

Am Muidhe




Student Sheet












General instructions to students:

1. Note the main RISKS at the site when you arrive.
2. Respect the geological code of conduct at all times, do not disturb wildlife, close gates. Observe the recommendations of the Scottish Natural Heritage when collecting rocks and fossils – see www.snh.scot/scottish-fossil-code
3. Before leaving transport, check that you have suitable clothing and footwear and the equipment to record your field observations:
 - ✓ Pencils
 - ✓ Clipboard
 - ✓ Task sheet
4. Stay close to your teacher/supervisor at all times. Note there is water, boggy ground, cliffs and scree.
5. Try and complete your observations in as much detail as possible. Listen to the teacher as they explain what you are looking at and ask questions if you are unsure about any aspects of the site.

Tasks to be completed:

Task	Description	Completed (tick)
1	<p>You are asked below to make drawings. Always put a scale on drawings and photographs. A ruler is best but a hand or a foot will do!</p>  <p>Feature Image 1: Looking west from Am Muidhe across a glaciated pavement along a U-shaped valley carved by a glacier. Draw a sketch of the view in front of you and label features that are produced by the action of a glacier.</p>	<input type="checkbox"/>
2	 <p>Feature Image 2: Grooves in a rock surface carved by boulders being carried by a moving glacier Find a grooved rock surface and draw detailed sketches showing features, both large and small, that result from abrasion by boulders carried by ice. Indicate the direction in which the ice was moving.</p>	<input type="checkbox"/>
3	 <p>Feature Image 3: Tight folds in Moine schist formed when Scotland was on the edge of Canada. It collided with a subduction zone during the closure of the Iapetus ocean.</p> <p>Most of the rock exposures around you, and in the distance, are made of a rock called schist. They are called the Moine schists and form most of Scotland north of the Great Glen right up to the north coast. They formed originally as sand and mud in a shallow sea on the edge of a giant continent called Rodinia a billion years ago. When Rodinia broke apart the Moine sedimentary rocks found themselves on the edge of a continent called Laurentia, modern Canada.</p> <p>470 million years ago the edge of Laurentia collided with a subduction zone, a line where old ocean floor sinks down into the Earth's mantle. All the rocks of the Scottish Highlands were folded and piled up to produce a great mountain range, the Caledonian- Appalachian mountains. In Scotland, this time is called the Grampian 'orogeny', a word that means 'mountain building'. The Moine rocks were involved in a second orogeny called the Scandian orogeny 430 million years ago when a small continent called Avalonia, carrying the rocks that now underlie England, collided with Laurentia.</p> <p>The bands in the rocks here are the original sedimentary layers but they have been intensely folded, piled up and heated by being buried deep below the surface, so that new mineral grains have formed, a process called 'metamorphism'. It is hard to imagine how rocks can fold but when they are red hot they become plastic, a bit like an iron bar when it is heated. These rocks have been folded and stretched. When you get home find an old strip of carpet and create a fold by pushing in the ends. If you make the fold tall enough it will flop over and look very like the folds in front of you now.</p> <p>Look closely at the mineral grains in the different beds. You will see that they vary in colour and size. Find a distinctive band and see how far you can follow it before it dies out. Compete with your friends to find the longest continuous bed!</p>	<input type="checkbox"/>

4	 <p>Feature Image 4: Very complicated folded folds. The Moine rocks have experienced several stages of folding</p> <p>The Moine rocks here have extremely complicated folds. They have been folded more than once. There are big folds and little zig-zag folds which follow around the big folds. Make a drawing. See how far you can follow the individual beds. You will find that they can't be followed very far. You will also find out that the folds are themselves folded. Draw one of these 'refolded folds' (this is quite difficult!).</p>	
5	 <p>The white sausages in front of you are called 'boudins', the French word for sausage. They form when a strong, rigid rock, embedded in less strong rocks is stretched. When folds form with a long, thin, U-shape the beds on the parallel 'limbs' of the fold are stretched. The weaker rocks can 'flow' more easily but the rigid rocks simply pull apart forming 'sausages'. The ones here are made mainly of quartz, a very tough mineral. Make a labelled drawing of the boudins and the weaker folded rocks around them.</p> <p>Feature Image 5: A row of boudins, French for a sausage. They form when layers of hard rock are stretched during folding</p>	
6	 <p>Feature Image 6: A band of pegmatite, a rock made of very large crystals, formed from magma that cut through the Moine schists</p> <p>The white rocks here are quite different to the Moine schists. They do not show bedding and they are not folded. Look closely and you will see that they are made of extremely large crystals of quartz, feldspar and darker plates of mica. They are a form of granite, an igneous rock. Very coarse-grained igneous rocks like this are called 'pegmatites' and they form from magmas with a lot of water dissolved in them. You can see that the pegmatite cuts across the folded Moine rocks. Make a drawing and explain which rock formed first.</p>	
7	<p>Walk about on the pegmatites and decide whether they all formed at the same time, or in several stages. Make a drawing explaining your conclusion.</p>	
8	<p>Walk about on the pegmatites and you will find places where the black, shiny crystals of mica are arranged in patterns resembling trees. This is how they grew from the magma. Make a sketch. They show that the pegmatite has never been folded. Making use of information in Task 3, what is their maximum age?</p>  <p>Feature Image 7: Pegmatite with black shiny crystals of mica arranged in patterns resembling trees.</p>	

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Name		Location	Am Muidhe
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