Match the volcano type with its characteristics

What are the three main volcanoes? There are three main types of volcano - composite or strato, shield and dome. Composite volcanoes Composite volcanoes, also known as strato volcanoes, steep side-pots formed from layers of ash and [lava] flowing. The eruptions of these volcanoes can be pyroclastic flow instead of the lava flow. Pyroclastic flow is an overheated mixture of hot steam, ash, rock and dust. The pyroclastic flow can travel down the side of a volcano at very high speeds with temperatures over 400 degrees Celsius. Composite volcanoes can rise more than 8,000 feet. A simple cross-section of a complex volcano when composite volcanoes erupt explosively and pose a threat to nearby life and property. Eruptions are explosive due to the thick, highly viscous lava produced by composite cone volcanoes. This viscous lava has a lot to do with why they are shaped the way they are. Thick lava can't travel far down the volcano's slope before it cools down. Composite volcanoes are usually found in destructive plate margins. Examples of composite volcanoes include Mount Fuji (Japan), Mount St Helens (USA) and Mount Pinatubo (Philippines). Shield volcanoes Shield volcanoes are low, slightly sloping on the sides and are formed from layers of lava. Eruptions are generally not explosive. Shield volcanoes produce fast-flowing liquid [lava] that flow for many miles. Eruptions are usually common, but relatively tame. Although these eruptions destroy property, a person's death or injury rarely occurs. A simple cross section of a shield volcano shield volcanoes is usually found in constructive boundaries, and sometimes in volcanic hotspots. Examples of shield volcanoes include Mount Kilauea and Maunaloa in Hawaii. The video below shows the lava flow to Mount Kilauea. Dome (Acid Lava Cone) Acid [lava] is much thicker than [lava], which flows from shield volcanoes. Dome volcanoes have a much steeper side than shield volcanoes. This is because lava is thick and sticky. It can't flow very far before it cools down and hardens. An example is puy de dome in france's Auvergne region, which erupted more than 1 million years ago. You are here: home > geotopics > volcanoes > what is a volcano? > Type volcano In this section, you will learn about the different types of volcanoes, how they develop and where they are usually located. What You'll Learn to Do to recognize different types of volcanoes as well as their physical characteristics: composite, shield and slag cones to detect various volcanic eruptions Discuss the turning of supervolcanoes of the volcano into a vent through which molten rock and gas escape from a magma chamber. Volcanoes differ in many features such as height, shape, and slope slope. Some volcanoes have tall cones and others are just cracks in the ground (Figure 1). As expected, the magma is associated with the composition of the volcano. Figure 1. Mount St. Helens was a beautiful, classic, cone-shaped volcano. The eruption of the volcano in 1980 blew more than 400 meters (1,300 feet) off the top of the mountain. Composite Volcanoes Composite Volcanoes are made from felsic to intermediate rock. The viscosity of lava means that eruptions on these volcanoes are often explosive (Figure 2). Figure 2. Mt. Fuji, the highest mountain in Japan, is a dormant composite volcano. The viscous lava can't travel far off the side of the volcano before solidifying, which creates the steep slopes of a complex volcano. Viscosity also causes some eruptions that explode into ash and small rocks. The volcano is built layer by layer, ash and lava solidify, one from the other (Figure 3). The result is classic cone-shaped composite volcanoes. Figure 3. The cross section of a complex volcano reveals alternating layers of rock and ash: (1) magma chamber, (2) bed rock, (3) tube, (4) ash layers, (5) lava layers, (6) lava flow, (7) opening, (8) lava, (9) ash cloud. Often there is a large crater at the top of the last eruption. Shield Volcanoes Shield volcanoes get their names in their shape. Although shield volcanoes are not steep, they may be very large. Shield volcanoes are common in scattering centersor intraplate hot spots (Figure 4). Figure 4. Mauna Loa volcano in Hawaii (in the background) is the largest shield volcano on Earth with a diameter of more than 112 km (70 miles). The volcano forms a significant part of the island of Hawaii. The lava that creates shield volcanoes from liquid and flows easily. The spreading lava creates the shape of the shield. Shield volcanoes are built on many layers over time, and the layers tend to have very similar compositions. Low viscosity also means that shield eruptions are not explosive. This Volcanoes 101 video from National Geographic discusses where volcanoes are located and what their properties come from: Cinder Cones Figure 5. in 1943, a Mexican farmer first witnessed a slag cone erupting in its territory. In one year, Paricutín was 1,000 feet tall. By 1952, it had reached 424 meters and then stopped erupting. Slag cones are the most common type of volcano. The slag cone is conical in shape, but much smaller than a complex volcano. Slag cones rarely reach the 300-meter-high but steep side. Slag cones grow rapidly, usually in an eruption cycle (Figure 5). Slag cones consist of small fragments of rock, like pumice stone, stacked on top of each other. The rock shoots up into the air and doesn't fall far from the vents. The exact composition of the slag pot depends on the composition of lava thrown from the volcano. Slags usually get craters at the top. Slag cones are often found near larger volcanoes (Figure 6). Figure 6. This landsat image The topography of San Francisco Mountain, an extinct volcano, has many slag cones near it in northern Arizona. Sunset crater is a slag cone that erupted about 1,000 years ago. Summary Composite, shield, slag cones, and supervolcanose are the main types of volcanoes. Composite volcanoes have tall, steep cones that produce explosive eruptions. Shield volcanoes form very large, gently sloping stacks of effusive eruptions. Slag cones are the smallest volcanoes and result in accumulation of many small fragments of rejection material. An explosive eruption can create a caldera, a large hole into which the mountain collapses. Types of eruptions 7. Some eruption structures are formed during volcanic activity: the Plilian eruption column, Hawaiian pahoehoe flows, and the lava arc of a Strombolian eruption. Several types of volcanic eruptions–during which lava, tephra (ash, lapilli, volcanic bombs and blocks), and assorted gases expelled from volcanic vents or crevices–have been distinguished by volcanologists. They are often called famous volcanoes, where this type of behavior is observed. Some volcanoes may exhibit only a characteristic type of eruption during an activity period, while others may display a whole series of types for each one eruption series. There are three different types of eruptions. The most well-observed are magmatic eruptions, which include decompression gas within magma that drives it forward. Phreatomagmatic eruptions are another type of volcanic eruption, driven by the compression of gas magma, the direct opposite of the process of turning on magmatic activity. The third type of eruption is phreatic eruption, which is driven by super-welding of steam through contact with magm; these types of eruptions often show no magmatic release, instead causing granulation of existing rocks. There are several subtypes within these broad eruption types. The weakest are Hawaiians and submarines, then Strombolians, then Vulcans and Surtseyans. The stronger eruptive types are Pelean eruptions, followed by Plilian eruptions; the strongest eruptions are called Ultra-Plinian. Subglacial and phreatic eruptions are defined by the breakout mechanism and vary in strength. An important measure of eruption strength is the volcanic explosivity index (VEI), a scale of magnitude between 0 and 8 that often correlate with breakout types. Breakout mechanisms Figure 8. Diagram showing the range of VEI correlation and total ejected volume. Volcanic eruptions arise from three main mechanisms: Gas emissions from decompression causing magmatic eruptions Heat contraction in contact with cooling water causing phreatomagmatic eruptions to ejaculate strained particles during steam eruptions causing phreatic eruptions Two types of eruptions in terms of activity, explosive and effusive eruptions. Explosive eruptions are characterized by gas-driven explosions that drive magma and tephra. Effusive eruptions, meanwhile, are characterized by the outging of lava without a significant explosive eruption. Volcanic eruptions have very different strengths. One extreme are effusive Hawaiian eruptions, which are characterized by lava fountains and liquid lava flows, which are usually not very dangerous. At the other extreme, Plilian eruptions are large, violent, and extremely dangerous explosive events. Volcanoes are not tied to an eruptive style and often display many different types, passive and explosive, even in the span of a single breakout cycle. Volcanoes don't always erupt vertically in a crater near the peak, either. Some volcanoes exhibit side and crevice eruptions. Notably, many Hawaiian eruptions start in crevice zones, and some of the strongest Surtseyan eruptions develop along fracture zones. Scientists believed that the pulses of magma were mixed in the chamber before climbing upwards - a process estimated to take thousands of years. But Columbia University volcanologists found that the eruption of Costa Rica's Irazú volcano in 1963 likely triggered a magma that took a nonstop route through the mantle over a few months. Volcano explosivity Index The volcanic explosivity index (usually abbreviated as VEI) is a scale, from 0 to 8, to measure the strength of eruptions. It is used by the Smithsonian Institute's Global Volcanism Program to assess the effects of historical and prehistoric lava flows. It works similar to the Richter scale of earthquakes, so that each interval value represents a ten-time increase in magnitude (it's logarithmic). The vast majority of volcanic eruptions are vei between 0 and 2. Vulkáni kitörések vei index VEI Plume magassága Kitörés típusa Gyakoriság ** Példa 0 <100 m (330 ft)= 1,000 m3= (35,300 cu ft)= hawaiian= continuous= kilauea= 1= 100–1,000 m= (300–3,300 ft)= 10,000 m3= (353,000 cu ft)= hawaiian/strombolian= fortnightly= stromboli= 2= 1–5 km= (1–3 mi)= 1,000,000 m3= (35,300,000 cu ft)†= strombolian/vulcanian= monthly= galeras= (1992)= 3= 3–15 km= (2–9 mi)= 10,000,000 m3= (353,000,000 cu ft)= vulcanian= 3= monthly= nevado= del= ruiz= (1985)= 4= 10–25 km= (6–16 mi)= 100,000,000 m3= (0.024 cu mi)= vulcanian/peléan= 18= months= eyjafjallajökull= (2010)= 5=>25 km (16 mi) 1 km3 (0,24 cu mi) Plinian 10-15 év Mount St. Helens (1980) 6 >25 km 10 km3 (2 cu mi) pliniai/ultra-plinékorszaki 50–100 éves krakatoa (1883) 7 >25 km 100 km3 (20 cu mi) Ultra-Pliné 500–1000 éves Tambora (1815) 8 >25 km 1000 km3 (200 cu mi) Szupervulkanikus 50 000+ év Toba-tó (74 ka) * This is the minimum breakout volume required for the eruption </100 m>Category. ** The values are a rough estimate. They indicate the frequency of volcanoes of this magnitude or higher, † instead of the first magnitude and magnitude 2. 10, the value increases by magnitude 100 (from 10,000 to 1,000,000). Magmatic eruptions magmatic eruptions produce a juvenile cluster during explosive decompression gas emissions. They range in intensity from the relatively small lava fountains of Hawaii's disastrous Ultra-Plinia eruption columns to more than 30 kilometers (19 miles) high, larger than the eruption of Vesuvius 79 buried in Pompeii. Hawaii Figure 9. Diagram of an eruption in Hawaii. (key: 1. Ashes Pen 2. Lava Fountain Crater 3. 4. Lava Lake 5. Fumaroles 6. Lava Flow 7. Lava and ash layers 8. Stratum 9. Ledge 10. Magma wire 11. Magma Chamber 12. Dike) Click on the larger version. Hawaii eruptions are a kind of volcanic eruption, named after the Hawaiian volcanoes with which this eruption type is a hallmark. Hawaii eruptions are the calmest type of volcanic events, characterized by an effusive eruption of very liquid basalt-type lava in a low gaseous state. The volume of material emitted from Hawaiian eruptions is less than half that found in other breakout types. Continuous production of small amounts of lava builds up into large, wide forms of the shield volcano. Eruptions are not centralized at the main peak like other volcanic types, and often occur in the vents around the peak and crevice vents radiating out of the center. Hawaii eruptions often begin as a series of venting eruptions along a rift opening, called curtains of fire. They die as the lava begins to concentrate on some vents. Central-vent eruptions, meanwhile, often take the form of large lava fountains (both continuous and sporadic), which can reach heights of hundreds of meters or more. The particles in the lava fountains are usually cool in the air before going to earth, leading to the accumulation of cindery scoria fragments; However, if the air is particularly dense in the blasts, they can not cool down quickly enough due to the surrounding heat, and the ground is still warm, the accumulation of which forms splash suppositories. If the breakout rate is high enough, it can still form spatter-fed lava flows. Hawaiian eruptions are often extremely long-lived; Since 1983, the Slag Pot of Kilauea has been erupting. Another Hawaiian volcanic feature is the formation of active lava pools, self-sustaining pools of raw lava pools with a thin layer of semi-cooled rock; there are currently only 5 such lakes in the world, and the one in the opening of Kīlauea Kupaianaha is one of them. Figure 10. Ropey pahoehoe lava kilauea, Hawaiįi. Flows from hawaiian eruptions are basalt and can be divided into two types based on their structural characteristics. Pahoehoe a relatively smooth lava flow that can be billowy or ropey. It can be moved like a sheet, the progress of the toes, or a snaking lava column. A'a lava flows denser and viscous, then pahoehoe, and tends to move more slowly. The flows can be 2-20 m thick. A'a flows so thick that the outer layers cool down to a debris-like mass, insulating even warm interiors and preventing cooling. A'a lava moves in a peculiar way, the front of the flow steeper due to pressure from the back until it break off, after which the general mass moves forward behind. Pahoehoe lava can sometimes become A'a lava due to increasing viscosity or increasing rate of shearing, but A'a lava never becomes a pahoehoe flow. Volcanoes known to have Hawaiian activity include: Puau ōō, a parasitic slag cone located on the island of Kilauea in Hawaiįi, which has been erupting continuously since 1983. The eruptions began with a 6km longfissure-based curtain of fire on January 3. They were passed on to the central eruptions at the site of Kilauea's eastern rift, eventually building up the still-active cone. For a list of volcanoes in Hawaii, see The List of Volcanoes in the Hawaii-Emperor's Chain. Mount Etna, Italy. Mount Mihara in 1986 (see paragraph above) Strombolian 11. Diagram of a Strombolian eruption. (key: 1. Ashes Pen 2. Lapilli 3. Volcanic Ash Rain 4. Lava Fountain 5. Vulcan Bomb 6. Lava Flow 7. Lava and ash layers 8. Stratum 9. 10 dam. Magma wire 11. Magma Chamber 12. Ledge) Click on the larger version. Strombolian eruptions are a kind of volcanic eruption, named after the volcano Stromboli, which has been erupting continuously for centuries. Strombolian eruptions are driven by gas bubbles filled with magma. These gas bubbles in the magma accumulate and merge into large bubbles, called gas slants. These are big enough to cross the lava pole. When it comes to the surface, due to the difference in air pressure, the bubble explodes with a loud pop and throws the magm into the air in a similar way to the soap bubble. Due to the high gas pressure associated with lava, continuous activity is usually in the form of episodic explosive eruptions accompanied by distinctive loud explosions. During eruptions, these explosions occur as often as every few minutes. The term Strombolian has been used indiscriminately to describe a wide range of volcanic eruptions, from small volcanic explosions to large eruption columns. In reality, real Strombolian eruptions are characterized by short-lived and explosive eruptions of lava of medium viscosity, often ejecting alometre into the air. The columns are hundreds of meters high. The lava formed by Strombolian eruptions is a kind of relatively viscous basalt lava, and the final product mostly scoria. The relative passivity of the Strombolian eruptions, and the non-harmful nature of that source aperture, allows Strombolian eruptions to remain unchanged for millennia, and also makes it one of the least dangerous eruptive types. Figure 12. An example of lava arches formed during Strombolian activity. This is the image of Stromboli himself. Strombolian eruptions are volcanic bombs and lapilli fragments that travel on parabolic voyages before landing around the source vent. The constant accumulation of small fragments builds slags of basalt pyroclasts. This type of accumulation usually results in well-arranged rings tephra. Strombolian eruptions are similar to Hawaiian eruptions, but there are differences. Strombolian eruptions are noisier, do not produce sustained eruption columns, do not produce some volcanic products associated with Hawaiian volcanism (especially Pele's tears and Pele's hair), and less molten lava flows (although the eruption material usually form small rivulets). Volcanoes known to Strombolian activity include: Parícutin, Mexico, which erupted into a crevice in a cornfield in 1943. Two years into his life, pyroclastic activity began to wane, and the outing of lava from his base became his primary mode of activity. Eruptions ceased in 1952 and the final height was 424 m. It was the first time that scientists were able to observe the entire life cycle of a volcano. Etna, Italy, which has shown Strombolian activity during recent eruptions, for example in 1981, 1999, 2002-2003 and 2009. Mount Erebus in Antarctica, the southest active volcano in the world, has been observed erupting since 1972. Eruptive activity in Erebus consists of frequent Strombolian activity. Stromboli himself. The namesake of the mild explosive activity in his possession has been active throughout historical times; essentially continuous Strombolian eruptions, occasionally accompanied by lava flows, have been recorded in Stromboli for more than a millennium. Vulcan Figure 13. Diagram of a volcanic eruption. (key: 1. Ashes Pen 2. Lapilli 3. Lava Fountain 4. Volcanic Ash Rain 5. Vulcan Bomb 6. Lava Flow 7. Lava and ash layers 8. Stratum 9. Ledge 10. Magma wire 11. Magma Chamber 12. Dike) Volcanic eruptions are a kind of volcanic eruption, named after the volcano Vulcano. It was named after the outbreaks of Giuseppe Mercalli in 1888-1890. In volcanic eruptions, highly viscous magma from the volcano makes it difficult for vesiculate gases to escape. Similar to the Strombolian eruptions, it leads to the buildup of high gas pressure, eventually popping the cap holding the magma down and causing an explosive eruption. However, unlike strombolian eruptions, spurted lava fragments are not aerodynamic; this is due to the fact that higher the Vulcan magma and the larger incorporation of crystalline material broke off the previous cap. They are also more explosive than their Strombolian counterparts, with eruption columns often reaching between 5 and 10 km (3 and 6 miles) high. Finally, Vulcan inserts andesitic a dacitic instead of basalt. Figure 14. Tavurvur erupts in Papua New Guinea. Volcanoes that have exhibited Vulcan activity include: Sakurajima, Japan has been the site of volcanic activity nearly continuously since 1955. Tavurvur, Papua New Guinea, is one of several volcanoes in the Rabaul Caldera. Irazú volcano in Costa Rica showed volcanic activity in the 1965 eruption. Peléan Figure 15. Diagram of Peléan eruption. (key: 1. Ashes Pen 2. Volcanic Ash Rain 3. Lava Dome 4. Vulcan Bomb 5. Pyroclastic flow 6. Lava and ash layers layer 7.8. Magma Wire 9. Magma Chamber 10. Dike) Peléan eruptions (or nuée ardente) are a form of volcanic eruption, named after the volcano Mount Pelée Martinique, the site of a massive Peléan eruption in 1902 that is one of the worst natural disasters in history. The Peléan eruptions, large amounts of gas, dust, ash, and lava fragments blown out of the volcano's central crater, driven by the collapse of riolite, dacite, and andesite lava dome collapses that often create large eruption columns. The early sign of the impending eruption is the growth of the so-called Peléan or lava spine, a bulge at the volcano's peak preceding its complete collapse. The material collapses on itself and forms a rapidly moving pyroclastic flow (so-called block and ash flow), which moves down the side of the mountain at a huge speed, often 150 km/h. These massive landslides make Peléan eruptions one of the most dangerous in the world, capable of tearing through populated areas and causing huge human lives. The eruption of Mount Pelée in 1902 wreaked havoc, killing more than 30,000 people and racing to destroy the town of St. Pierre, the 20th-century city of St. Pierre. Peléan eruptions are characterized mostly by the glowing pyroclastic flows that lead. The mechanics of a Peléan eruption are very similar to a volcanic eruption, except that the Peléan eruptions in the volcano's structure can withstand more pressure, so the eruption occurs as a large explosion rather than more minor. Volcanoes known to Peléan activity include: Mount Pelée, Martinique. The eruption of Mount Pelée in 1902 completely destroyed the island, destroying the city of St. Pierre and leaving behind only three survivors. The eruption immediately preceded lava dome growth. Mayon volcano, the most active volcano in the Philippines. It was the site of many different types of eruptions, Peléan as well. About 40 gorges radiate from the summit, and frequent pyroclastic flows and landslides to the following lowlands. Mayon's most violent outbreak occurred in 1814 and was responsible for more than 1,200 deaths. The 1951 Peléan eruption on Mount Lamington. Before that, the eruption of the peak was not even recognized as a volcano. More than 3,000 people died, and it became a benchmark for studying large Peléa eruptions. Figure 16. (a) Mount Lamington following the devastating 1951 eruption. (b) The lava ridge formed after the eruption of Mount Pelée in 1902. (c) Pyroclastic flows from Mayon Volcano, Philippines, 1984. Plilian figure 17. Diagram of a Plilian eruption. (key: 1. Ashes Pen 2. Magma Wire 3. Volcanic Ash Rain 4. Lava and ash layers Layer 5.6. Magma Chamber) Plinian eruptions (or Vesuvius) are a kind of volcanic eruption, named after the historic eruption of Vesuvius 79 vesuvius that buried the Roman cities of Pompeii and Herculaneum, and especially the chronicler Pliny the Younger. The process of operating binia eruptions begins in the magma chamber, where dissolved volatile gases are stored in the magma. The gases vesiculate and accumulate as they rise through the magma line. These bubbles become agglutinate, and once they reach a certain size (about 75% of the total volume of the magma channel) they explode. The narrow boundaries of the pipeline are gases and associated magma up, form an erupting column. Eruption rate controls the gas content of the column, and low-strength surface rocks are often excellent under pressure of the eruption, forming a widening output structure that pushes the gases even faster. These huge eruptive columns are the distinctive feature of the Plilian eruption and reach 2-45 km (1-28 km) into the atmosphere. The densest part of the feather, just above the volcano, is driven internally by gas expansion. As it reaches higher into the air the feather expands and becomes less dense, convection and thermal expansion volcanic ash drives it even further up into the stratosphere. At the top of the pen, strong prevailing winds drive the pen in a direction away from the volcano. Figure 18. April 21, 1990 eruptive column of Redoubt volcano, as seen from the west of the Kenai Peninsula. These highly explosive eruptions are linked to volatile rich dacitic rhyming lava and occur most commonly in stratovolcanoes. Eruptions can last anywhere from hours to days, with longer eruptions associated with several felsic volcanoes. Although they are linked to felsic magma, Plilian eruptions also occur in basalt volcanoes, given that the magma chamber distinguishes and structure is rich in silica. Plinian eruptions are similar to both volcanic and Strombolian eruptions, except that instead of discrete explosive events, Plinian permanent breakout columns. They are also similar to hawaiian lava fountains that both eruption types produce persistent eruption columns maintained by an increase in bubbles that move up at about the same rate as the magma around them. Figure 19. Lahar is going on the 1985 eruption of Nevado del Ruiz, which completely destroyed the city of Armero in Colombia. Major Plinia eruptive events include: The AD 79 eruption of Vesuvius buried the Roman cities of Pompeii and Herculaneum beneath a layer of ash and tephra. This model is a Plilian eruption. Vesuvus has since erupted several times. The last eruption was in 1944 and caused problems for Allied armies as they passed through Italy. It was a report by Pliny that Younger is that leading scientists refer to vesuvian outbreaks like Plinian. The 1980 eruption of Mount St. Helens in Washington, which tore apart the volcano's peak, was a Plinian eruption of volcanic explosivity Index (VEI) 5. The most powerful type of eruptions, the VEI 8, are called Ultra-plinian eruptions, such as the most recent on Lake Toba 74,000 years ago, which extinguished 2,800 times the material that erupted in Mount St. Helens in 1980. Hekla in Iceland, an example of basalt Plinian volcanism, is that of the 1947-48 eruption. For the past 800 years there has been a pattern of violent initial eruptions of pumice stone, followed by prolonged extrusion of basalt lava from the lower part of the volcano. Pinatubo in the Philippines on June 15, 1991, which produced 5 km3 (1 cu mi) of dacitic magma, a 40 km (25 mi) high eruption column, and released 17 megatons of sulfur dioxide. Figure 20. The image correlate with types of volcanoes in their eruption, highlighting the differences. Click to view a larger version. Phreatomagmatic eruptions are phreatomagmatic eruptions that have interactions between water and magma. They are driven by thermal contraction (as opposed to magma magma, which are controlled by thermal dilation) of magma when in contact with water. This temperature difference between the two causes violent water-lava interactions that make up the eruption. The products of phreatomagmatic eruptions are thought to have more regular shape and finer granularity than products with magmatic eruptions because of differences in breakout mechanisms. There is a debate about the exact nature of phreatomagmatic eruptions, and some scientists believe that fuel refrigerant reactions may be more critical to explosive nature than thermal contraction. Fuel coolant reactions can fragment volcanic material by propagating voltage waves, widening cracks and increasing surfaces that ultimately lead to rapid cooling and explosive contraction eruptions. Surtseyan 21. Diagram of an eruption in Surtsey. (key: 1. Water vapour cloud 2. Condensed ash 3. 4. Water 5. Lava and ash layers 6. Stratum 7. Magma Wire 8. Magma Chamber 9. Dike) The Surtseyan eruption (or hydrovolcanic) is a type of volcanic eruption caused by shallow water interactions between water and lava, so named after the most famous example, the eruption and formation of the island of Surtsey off the coast of Iceland in 1963. Surtseyan eruptions are the wet equivalent of ground Strombolian eruptions, but because of where they take place they are much more explosive. This is because the water is heated lava, flashes of steam and dilates violently, fragmenting the magma that comes into contact with fine grainy ash. Surtseyan eruptions are a hallmark of shallow water volcanic oceanic islands, but they are not specifically limited to them. Surtseyan eruptions can happen on land as well and are caused by growing magma that comes into contact with an aa aauricle (aauricle formation) at shallow levels of the volcano. The products of surtseyan eruptions are usually oxidized with palagonite basalts (although andesitic eruptions occur, albeit rarely), and like strombolian eruptions Surtseyan eruptions tend to be continuous or otherwise rhythmic. Volcanoes known to surtseyan activity include Surtsey, Iceland. The volcano was built up from the depths and emerged from the Atlantic Ocean over the coast of Iceland in 1963. The initial hydrovulate was very explosive, but the volcano grew out of rising lava and began to interact less with water and air until eventually Surtseyan activity declined and became more Strombolian in nature. Ukinrek Maars in Alaska, 1977, and Capelinhos in the Azores, in 1957, are both examples of overwater Surtseyan activity. Mount Tarawera in New Zealand erupted along a rift zone in 1886, killing 150 people. Figure 22. (a) Surtsey, erupting after 13 days of breaking through the water. The vent is surrounded by a tatwood ring. (b) An example of an eruption of the fracture zone, a rift formed by the eruption of Mount Tarawera in 1886. Submarine figure 23. Diagram of a submarine eruption. (key: 1. Water vapour cloud 2. Water 3. Stratum 4. Lava Flow 5. Magma Wire 6. Magma Chamber 7. Dike 8. Pillow lava) Submarine eruptions are a type of volcanic eruption that occurs underwater. An estimated 75% of the total volcanic eruption volume generated by submarine eruptions near the middle of ocean ridges alone, but due to problems associated with detecting deep-sea Vulcans, they remained virtually unknown until advances in the 1990s allowed them to availes. Submarine eruptions can cause séats that break the surface to form volcanic islands and island chains. Submarine vulcanism is driven by different processes. Volcanoes near plate boundaries and Central Ocean ridges are built on the decompression melting of mantle rock rising from an upwelling part of a convection cell surface of the crust. Eruptions associated with subductive zones, meanwhile, are driven by subducting plates, which are added volatile to the growing plate, reducing melting point. Each process creates different rocks; Mid-Ocean ridge volcanic is mainly basalt, while subduction flows are mostly calc-alkali, and more explosive and viscous. Subglacial Figure 24. Diagram of a subglacial eruption. (key: 1. Water vapour cloud 2. Crater Lake 3. Ice 4. Lava and ash layers Layer 5.6. Padalava 7. Magma Wire 8. Magma Chamber 9. Dike) Subglacial eruptions are a type of volcanic eruption characterized by interactions between lava and ice, often under a glacier. The nature of glaciovolcanism dictates that it occurs in areas of high width and high height. It has been suggested that subglacial volcanoes that are not actively erupting often dump heat on the ice, which is them, producing meltwater. This meltwater mixture means that subglacial eruptions often generate dangerous jökulhlaups (floods) and lahars. The study of glaciovolcanism is still a relatively new area. Early accounts described the unusual flat-topped steep-sided volcanoes (called tuyas) in Iceland that were suggested to have formed during eruptions of ice. The first English-language study on the subject was published in 1947 by William Henry Mathews, describing the Tuya Butte field in northwest British Columbia, Canada. The eruption process that builds these structures, originally inferred from the paper, begins with volcanic growth beneath the glacier. At first, the eruptions resemble those that occur in the deep sea forming a pile of pads of lava at the bottom of the volcanic structure. Some lava shatters when it comes into contact with cold ice, forming a glassy breccia called hyaloclastite. After a while, the ice eventually blends into a lake, and more explosive eruptions of surtsey activity begin, mostly building wings made up of hyaloclastit. Finally, the lake comes from continuous volcanism, and lava streams become more efficient and denser as the lava cools much more slowly, often form a columnan join. The well-preserved tuyas show all these stages, such as the Icelandic Hjorleifshofdi. Glaciovvavulcanic products have been identified in Iceland, the Canadian province of British Columbia, the states of Hawaii and Alaska in the United States, the Cascade province of North America, South America, and even the planet Mars. Volcanoes known to be subglacial activity include: Mauna Kea in tropical Hawaii. There is evidence of previous subglacial eruptive activity of the volcano in the form of a subglacial deposit at the summit. The eruptions arises 10,000 years ago, in the last ice age, when the summit of Mauna Kea was covered with ice. In 2008, a British Antarctic survey reported a volcanic eruption in the Antarctic ice sheet 2,200 years It is believed to have been the largest eruption in Antarctica in 10,000 years. Volcanic ash deposits from the volcano were identified in an aerial radar survey, buried in subsequent snowfalls in the Hudson Mountains near the Pine Island Glacier. Iceland, well known for both glaciers and volcanoes, is often the site of subglacial eruptions. An example of an eruption under the Vatnajökull ice cap in 1996, which occurred during an estimated 2,500 ft (762 m) of ice. As part of their search for life on Mars, scientists have suggested that there may be subglacial volcanoes on the red planet. Several possible sites of such volcanicism have been reviewed and compared widely with similar properties to Iceland: Viable microbial communities have found living deep (-2800 m) geothermal groundwater at 349 K and pressure >300 bars. Furthermore, microbes have been made after the existence of basalt rocks on the skin of altered volcanic glass. All these conditions may exist in the polar regions of Mars today, where subglacial volcanism has occurred. Figure 25. Herðubreið, a tuya in Iceland. Phreatic eruptions Figure 26. Diagram of a phreatic eruption. (key: 1. Water vapour cloud 2. Magma Wire 3. Lava and ash layers Layer 4.5. Water plate 6. 7 explosion. Magma chamber) Phreatic eruptions (or steam-blast eruptions) are a kind of eruption driven by the expansion of steam. When cold soil or surface water comes into contact with hot rock or magma, it overheats and explodes, breaking the surrounding rock and thrusting out a mixture of steam, water, ash, volcanic bombs, and volcanic blocks. A distinctive feature of freatic explosions is that only fragments of existing solid rock are blown out of the volcanic pipeline; no new magma has broken out. Since under pressure they are driven by cracks in the layers of rock, phreatic activity does not always lead to an eruption; if the rock face is strong enough to withstand explosive force, open eruptions should not occur, although cracks in the rock are likely to form and weaken it, promoting future eruptions. Volcanoes known for exhibiting phreatic activity include Mount St. Helens, which exhibited phreatic activity before the catastrophic 1980 eruption (which itself was plianian). Taal Volcano, Philippines, 1965. La Soufrière Guadeloupe (Little Antilles), 1975-1976 activity. Soufrière Hills volcano in Montserrat, West Indies, 1995-2012. Poás volcano, frequent geysers, like phreatic eruptions in the crater lake. Mount Bulusan, well known for its sudden phreatic eruptions. Mount Ontake, all historic eruptions of the volcano have been phreatic including the deadly 2014 eruption. Supervolcanons What could cause such a huge caldera? You can stand on the rim and look at the huge Yellowstone Caldera, but it's hard to imagine a volcano or a set it's so huge. Supervolcanoes is a fairly new idea of volcanology. Although the eruptions are incredibly massive, they are extremely rare. The power of Yellowstone, even 640,000 years after the latest eruption, can be seen in the fantastic geysers. Supervolcano eruptions are extremely rare in Earth's history. It's a good thing because it's unimaginably big. The supervolcano must erupt more than 1,000 cubic kilometers (240 cubic miles) of material, compared with 1.2 km3 in Mount St. Helens or 25 km3 in Mount Pinatubo, a major eruption in the Philippines in 1991. Not surprisingly, supervolcanes are the most dangerous type of volcano. Supervolcano eruptions The exact cause of the supervolcano eruptions is still in dispute. However, scientists believe that a very large magmakara will erupt completely in a catastrophic explosion. This creates a huge hole or caldera into which the surface collapses (Figure 27). Figure 27. The caldera of Santorini in Greece is so large that it can only be seen by satellite. Yellowstone Caldera is the largest supervolcano in North America under Yellowstone National Park in Wyoming. Yellowstone sits above a hotspot that erupted disastrously three times: 2.1 million, 1.3 million, and 640,000 years ago. Yellowstone has produced many minor (but still huge) eruptions more recently (Figure 28). Fortunately, the yellowstone activity is limited to the region's famous geysers. The Old Faithful webcam shows intermittent eruptions in Yellowstone's famous geysers in real time. Figure 28. The Yellowstone hotspot has created huge eruptions. The Yellowstone caldera collapsed in the latest super eruption. Supervolcane eruptions and life on Earth A supervolcane can change life on Earth as we know it. Ash can block sunlight so much that photosynthesis would decrease and global temperatures would plummet. Volcanic eruptions may have contributed to some mass extinctions in our planet's history. No one knows when the next super breakout will be. Interesting volcano videos can be seen in National Geographic Videos: Environment Video, Natural Disasters, Earthquakes. One of the interesting is Mount Mammoth, which explores Hot Creek and the volcanic area part of California. Summary Supervolcano outbreaks are rare, but huge and deadly. Yellowstone Caldera is a supervolcano that has erupted catastropically three times. Supervolcano eruptions can change life on Earth. Check the understanding answer to the question(s) below to see how well you understand the topics in the previous section. This short quiz doesn't count in class and you can take it again an unlimited number of times. With this quiz, you can check your understanding and decide whether to (1) continue to study the previous section or (2) move on to the next stage. Section.