

# Extreme Earth!

In this activity, students will explore extreme life on Earth and make analogues to Mars.

Through this activity, students will use their imagination and deductive reasoning in order to accomplish the following objectives:

1. Determine locations on Earth where extreme life may exist.
2. Develop geographical and map analysis skills.
3. Develop analogues between extreme life on Earth and the possibility of life on Mars.

**Grade Levels:** 5-9

## **Background Information**

### *Extreme Life on Earth and its Analogues for Mars*

With the advancement of science and technology, areas of the Earth once thought to be desolate and deserted have now been proven to support extreme forms of life. For example, deep-sea hydrothermal vents such as Snake Pit in the Atlantic Ocean have been shown to be breeding grounds for several forms of microbiology. These areas are under enormously high temperatures and pressures and lack sunlight, yet life thrives in and around such extreme locations.

It is with such knowledge in mind that many scientists find reason for the possibility that life may exist on Mars. A planet once thought uninhabitable due to its extreme conditions, many areas of Mars are now thought to be analogous to those here on Earth. From valleys that appear to have been eroded by water to polar ice caps that may preserve early forms of Martian life, the existence of life on Mars is a source of much debate in the scientific community. Analysis of extreme life on Earth and its analogues to Mars offers students the opportunity to develop their creative and logical reasoning skills in a fun, exciting environment!



**Time:** 1 (50 min) period

**Level:** Easy

### **Materials/Resources**

1. Each student needs one copy of the “Individual Coordinates” page.
2. Each group needs one copy of the “Group Coordinates” page.
3. Each group needs access to a global atlas.

### **Recommended Procedures**

#### **Beginning the Activity**

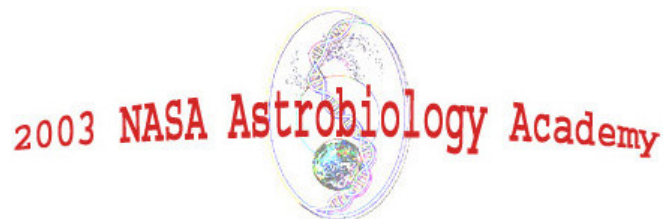
1. Inform your students that you recently received an urgent message from a friend of yours, a local scientist. The message reads:

*“We need your help in the search for life on Mars! Can you think of locations on Earth that might be similar to those on Mars? Many scientists believe that if life can exist in extreme locations on Earth, it is possible that life exists in similar conditions on Mars! We need you think of locations on Earth where extreme life may exist, record the coordinates of these locations, and explain why you think similar conditions may host life on Mars!”*

2. Inform your students that in order to help your friend, they will be brainstorming locations on Earth where extreme life may exist, recording the coordinates of these locations, and relaying their ideas on analogues life on Mars.
3. Divide the students into groups of 3-4.
4. Pass out one copy of the “Individual Coordinates” page to each student, along with one copy of the “Group Coordinates” page and atlas per group.

#### **Developing the Activity**

1. Instruct your students on the topic of extreme life on Earth. Give the students enough information for them to understand the concept of



extreme Earth life conditions, but also encourage them to creatively hypothesize other locations where extreme life may exist.

2. Have the students brainstorm these locations on their own for 5-10 minutes and record them on their “Individual Coordinates” page in the section entitled “Brainstorming Locations.”
3. Once each student has recorded 3-5 possible locations, have the students meet with their team members for approximately 10 minutes to determine the best location where they believe extreme life may exist on Earth.
4. Group members should then find this location in a world atlas and record its coordinates in longitude/latitude form on the “Group Coordinates” page.

### **Concluding the Activity**

1. Have one member of each group stand and detail his/her group’s location. Have the student explain their brainstorming ideas, why they picked their respective location, and if they believe a similar location may support life on Mars.
2. Once each group has explained their locations, conduct a group discussion of analogues between extreme life on Earth and the possibility of life on Mars. Ideas for discussion can be found in the evaluation questions below.

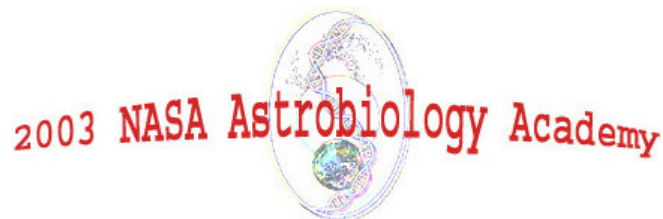
### **Extending the Activity**

Additional topics for investigation:

Life in extreme environments and its analogues to Mars is a topic of much discussion in the modern scientific community. However, analogues to other environments can be made, including the possibility of life on Europa (Jupiter’s moon), as well as theories concerning the development of the early Earth.

### **Evaluation Questions**

1. What makes it difficult for life to exist at these extreme Earth locations?
2. How can life survive in these conditions?
3. Could the extreme conditions of Earth exist on Mars?



4. If so, could life therefore exist on Mars?
5. How would we, as humans, go about determining if life exists on Mars?

## **Example Locations of Extreme Life on Earth**

The following serve as examples of extreme life-supporting environments:

1. *Deep-Sea Hydrothermal Vents at Snake Pit* (23°23'N, 44°56.1'W, Atlantic Ocean): With average temperatures of 345°C and pH levels of 3.7- 3.9, extremophiles flourish in this extreme environment.
2. *Sahara Desert, Algeria* (24°39'54"N, 9°40'15"E): Extreme temperatures and only an average of 8 inches of rain a year is not enough to prevent life from existing in this extreme Earth environment.
3. *Death Valley* (36°25'16"N, 116°51'46"W): With record temperatures over 130°F and an annual rainfall of less than 2 inches, life continues to exist in this environment.
4. *Lake Vostok, Antarctica* (77°S, 105°E): Frozen for more than 500,000 years, some believe this frozen Antarctic lake may be home to many forms of extreme life.
5. *Kilauea Volcano, Hawaii* (19°27'7"N, 155°18'31"W): Extreme temperatures and flowing molten lava may still play host to extreme microorganisms (known as thermophiles) in and around the volcano.
6. *Lake Lincancabur, Chile* (22°49'59"S, 67°52'57"W): At nearly 6,000 meters above sea level, this lake is still home to a thriving ecosystem.



## Individual Coordinates Page

<u>Type of Location</u>	<u>Why Extreme?</u>	<u>Specific Examples</u>
<i>e.g. desert</i>	<i>high temperatures, little annual rainfall</i>	<i>Sahara Desert Mojave Desert</i>

## Group Coordinates Page

<b>Location Name</b>	<b>Location Type</b>	<b>Coordinates</b>	<b>Why Extreme?</b>
<i>e.g. Snake Pit</i>	<i>Hydrothermal deep-sea vent</i>	<i>Longitude 23°23' Latitude 44°56.1'</i>	<i>High temperatures (345°C) and acidic pH levels (3.7-3.9)</i>

## Resources

1. “Death-Valley.us.” <http://www.death-valley.us/>
2. “Gallery – Sahara Desert, Algeria.”  
<http://www.cyberseek.com/nabs/gallery-Algeria-Sahara.htm>
3. “Hiking Around Las Vegas, Death Valley National Park, Gower Gulch Loop Trail.”  
[http://users.lvcm.com/jlboone/DEVA/G\\_Gulch\\_Loop/G\\_Gulch\\_Loop.htm](http://users.lvcm.com/jlboone/DEVA/G_Gulch_Loop/G_Gulch_Loop.htm)
4. “Kilauea, Hawaii.”  
[http://volcano.und.nodak.edu/vwdocs/current\\_volcs/kilauea/kilauea.html](http://volcano.und.nodak.edu/vwdocs/current_volcs/kilauea/kilauea.html)
5. “Lake Vostok.” <http://www.cyberspaceorbit.com/gridvost.htm>
6. “Probing the Mysteries of Sea-Floor Volcanoes and Hydrothermal Vents.”  
<http://www.washington.edu/research/pathbreakers/1983c.html>
7. “What’s Living in the World’s Highest Lake?”  
<http://www.seti.org/litu/projects/highlights/licancabur.html>

## Contact

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