Generation of pillow basalts in Iceland, submarine to subglacial.

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Pillow basalt formations are common in Iceland, most examples formed by subglacial eruptions during the last major glaciation. These formations are concentrated within Iceland volcanic zone and formations younger than 2.8 MA. In this talk I present an investigation of basalt pillow lava formations from several places in Iceland, among others Surstey, Kverkfjoll, Langjokull, Reykjanes and Kirkjubajarklaustur. Presenting not only the youngest pillows formed in Iceland but also show difference between subaquatic and subaerial to subaquatic pillows. Frequent occurrence of pillows in Iceland is due to the ice sheet during the last major glaciation. The geological features of the pillows can be used in order to constrain the eruptive and environmental conditions. Vesicular cores in many of the pillows, are relate to a depressurization event during eruption caused by jokulhlaup. Pillows occur in three main types of settings in Iceland, ridges and hillocks entirely made up of pillows, such formations only being found within the centre of Iceland, the lower most part of hyaloclastite formations in tuya-mountains and hyaloclastite ridges, these formations being observed in the centre of Iceland as well as towards the coastal areas, and as products of initially subaerial lava flows that have subsequently flowed into water. The sharp division between pillows and hyaloclastites observed in many subglacial volcanic formations reflects eruptive pressure conditions. Morphological studies of pillows, viscosity considerations, analogue experiments, and numerical calculations suggest that pillow size and shape variations are primarily controlled by eruption rate and viscosity. The cooling history of a pillow pile can be divided into two main stages. In the first stage the pillow is erupted into water. In the second stage the pillow is buried beneath later pillows and becomes part of the pillow pile. Any pillow is then surrounded by other, still hot pillows and cooling is now by water or steam through the pillow pile. After burial the cooling rate is expected to slow. Aspect of subglacial eruptions is heat loss from the pillow basalt results in rapid melting of the surrounding ice. The resulting large bodies of water are unstable and can escape from the ice in catastrophic outbursts or jokulhlaups. Sudden changes of environmental pressure can feedback into the eruptive activity, causing vesiculation and a switch to explosive activity. Confining pressure influences magma degassing. At low pressures the most abundant magmatic volatile is water, since the much less soluble carbon dioxide starts degassing at much greater depths. The rapidly quenched glassy rims of pillows provide information on the preeruptive volatile content of the magma. Since water solubility in magmas is pressure dependent it can be used to estimate erupting pressures, provided the magma is volatile saturated. The pressures can be used to estimate the thickness of water or ice.

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