Short Performance Assessment: **MS-ESS2-1**

Grade Level: **Middle School**

Adapted from SNAP[1]

Title	**Manpupuner Rock Formations**		
Designed by	**Elizabeth Perez & Paul Andersen**	Course(s)	**MS**

Performance Expectation	**MS-ESS2-1**: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. **Clarification Statement**: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials. **Assessment Boundary**: Assessment does not include the identification and naming of minerals.

Science and Engineering Practice	**Developing and Using Models** • Develop and use a model to describe phenomena.
Disciplinary Core Ideas	**ESS2.A: Earth's Materials and Systems** • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.
Crosscutting Concept	**Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.

Student Performance	1. Components of the model 2. Relationships 3. Connections

[1] The Short Performance Assessment (SPA) and the Assessment Rubric adapted from the Stanford NGSS Assessment Project http://snapgse.stanford.edu/

Name_____

The Manpupuner Rock Formation is found near the Ural Mountains in Russia. Over the past 200 million years the mountains around the rock structures have eroded away by weathering leaving these large pillars that are 30-40 meters in height. We will be attempting to determine the processes that formed the rocks in these formations.

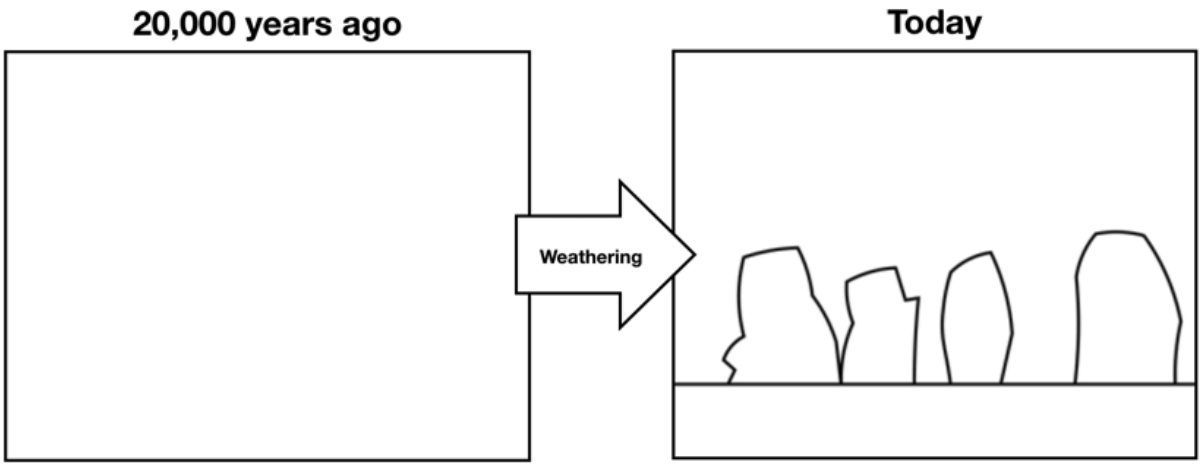
Highest point	
Prominence	98–138 ft (30–42 m)
Coordinates	62°15′28″N 59°17′53″E
Geography	

Location in Russia

Location	Troitsko-Pechorsky District, Komi Republic, Russia
Geology	
Age of rock	200 million years

Source: Wikipedia

1. Watch a short video taken from the base of these rock formations. In the box below draw a model of what this area may have looked like 20,000 years ago.



Geologists have determined that the Manpupuner Rock Formations are composed of solid sericite-quartzite schists (a type of **metamorphic** rock) which formed from **sedimentary** rocks in the area.

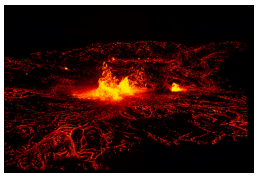
2. Using the diagram below, draw arrows to create a model showing a possible sequence of processes forming the Manpupuner Rock Formations **starting with Magma**. Label each arrow with a number indicating the step in the process the arrow represents (i.e. 1, 2, 3, etc.). Next to the number identify the rock process that is causing the change.

Sedimentary Rock
Source: CC BY-SA 3.0, Wikimedia

Sediment
Source: CC BY-SA 3.0, Wikimedia

Igneous Rock
Source: CC BY-SA 3.0, Wikimedia

Metamorphic Rock
Source: CC BY-SA 3.0, Wikimedia



Magma
Source: Public Domain
By National Park Service Digital Image Archives

Using your rock cycle model from above, complete the table on the next page.

Word Bank:

- crystallization	- sedimentation
- melting	- weathering
- erosion	- deformation

3. Choose two of the Earth processes identified in question 2 to model in more detail. For each process mark the location, change and energy source driving the process. Then develop a model that shows this process. Your model must include **material change**, **energy flow** and **atomic arrangement**.

#	Process name	Location on Earth	Type of Change	Energy Source
		☐ Surface ☐ Interior	☐ Chemical ☐ Physical	☐ Sun ☐ Earth's hot interior
Develop a Model				

#	Process name	Location on Earth	Type of Change	Energy Source
		☐ Surface ☐ Interior	☐ Chemical ☐ Physical	☐ Sun ☐ Earth's hot interior
Develop a Model				