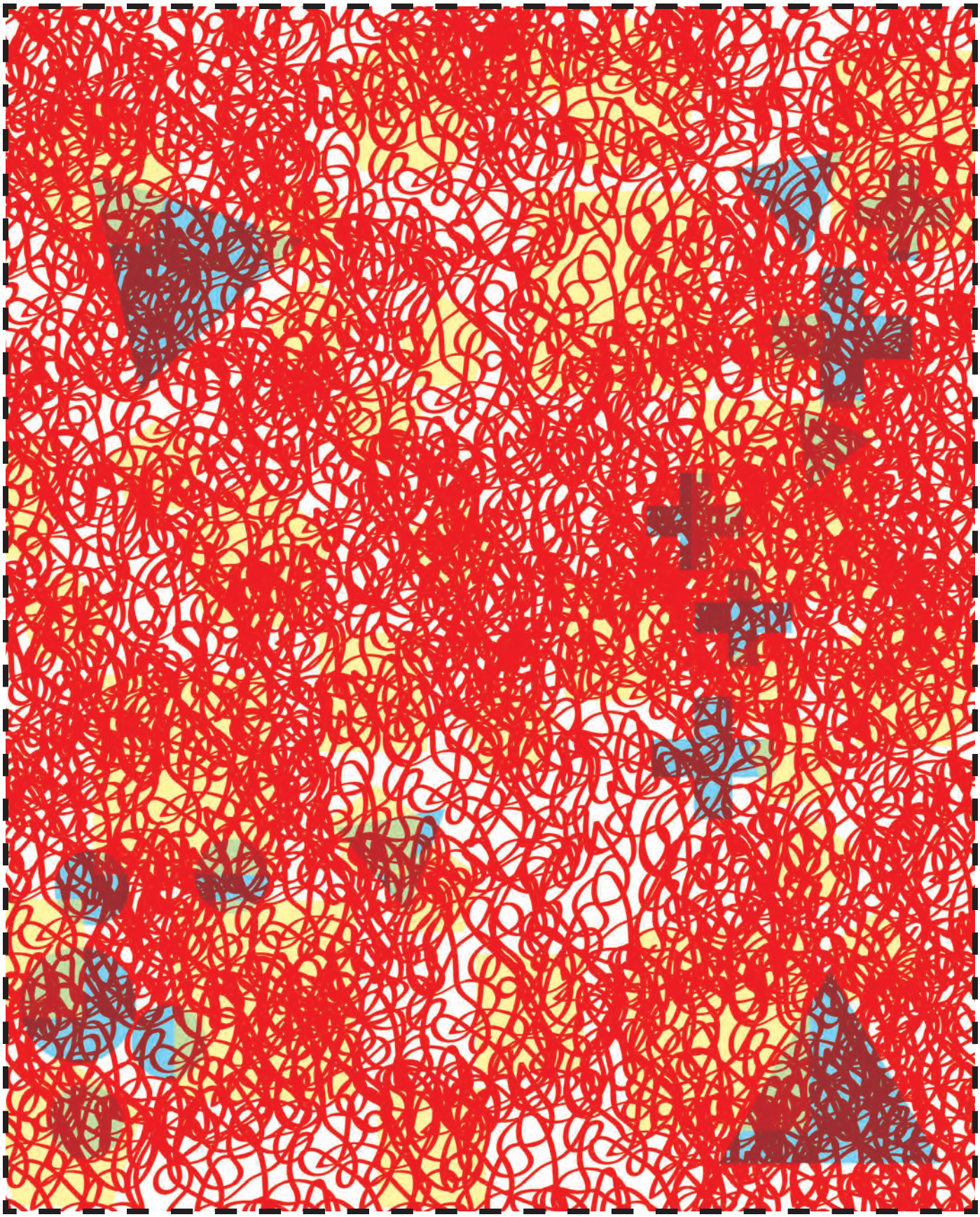


# Activity 4 Mineral Paper: Site A, Model 2 (p. 2)

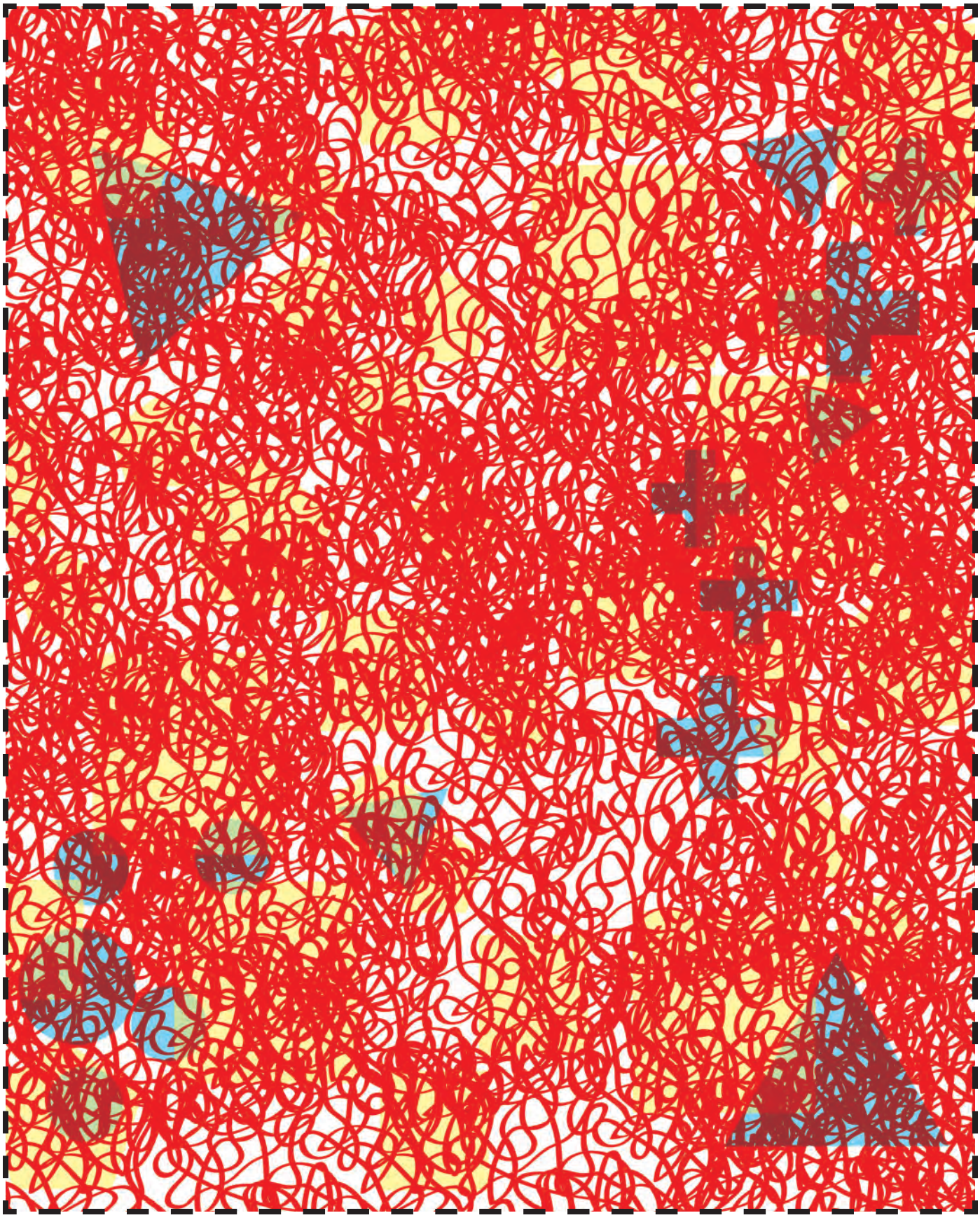


Activity 4

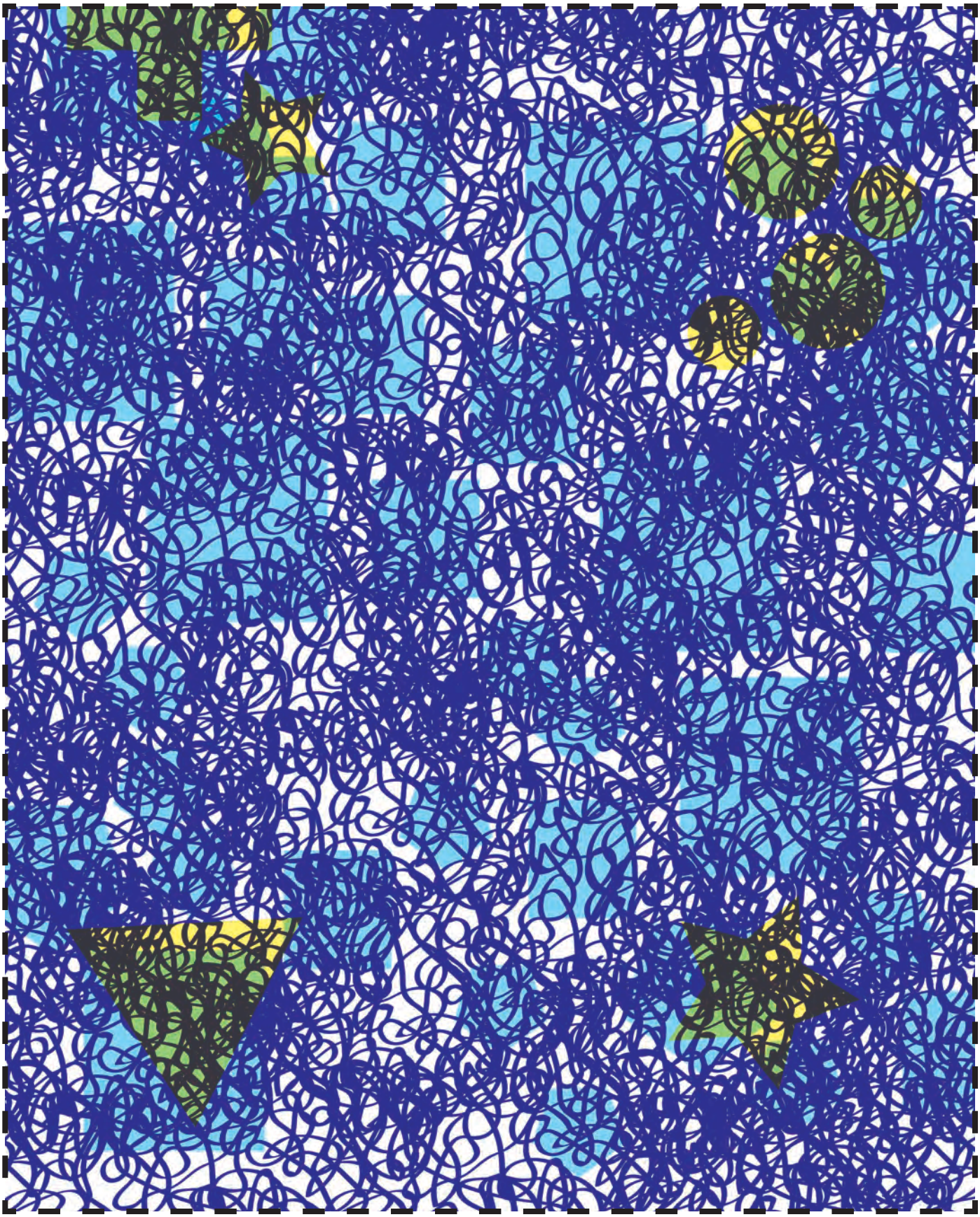
# Mineral Paper: Site A, Model 1 (p. 3)



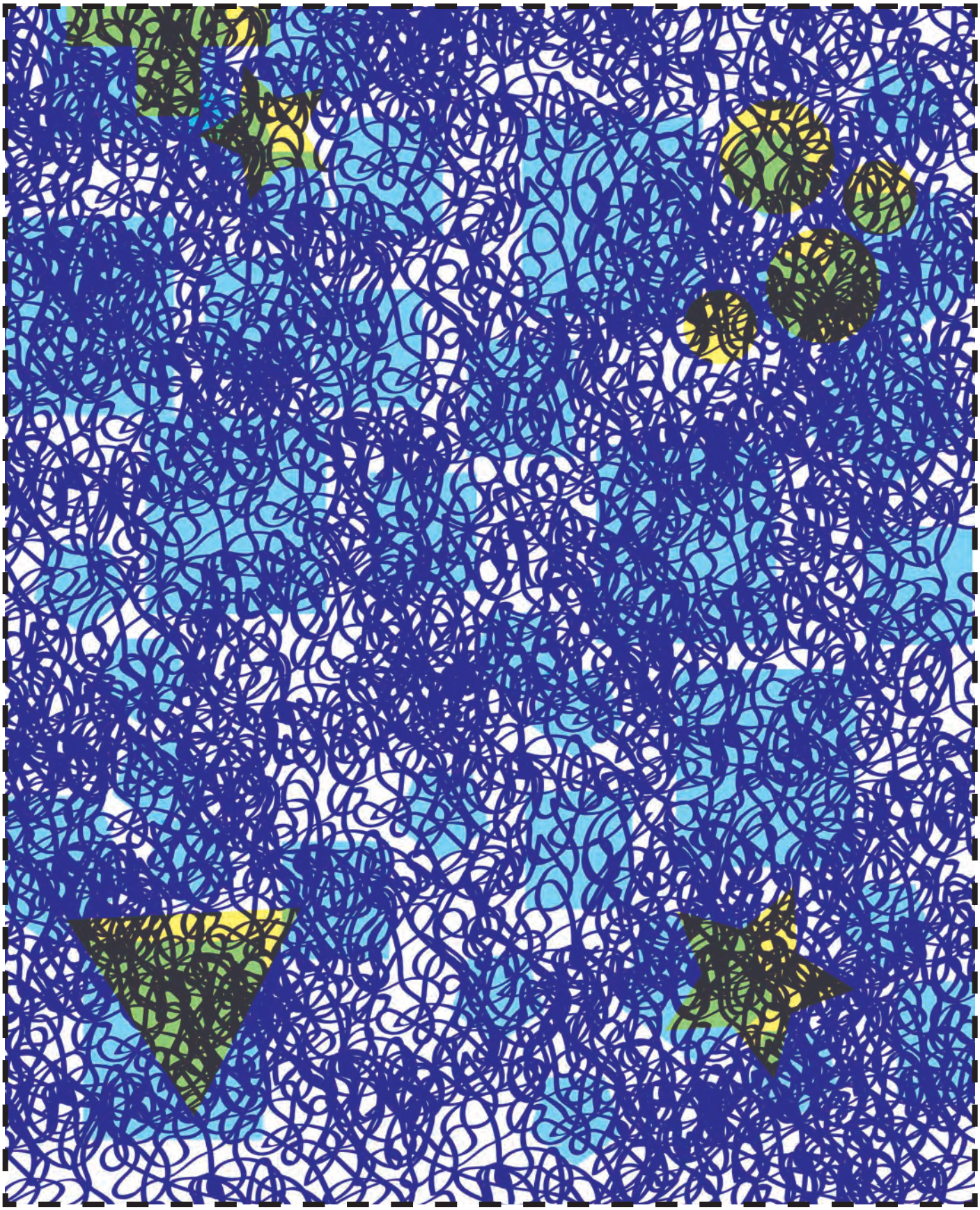
# Activity 4 Mineral Paper: Site A, Model 2 (p. 3)



# Activity 4 Mineral Paper: Site B, Model 1 (p. 1)

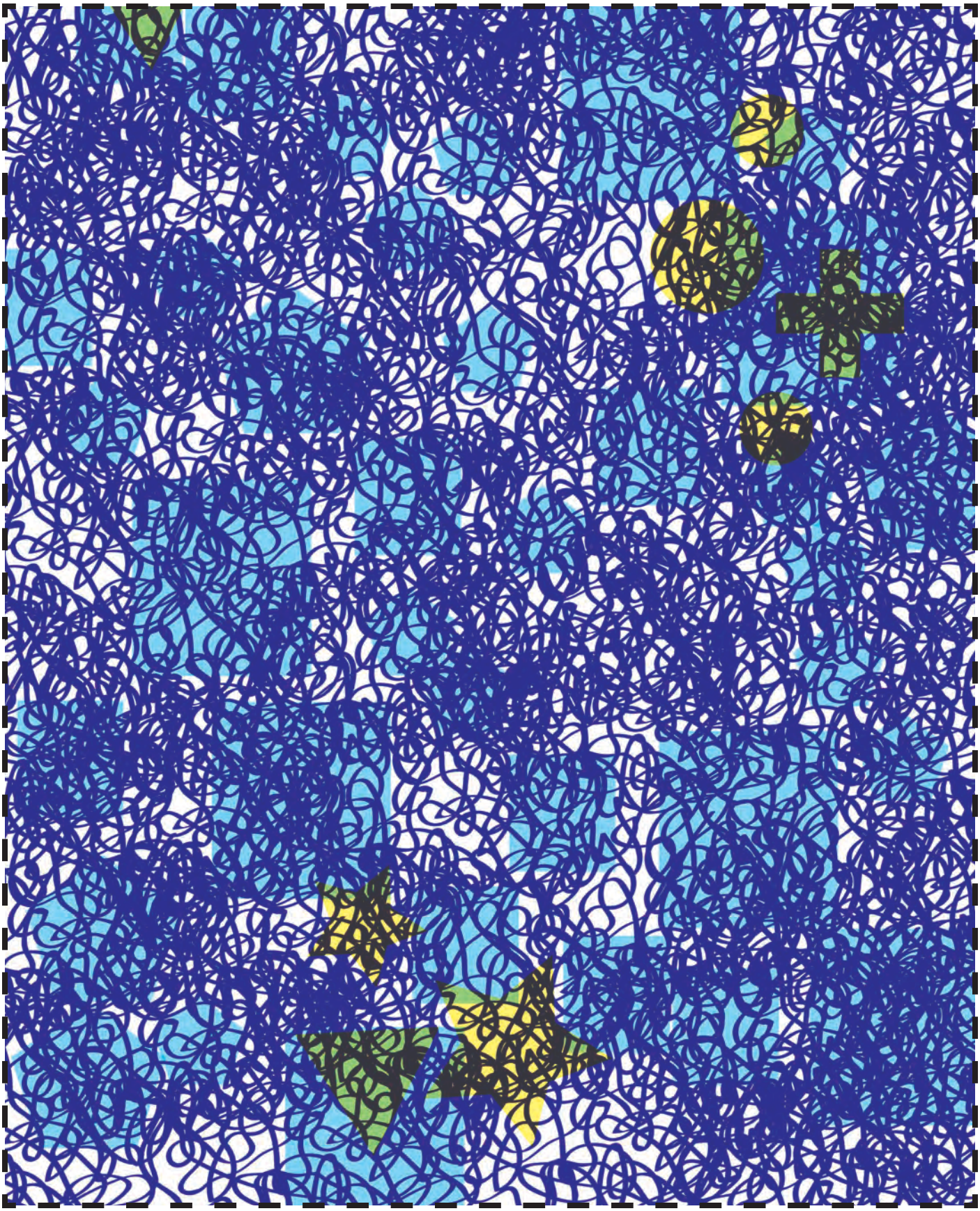


# Activity 4 Mineral Paper: Site B, Model 2 (p. 1)

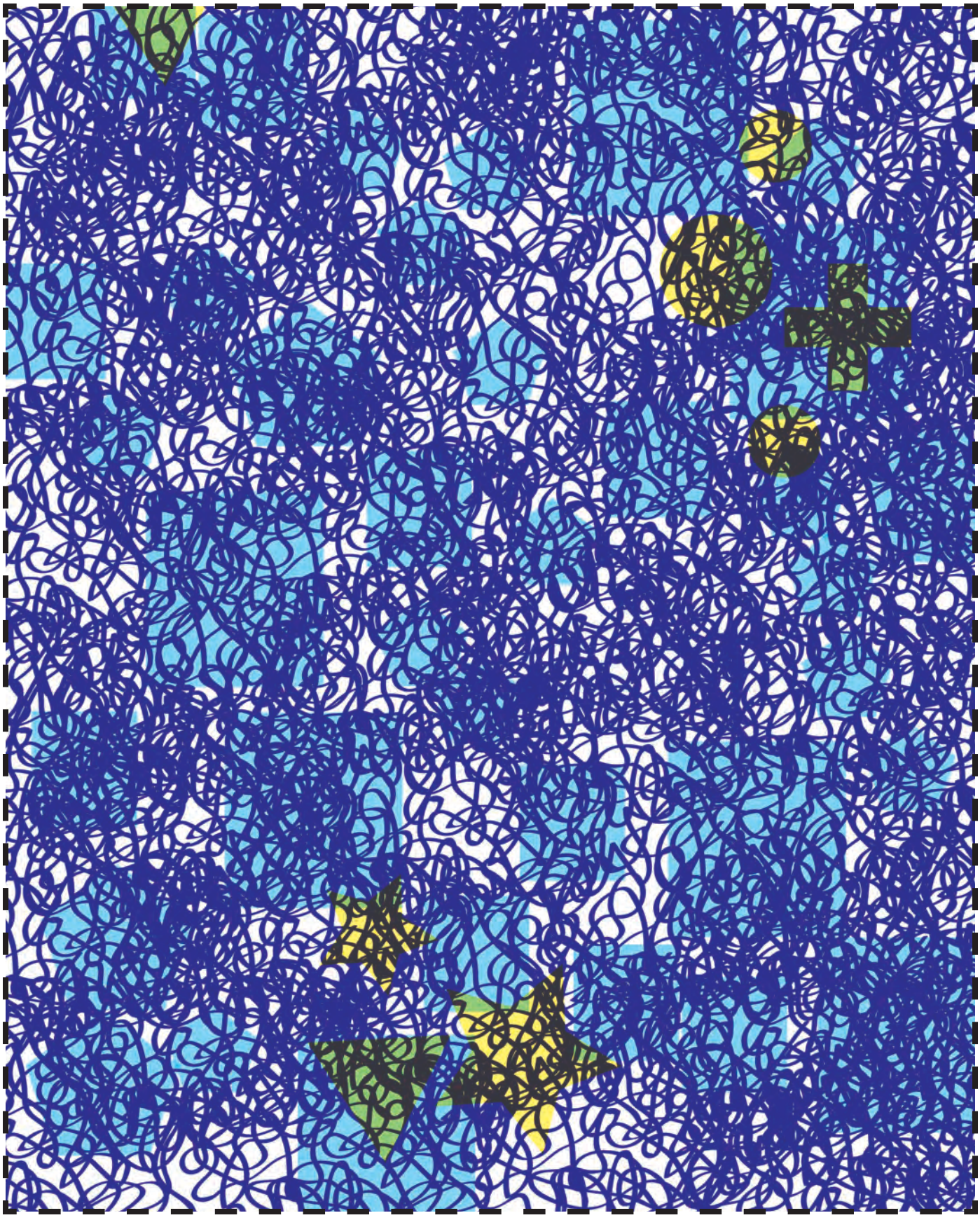


Activity 4

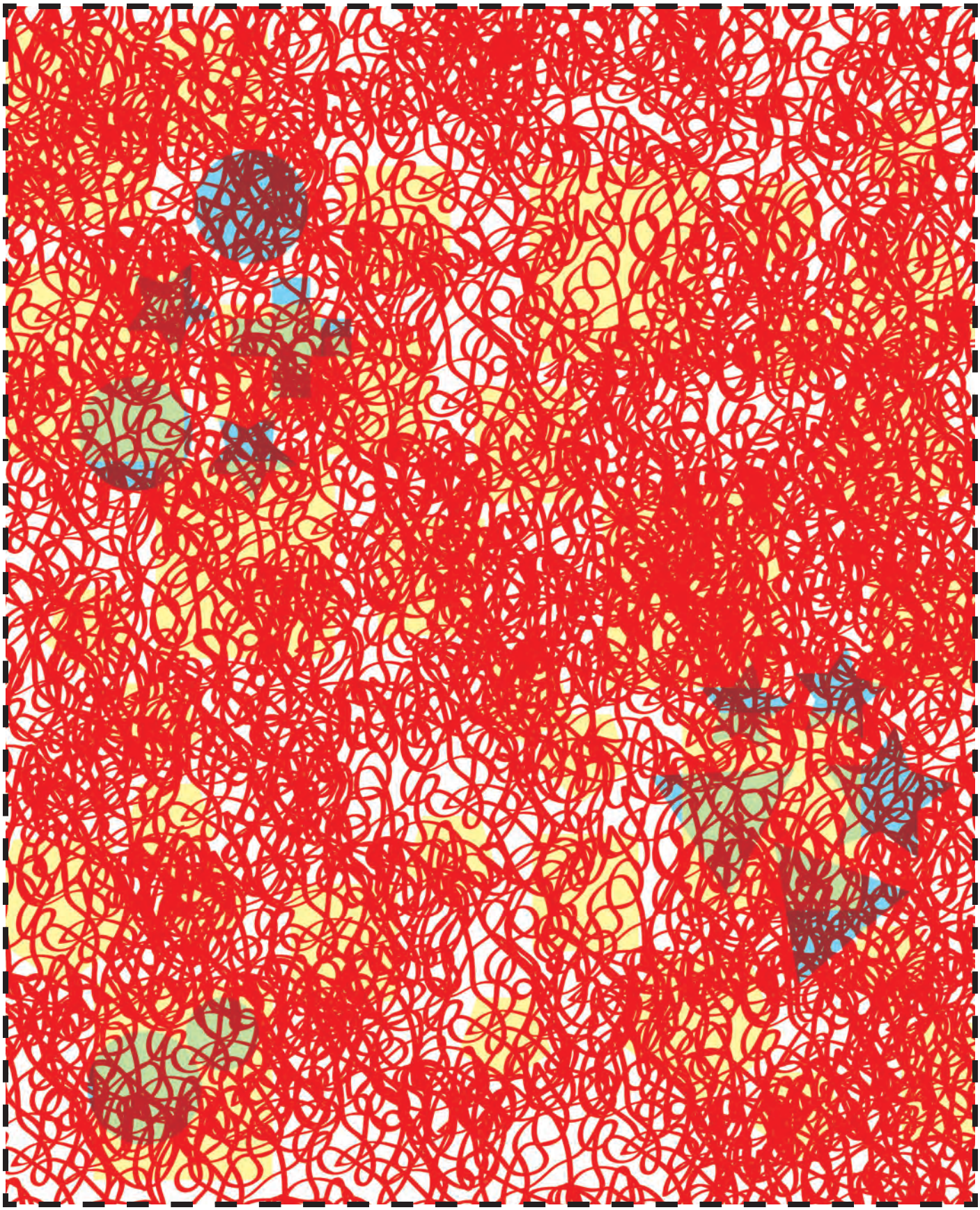
# Mineral Paper: Site B, Model 1 (p. 2)



# Activity 4 Mineral Paper: Site B, Model 2 (p. 2)



# Activity 4 Mineral Paper: Site B, Model 1 (p. 3)



# Activity 4 Mineral Paper: Site B, Model 2 (p. 3)