**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Glaciers of the Upper Midwest Hr \_\_\_\_\_\_**

Over the last 2 million years, there have been 4 major ice ages during which glaciers covered large parts of Minnesota. The last of these glacial advances ended about 10,000 years ago. These glaciers were enormous sheets of ice over a mile thick and covering thousands of square miles. The massive force exerted by the weight of this ice along with the torrent of meltwater released as it melted carved many of the surface landforms visible in Minnesota today. Our 10,000+ lakes, the Minnesota River Valley, The Great Lakes, and the deep potholes of Taylor’s Falls all owe their existence to glacial processes. This activity will give you a unique opportunity to view 3D maps of our part of the world and search for clues that these ancient glaciers have left behind. What a cool assignment!

**Part 1- Preliminary Investigation**: Use the 3D glasses to check out the map of the upper Midwest. As a group, discuss and then circle 3 different land formations that you think might have been formed by glaciers or the water from melting ice. Number these sites 1, 2, and 3. In the space below, describe each of these formations and explain how you think they may have formed.

|  |  |  |
| --- | --- | --- |
| **Location** | **Description of Landform** | **Hypothesis – how do you think this formed?** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |

Now try to find a location that seems to have escaped the effects of glaciation. Circle this location and number it 4. Then fill in the table below.

|  |  |  |
| --- | --- | --- |
| **Location** | **Description of Landform** | **Hypothesis– why do you think glaciers missed this?** |
| **4** |  |  |

Now it’s time to think about direction! Find 2 places on the map where you think you can tell which way the glaciers were moving. Draw arrows on the map and number the arrows 5 and 6.

|  |  |  |
| --- | --- | --- |
| **Location** | **Direction you think glacier was moving** | **Evidence for this direction of movement** |
| **5** |  |  |
| **6** |  |  |

**Part 2 – Learning about Glacial Features:**  Now we need to learn a bit about some of the specific landforms that are created by glacial activity. Read the description of each of the formations below. Then find one spot on the map where this type of formation seems to be present. It is ok if some of these use the same sites as you located in Part 1.

**Lateral Moraine:** A moraine is a large pile of glacial debris left behind by a glacier. Lateral moraines are ones that form on the side of the glacier. These formations mark the edges of where the glacier once was – kind of like a riverbank marks the edges of a river. Circle the spot where you think a lateral moraine has formed and label it lateral moraine.

**Terminal (end) Moraine:** This type of moraine forms along the front of the glacier, kind of like a bulldozer that pushes a pile of material in front of it. The terminal moraine marks the farthest advance of the glacier. Circle the spot where you think a terminal moraine has formed and label it terminal moraine.

**Kettle lakes:** As glaciers melt and break up, they often leave behind enormous blocks of ice partially buried in the ground. As the ice blocks melt, they leave behind depressions in the landscape. The depressions fill with snowmelt and rainwater to produce [kettle lakes](http://en.wikipedia.org/wiki/Kettle_%28landform%29). In the satellite view, this will look like a region with a bunch of small, shallow lakes. Circle the area where you think kettle lakes are located and label it kettle lakes.

**Driftless Area:** Southeastern Minnesota, Southwestern Wisconsin and Northeastern Iowa make up the driftless area. This is an area that has not been glaciated during the last few million years. Circle this area on the map and label it driftless area. What evidence do you see that this is an area that hasn’t been glaciated?

Evidence:

**Mesabi Range:** The Mesabi Range is not a glacial feature. Instead, this is a ridge of iron-bearing taconite ore. This is actually one of the most important iron deposits on Earth! Remember that taconite is very hard, so glaciers tended to split around this formation instead of scraping it away. This formation is very visible in the satellite photo. Look for a very narrow, snake like formation that runs SW to NE about half way between Duluth and Canada. Circle and label the Mesabi Range on your map.

Now that you have labeled all of the above formations, have Mr. Prem check out your map and sign below. Once your group has their map approved, use a damp Kleenex to clean your map. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part 3 - Smaller scale glacial features:** These landforms are a bit too small to be easily visible in the large 3D map. View the amazing power point Mr. Prem put together and fill in the information in the chart below.

|  |  |  |
| --- | --- | --- |
| **Feature** | **Description or drawing** | **How formed** |
| Drumlin |  |  |
| Esker |  |  |
| Kame |  |  |
| Till |  |  |