

Volcanic eruptions in iceland



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Take-home Test

1. Describe the three different types of volcanic eruptions that have given rise to Iceland's volcanic landforms.

- Effusive: An effusive eruption is a volcanic eruption characterized by the flow of lava onto the ground. Lava flows generated by effusive eruptions vary in shape, thickness, length, and width depending on the type of lava that erupted, the type of discharge, the slope of the ground over which the lava travels, and the duration of the volcanic eruption.
- Explosive: This is a violent, explosive type of eruption. This is a result of when sufficient gas has dissolved under pressure within a viscous magma, such that the discharged lava violently bubbles up into volcanic ash as pressure is suddenly lowered at the vent. Explosive eruptions can send rocks, dust, gas and lava fragments into the atmosphere. A cloud is then created which then collapses, creating a flow of hot volcanic matter (gas + rocks).

- Mixed: This eruption is a mixture of both lava and tephra (fragmental material produced by a volcanic eruption).

2. Describe the characteristics of a Tuya. How does this acquire its distinctive shape?

A Tuya is a flat-topped, steep-sided volcano formed when lava erupts through a thick glacier or ice sheet. Such volcanic formations are restricted to regions which were covered by glaciers and had volcanic activity during the same period. Their formation is due to lava that erupts under a glacier and cools very quickly. It cannot travel far, so it piles up into a steep-sided hill.

3. Define the term jökulhlaup and explain its significance to Iceland.

Jökulhlaups in Iceland may originate from marginal or subglacial sources of water melted by atmospheric processes, permanent geothermal heat or volcanic eruptions. Glacier-volcano interactions produce meltwater that either drains toward the glacier margin or accumulates in subglacial lakes. Iceland is a unique and valuable study-site for glacio-volcanic interactions. The jökulhlaups can be seen as modern analogues of past mega floods on the earth and their exploration may improve understanding of ice-volcano processes on other planets.

Jökulhlaups, both those draining meltwater stored in subglacial lakes and meltwater produced during a volcanic eruption, have significant landscaping potential: they erode large canyons and transport enormous quantities of sediment and icebergs over vast outwash plains.

4. What are the origins of Icelandic river waters? Describe the relevant main characteristics.

Icelandic rivers are of three general types:

- Theglacial-fed riverswhich carry large quantities of fine silt and are typically brown in colour. Their runoff, being conditioned by ice melt, is high in the summer and low in the winter. Glacial rivers are close to freezing at source but warm up considerably in lowland areas. They typically divide into many interlinked distributaries which constantly change direction.
- Thedirect runoff rivers; are relatively clear. They are characteristic of old basaltic areas where the bedrock is impermeable. They have their greatest flows in the spring during snowmelt and in autumn following heavy rains. Water temperature in these streams generally follows the air temperature.
- Thespring-fed streamdrains areas covered by permeable post-glacial lava fields. In these zones the ground is more porous; therefore water emerges in springs at lower levels to supply the rivers with a constant flow of generally clear water. These spring-fed rivers have a water temperature of 3–5°C at source and never freeze over at that point. Their beds and banks are usually stable.

5. Explain the following terms:

- Tephrochronology: A geo-chronological technique that uses discrete layers of tephra volcanic ash from a single eruption to create a chronological framework in which archaeological records can be placed.
- Cryptotephra: Very few studies have looked in detail at the sedimentation and distribution of cryptotephra deposits within

sequences and, more importantly, the criteria for defining the correct stratigraphic position of the volcanic event. Cryptotephra is a tephra-derived glass shard which is not that visible to the naked human eye since they are less than 125micrometers.

- Isopachs: Lines on a map or diagrams which connect points beneath which a particular stratum or group of strata has the same thickness.

6. One measure used to tackle the problem of soil erosion is re-seeding with appropriate floral species. What characteristics of a plant would make it suitable for such a purpose?

Soil stabilizing plants range in size, root type (ideally long), degree of ground cover (fast growth) and visual appeal, and selecting a variety of plants is essential for combating the impact of wind and water erosion. Low plants provide ground cover from wind, while higher trees slow down the force of rain before it hits the ground or more delicate ground cover plants. Once plants are established, their life cycles help return nutrients to the soil to encourage future plant growth (important to have an easy seed dispersal process as well) and maintain adequate moisture levels to avoid soil drying or oversaturation.

7. Describe one method that could be used to measure the profile of a beach.

- Select sampling points for beach profiles across the width of the beach.
- At each sample point in turn, place a pole at the start and finish. The first point should ideally be the low tide mark, or as close to it.
- The next step is to note the main changes in slope angle up the beach, each change is to inform the ' sections' for the profile.

- For each change in slope, use a clinometer to take a bearing to record the slope angle (It is important to ensure that the bearing is taken from a point on the pole that corresponds with the eye level of the person using the clinometer).
- Measure the distance along the ground of the section, and record this information alongside the slope angle.
- Repeat processes for each break in slope that you have identified.

8. Explain the following:

- Lateral moraines: Parallel ridges of debris deposited along the sides of a glacier. The unconsolidated debris can be deposited on top of the glacier by frost shattering of the valley walls or tributary streams flowing into the valley. Because lateral moraines are deposited on top of the glacier, they do not experience the postglacial erosion of the valley floor and therefore, as the glacier melts, lateral moraines are usually preserved as high ridges. Lateral moraines stand high because they protect the ice under them from the elements, causing it to melt or sublime less than the uncovered parts of the glacier. Multiple lateral moraines may develop as the glacier advances and retreats.
- Kettle Lake: Kettles are depressions left behind after partially-buried ice blocks melt. “ Kettle Lake” describes the way the lake basin was formed. While glaciers were forming, a block of ice broke of, and found a uniform position. As the glacier continued to melt, the debris from the glacier (soil, rocks, stones, gravel, etc.) filled in around the block of ice. When the block of ice finally melted, all the debris surrounding it

fell into the hole, creating the kettle type basin, which when filled with water, became a lake as we know it.

- Outwash plain: is a flat region formed of glacial sediments deposited by melt water outwash at the terminus of a glacier.

9. Explain the presence of wave-cut platforms in areas of Iceland presently distant from the coast.

A wave-cut platform is the narrow flat area often found at the base of a sea cliff or along the shoreline of a lake, bay, or sea that was created by the erosion of waves. Wave-cut platforms are often most obvious at low tide when they become visible as huge areas of flat rock. In Iceland, some cases, the rock is relatively easy to erode. Sea-level changes have left a stamp on the coast, and wave-cut platforms can be seen in many around Iceland.

10. Distinguish between mafic and felsic lava:

These words are used to indicate the chemical composition of silicate minerals, magmas, and igneous rocks.

Mafic is used for silicate minerals, magmas, and rocks which are relatively high in the heavier elements. The minerals are usually dark in color and have relatively high specific gravities and also represent material which is newly differentiated from the upper mantle.

Felsic is used for silicate minerals, magmas, and rocks which have a lower percentage of the heavier elements, and are correspondingly enriched in the lighter elements, such as silicon and oxygen. Felsic minerals are usually light in color and have specific gravities. The most common felsic rock is granite,

which represents the purified end product of the earth's internal differentiation process.

11. What is the nominal fix accuracy of a GPS? Why can a DGPS improve this nominal accuracy?

The nominal fix accuracy of a GPS is of 100 meters with a selective availability enabled on the system. The GPS has a number of small errors (e.g. signal delay), so a DGPS can be used to improve nominal accuracy since it transmits messages from local stations that are connected to satellites, producing better and accurate data readings.

12. In cartographic terms, explain why the datum used by a GPS navigation set must be the same as for the reference chart being used.

A datum is a set of reference points on the Earth's surface against which their position can be associated with a model of the shape of the Earth to define a geodetic coordinate system. Horizontal datum is used to describe a point in latitude and longitude. A vertical datum measures elevations or depths. Because the Earth is an imperfect ellipsoid, all localized datums can give a more accurate representation of the area which is being covered than the latest version of the World Geodetic System datum (84).

- Marie Claire Attard Bason