Our Diverse Prairie Landscape: Saskatchewan is Not Just Flat! Erratic-al!

Subject/Grade: Earth Science 30, Grade 8 Science and Grade 7 Science
Lesson Title: Saskatchewan is Not Just Flat! Erratic-al!

Stage 1: Identify Desired Results

Outcome(s)/Indicator(s)

Earth Science 30 Lithosphere

Analyze surface geography as a product of deposition, weathering, erosion and mass wasting processes. [SI, CP]

a) Observe, describe and locate common landforms (e.g., moraines, potholes, drumlins, buttes, coulees, dunes, oxbow lakes and river valleys. (K)

c) Explain how surficial geological features of Saskatchewan such as Qu' Appelle Valley are characterized by specific depositional and erosional processes. (K)

d) Describe the effects of mechanical weathering and erosion, including glaciation, on the surface geography of Saskatchewan as shown by landforms such as drumlins, moraines, eskers, kettles, and outwash. (K)

Grade 8 Water Systems

WS 8.2- Examine how wind, water, and ice have shaped and continue to shape the Canadian landscape.

f) Create a written, visual, physical, or dramatic representation of the processes that lead to the development of rivers, lakes, continental drainage systems, and ocean basins, including glaciation, continental drift, erosion, and volcanic action.

g) Relate factors that affect glacier formation and reduction and their effects on the environment to the formation of glacial landforms in Saskatchewan (e.g., drumlins, moraines, eskers, and kettle lakes).

Grade 7 Earth's Crust and Resources

EC7.3 Investigate the characteristics and formation of the surface geology of Saskatchewan, including soil, and identify correlations between surface geology and past, present, and possible future land uses. [DM, SI]

f) Differentiate between weathering and erosion, and explain the role of water in each process.

g) Document the natural surface geological features of the local environment and provide explanations for

the origin of those features.

Key Understandings: ('I Can' statements)	**Essential Questions:**
● I can use a map to interpret information. ● I can create a map using a grid system. ● I can describe and apply my knowledge about glacial landforms to explain the flow direction of a glacier. ● I can describe what a glacial erratic is and how it applies to the activity.	● What is a glacial erratic? ● What are some clues an environment may give to the source of an erratic. ● What information is useful on the Geological Highway map for our activity? ● What is a null hypothesis?

Teacher Background

The Laurentide Ice Sheet was the last glacier to advance over Saskatchewan; it reached its maximum thickness and extent approximately 18,000 years ago. The retreat of the Laurentide Ice Sheet went on for the next 10,000 years; through the movement of the ice sheet the landscape of Saskatchewan was created. In this lesson students will create a map to show the source of an erratic and hypothesize as to the source of the Rockhaven Erratic. Students will also utilize the grid enlargement technique.

Definitions

Eskers: are ridges formed by streams flowing under the ice sheet. Eskers are parallel to the direction of ice flow.

Moraine: Moraines are mounds, ridges or accumulations of till. Moraines are deposited by the glacier and can take a variety of forms. Moraines can be parallel to ice flow or perpendicular to ice flow depending on the type of moraine. An end moraine is the ridge formed at the end of a glacier. This type of moraine is perpendicular to ice flow. A lateral moraine is a ridge or mound accumulated along the sides of the glacier.

Hummocky Terrain: Hummocky moraines can also be referred to as hummocky terrain. This type of terrain is formed when an area is marked by many hills (hummocks) and kettles.

Drumlin: A drumlin is a hill formed from build up of glacial debris. A drumlin is not symmetrical; the gently sloped slide is parallel to the direction of ice flow and faces the direction the ice came from. The drumlin is built under the margin of the ice while the glacier is moving.

Striae: Striae are scratch marks caused by the rocks and sediments frozen in the glacial ice as they travel over the landscape.

Erratic: An erratic is a rock that has been moved from its outcrop to an area where the lithology (rock type) is different. Erratics can be very big. There is one (Rockhaven Erratic) at Big Rock Heritage Site near Cutknife Saskatchewan (#21 south map). It weighs over 2500 tonnes and was once over 10 m by 10m by 10m but has been broken apart.

Glacial Lakes: are formed when glacial meltwater is trapped in low-lying areas. The melt water contains fine sediments that settle on the bottom of the lake bed.

Stage 3: Build Learning Plan

Set (Warm-up, Focusing the Learning): Time: 10min

As a class discuss the clues that an environment may give to the source of an erratic. Some clues may include the position of certain landforms. Eskers are landforms created by streams flowing either on top of or underneath a glacier and are parallel to the direction of ice movement. Drumlins are teardrop-shaped ridges formed by glacial debris beneath a glacier and are oriented parallel to the direction of ice movement. Remember that not all features are parallel to the glacier; ridged moraines and end moraines are perpendicular to ice movement.

Development: Time: 35 min

1) Allow the students to form groups of 2-4. Hand out large poster paper and instruct the students to create a grid of 16 squares on the paper (4 x 4). Each square should be at least 6cm by 6cm or larger (this will depend on the size of the poster paper). This will form the basis of the map.
2) Using the map on the student activity sheet the students will create a larger, coloured version of the same map; based on the grid drawn on the poster paper.
3) Once students have created the map, place a granitic erratic (available from a rock kit or found on the schoolyard) on the "x"mark on the map. The erratic was once part of the granitic intrusion in the north-east corner of the map.
4) Each group should then interpret the symbols on the map to work out flow direction.

Learning Closure: Time: 15min

1) Have each group present their interpretation of the flow direction and make sure that they provide evidence and reasoning for their explanation.
2) Have a class discussion about the interpretations and clear up any misunderstandings.
3) Then, ask students to speculate as to the source of the granitic gneiss erratic found at Rockhaven.

Materials/Equipment:

- Saskatchewan Geological Highway Map 1 per every 3 students
- Poster Paper
- Pencil Crayons
- Granite or rock samples
- Student Activity Sheet

Safety Considerations:

- Handle the glacial erratic sample with care. Do not throw it to or at other students.

Possible Adaptations/ Differentiation

If students have not been introduced to glacial landforms yet, then incorporate a research component to the activity where students research the glacial landforms that they will encounter in the activity.

If students are not familiar with interpreting maps or are overwhelmed by the Saskatchewan Geological Highway map, then create a mini lesson and go through the map together as a class.

Depending on student's readiness you can guide students through the activity or you can let students guide themselves. You may have different groupings of students based on readiness for the activity where one or two groups are guided through the activity while the other groups work on the activity with less guidance.

Stage 4: Determine Evidence for Assessing Learning

- Students can hand-in the activity sheet and the map that they created on the poster for marks.
- Students should transfer the knowledge gained from the map activity to the exit slip.

Extensions

- Students may use found objects to make their map three-dimensional.
- Students may challenge each other to a treasure hunt using glacial features as the basis for locating the treasure.

Look at the Digital Geological Highway Map of Saskatchewan (*GeoExplore Saskatchewan*) website for further information and a deeper understanding of the local context:

Main Website
https://skgeolhighwaymap.maps.arcgis.com/apps/MapSeries/index.html?appid=a845cbb370f7401597806887318e2676

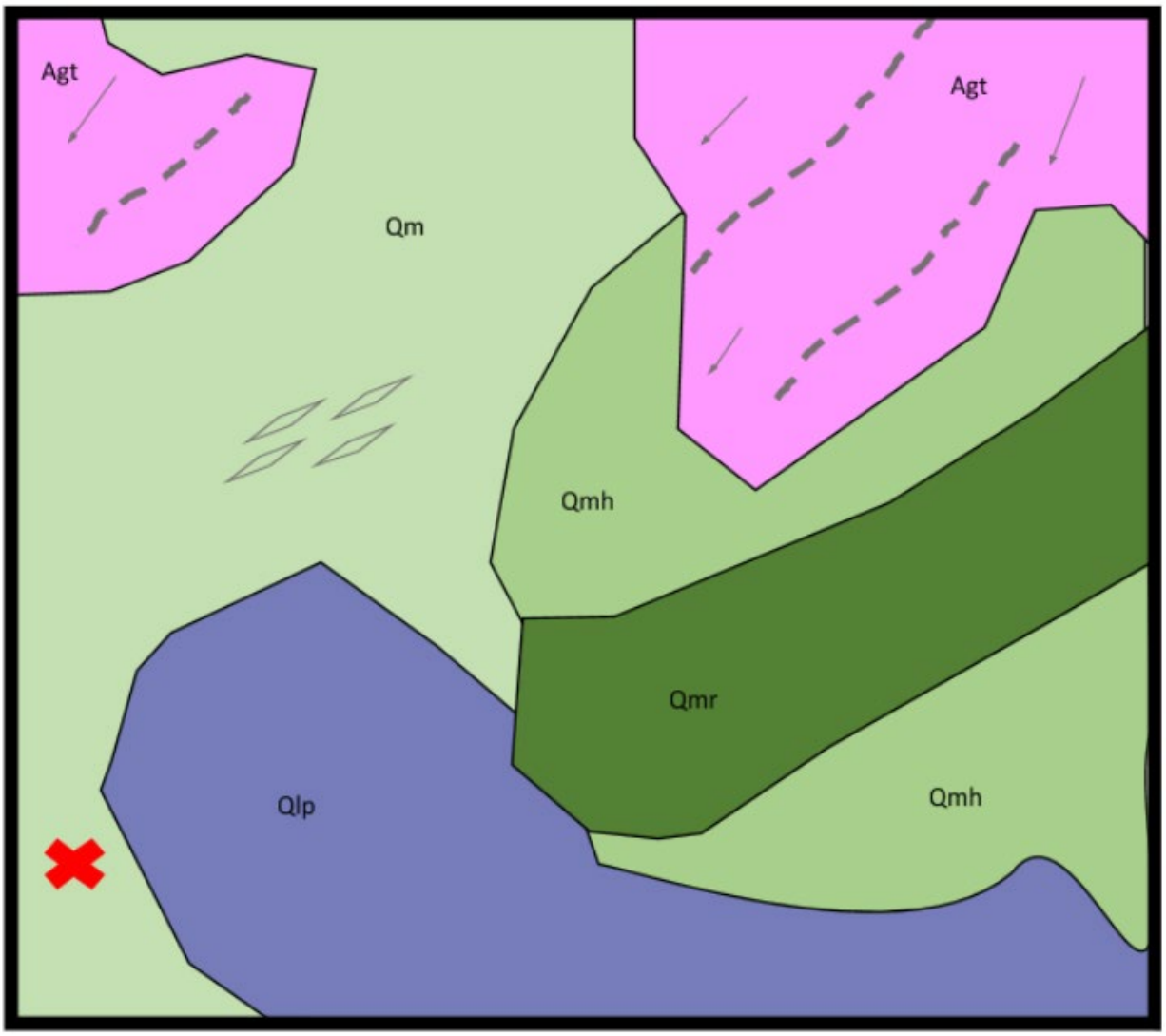
For more background information related to this lesson check out

- Main tab “Landforms”
- Main tab “Ice Age”

Name:_____

Student Activity Sheet

Erratic-al



Legend

- Esker
- Striae
- Drumlin
- Place erratic here

Qlp	Lake plain
Qmr	Moraine - ridged
Qmh	Moraine - hummocky
Qm	Moraine
Agt	Granite and granitic gneiss

1. Enlarge the above map onto poster paper by constructing a grid on both the map and the poster paper. The grid on the map should consist of four squares across and four squares down, creating a total of 16 squares. On the poster paper ensure that there are 16 squares as well, they should be at least twice the size as the squares on your map. Copy the map onto the poster paper by drawing exactly what is on the map onto the same square on the poster paper.

2. Use the Geological Highway Map of Saskatchewan to determine the different lithologies (rock types) based on the colours and text symbols in the legend. What do the capital letters Q and A stand for in the legend?

   _____

   _____

3. Ask for an erratic, and place it on the map in the correct spot.

4. What is one non-glacial way you may be able to determine the source of the erratic?

   _____

   _____

5. Use the following glacial features to determine the source of your erratic: ridged moraine, esker, striae, drumlins.

6. Look at #21 (south sheet) on the Geological Highway Map of Saskatchewan. Where is the potential source of this erratic?

   _____

   _____

7. Look at the #41 near Pinehouse Lake (north sheet) on the Geological Highway Map of Saskatchewan. What is the pink area just north of #41? #41 shows up in three places on the map. Why is that?

   _____

   _____

8. Create a null hypothesis: The erratic was not transported by glaciers. Accept or reject? If reject, what other hypothesis is proposed to explain the erratic. Is this hypothesis falsifiable?

   _____

   _____

   _____

EXIT SLIP: The erratic at Rockhaven is thought to originate at or near #41, yet #41 is not within the pink granitic area. Explain.

Hint: Are there any clues that lead to this area as the source of the erratic?

Hint: Does the legend of the map give any clues?

Hint: What explanation of #41 is provided on the map sheet?

_____

_____

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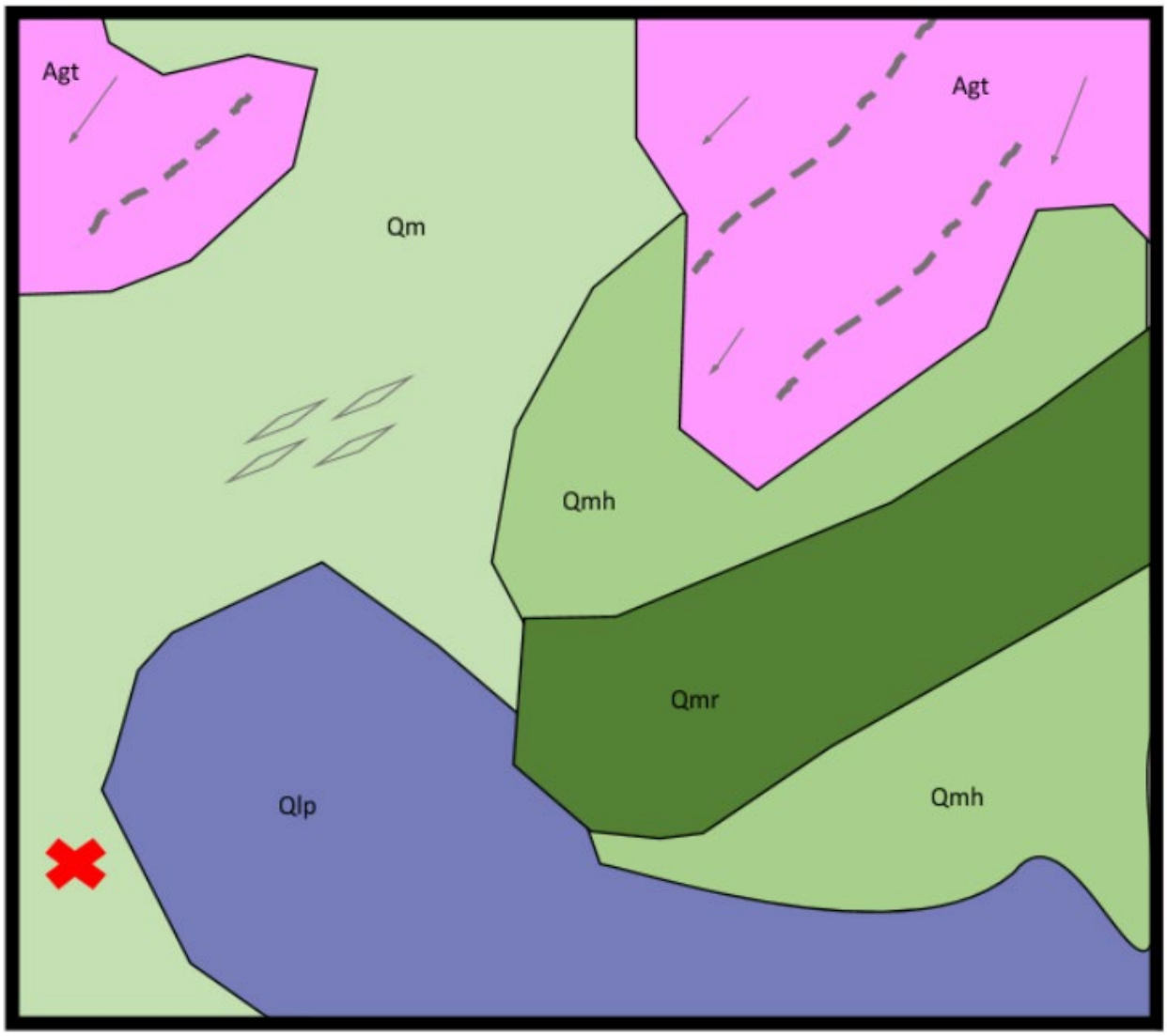
_____

Geoscape Southern Saskatchewan: Geoscience for Prairie Communities

Student Activity Sheet

Answers

Erratic-al



Legend

Esker

Striae

Drumlin

Place erratic here

Qlp — Lake plain

Qmr — Moraine - ridged

Qmh — Moraine - hummocky

Qm — Moraine

Agt — Granite and granitic gneiss

2. Granite - pink
   Moraine – light green
   Glacial Lake – light purple
   Ridged Moraine – dark green
   Hummocky Terrain – green
   A is for Archean and Q is for Quaternary. These are the ages of the units.

4. A detailed geological study of the erratic can be performed, determining the minerals that make up the erratic and any other information (such as age of the rock) that can be compared to the potential source of the erratic.

6. The potential source is the Precambrian Shield.

7. The pink area north of #41 is granitic gneisses and granitic intrusions.

Exit Slip

#41 is on the map in three places. It is there to show the contact between the Precambrian shield and younger sedimentary rocks to the south. This contact is called an unconformity, it is important because there is a large gap in age between the rock types on either side of it. The erratic is granitic gneiss so could be from the large granitic gneiss area (dark pink) north of the unconformity. The site at #41 does not represent a single place, rather it represents where the contact between Precambrian Shield and younger Phanerozoic sedimentary rocks meets the surface. It is important to notice that the glacial landforms indicate that rocks from the shield could have been transported south to areas where granite gneiss is not exposed.