



Kilauea: Hawaii

Kilauea is the world's most active volcano. It is an exciting volcano to study because it is part of a massive chain of powerful volcanoes that makes up the Hawaiian chain.

Kilauea Facts

Height

1247 metres

Meaning

Kilauea means spewing or much spreading

Other volcanoes nearby

Kilauea lies on the south east flank of the much larger Mauna Loa.

Mauna Loa's size

Mauna Loa is 4169 metres tall. It is sometimes snow-capped, even in Hawaii!

Volcano type

Hawaiian volcanoes are shield volcanoes. They are large, but have very gently sloping sides.

Magma

Volcanoes in Hawaii have basaltic, basic magma, which makes the lava runny. Because it is runny, it is not so explosive.

Tsunamis

Hawaii Tsunami Centre

Tsunamis have hit Hawaii in the past due to its location in the middle of the Ring of Fire. In 1946 a tsunami largely destroyed Hilo, the second biggest city in all of Hawaii.



Kilauea

Why is it there?

Kilauea is a shield volcano, and is caused by an over heated area of the earth's core which causes heating over one spot. These spots are called mantle plumes or hot spots. The Hawaiian hot spot lies beneath the Big Island of Hawaii.

The plate on which Hawaii sits is the Pacific plate, and this plate is moving north eastwards at the rate of around 6cm per year. As the plate moves it moves across the hot spot which melts more of the crust making the islands 'accumulate.'

The newest part of the island, where it is most active, lies in the south east. At the moment the most active volcanoes are Mauna Loa and Kilauea. The newest volcano, which, in the end will form another island is the Loihi seamount which lies off the south east coast of the Big Island, Hawaii.

Kilauea as hazard

Safe but not safe enough



Whilst Kilauea does not erupt explosively like the volcanoes of Indonesia, it does erupt consistently and it is a threat to property. Some areas of the volcano are very treacherous and have claimed the lives of careless walkers and

even of volcanologists. Moreover, some residents who live near the volcano have been breathing in high levels of toxic gas, sulphur dioxide, which is an increasing risk. In 1990, an eruption created a lava field which consumed almost the whole town of Kalapana on the eastern side of Hawaii.

Many homes were lost to the lava.

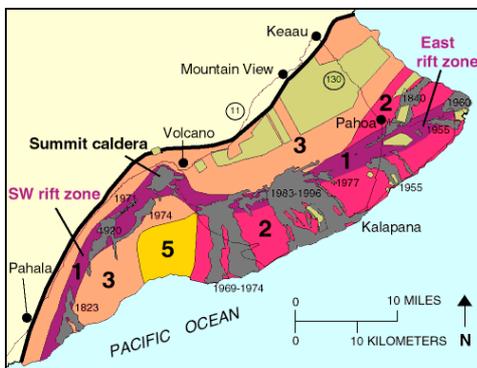
So, what to do about the hazard?

Making a plan

The United States Geological Survey (USGS) conducts research into the volcanoes in Hawaii. One of their research interests lies in ensuring the safety of residents of the island, in the face of volcanic activity. Following the destruction of the town of Kalapana in 1990, the USGS has made a map which identifies the level of volcanic risk to places around the island. The areas of highest risk are the lava channels that emanate from both Kilauea and Mauna Loa, on the Big Island.



The Hawaii Center for vulcanology houses both the USGS Hawaiian Volcano Observatory and the Centre for the Study of Active Volcanoes.



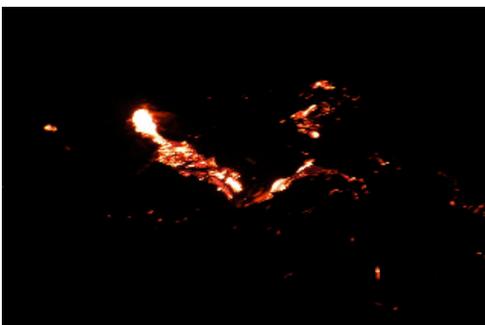
There are some areas near to the volcanoes that the USGS monitors closely because they are in areas that could be taken by lava flows. As the town of Hilo expands, the demand for land drives people to move onto land that is cheaper, but closer to volcanic fields. Recent housing subdivisions have been created in areas that may be at risk.

The USGS also monitors the way that Volcano National Park is used, and has rangers who ensure that walkers do not stray into dangerous areas.

The hazards at Hawaiian volcanoes include: lava flows, tephra (airborne lava fragments), volcanic gases, explosive eruptions, ground cracks and settling.

The map above shows the map that has been created to indicate high risk areas. It is reproduced from the USGS website.

Gas! Gas!



I'm lost in the vog!

Whilst most of the time lava merely oozes out of volcanic vents in Hawaii, Sometimes clouds of steam and sulphur dioxide rise from Pu`u `O`o a part of the Kilauea volcanic system. The regular release of gas since 1983 has created volcanic smog, 'vog' and acid-rain conditions on the Big Island of Hawaii. Vog contributes to breathing problems and acid rain damages crops and corrodes facing stones on buildings and damages metal.

Photographs taken by Andrew Lee. Map from USGS.



The Sumatra-Andaman Earthquake, 2004

The Sumatra-Andaman earthquake and tsunami killed almost 250 million people. What happened and could lives have been saved?

Facts

Indonesia

Indonesia is an island state of some 18,000 islands. The population of Indonesia is greater than 200 million, making it the fourth most populous country in the world.

Where is Indonesia?

Indonesia lies between the Indian and Pacific Ocean north west of Australia.



Energy

The energy expended by the tsunami is estimated to have been 3.35 exajoules, which is as much energy as the US uses in 11 days or the explosion of 0.25 gigatons of TNT.

Death toll

Around 170,000 people lost their lives in Indonesia; 35,000 in Sri Lanka, 18,000 in India, 8,000 in Thailand and many others around the Indian Ocean.

Human impact

The fact that humans had destroyed many coral reefs to improve fishing in the area meant that the reefs did not protect the land as much as they may have done otherwise.

What happened?

It's a long story

On 26th December 2004 an earthquake of over 9.0 on the Richter scale hit 160km off the west coast of Sumatra in the northern reaches of Indonesia. The earthquake was the result of an adjustment along the Sumatra fault line which separates the Indian Plate (part of the Indo-Australian plate with the Burma plate). This pressure had been building up for some time. Eventually this pressure was released and a 1200km line cracked and sank 15m. This rupture triggered an earthquake and the earthquake and displacement of water caused a mammoth tsunami. The earthquake alone was the second largest ever recorded by a seismometer. The focus of the earthquake was 30km underground, but the effects of the earthquake were felt throughout the Indian Ocean.

Why were so many people killed?

Tragedy in Asia

Almost a quarter of a million people were killed in the tsunami that occurred as a result of the earthquake. Although the earthquake was significant, Indonesia is no stranger to them, and buildings are designed to wobble and not break, and people know what to do when there is a quake. Yet, in this instance the main danger came with the tsunami. Although Indonesia is also no stranger to tsunamis there is little one can do in the face of such a wave, except run to higher ground, and this was not possible for many.

But many of the dead were in fact not in Indonesia at all because the tsunami stretched across the Indian Ocean. As it is the Pacific Ocean which tends to get most of the tsunamis, because of the Ring of Fire, the Indian Ocean had been caught unawares, and countries all around it were badly affected.

What causes a tsunami?

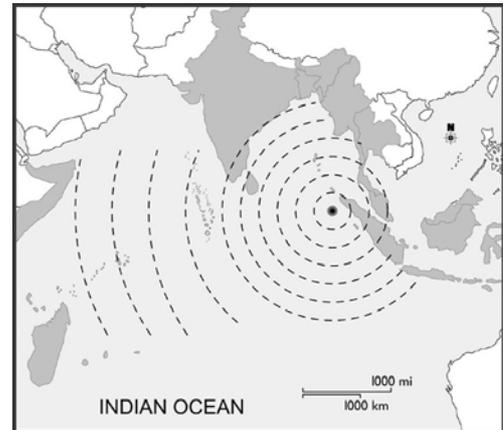
Waving and drowning

A tsunami is a massive wave caused by tectonic movements. It can travel at great speed. The tsunami associated with this earthquake travelled at 800km/h. The wave does little damage when at sea, but when it reaches land it is devastating.

You can see from the map on the right hand side, how many countries were affected. There is a list of fatalities on the previous page.

The wave builds up when it is displaced by underwater movements and the only way to be safe is to get out of its way.

Nevertheless, some areas on the map were saved, because of the way that the coast faced, or because of the proximity of vegetation or high land. Mangroves are said to have been responsible, in some areas for protecting land from the onslaught of the tsunami.



Indian Ocean Earthquake epicentre in Banda Aceh and Indian Ocean tsunami damage centres

So what's happened since?

Help is on its way



After the tsunami people from all around the world gave large amounts of money. 7 billion US dollars in all. The countries surrounding the Indian Ocean, and the United Nations resolved to create a Indian Ocean Tsunami Warning System, like the one that operates in the Pacific Ocean. It is hoped that this system will be in place by July 2006. The system will connect sensors and an audible warning system to ensure that if warning needs to be given, it will be heard.

Also, much rebuilding has occurred. Because of the nature of the local economies much has already been rebuilt. The money given has gone a long way in very poor countries. In some instances, however, such as the case in Galle, Sri Lanka, the whole city was destroyed.

Yet, with thousands killed and many who have been made homeless or lost their families, there is much sadness and it will be impossible for people in the country to entirely recover.

Already warning agencies have increased the number of people who are emailed in the event of the detection of a tsunami bearing earthquake. Also, designs have been made to build houses that are more resistant to inundation (tsunami flooding).

Many children were made orphans in the tsunami, and many parents lost their children, and so it has been a very difficult time for many people.

Photographs from Classroom Clip Art. Indonesia map from World Atlas. Tsunami map source BBC. Please contact the RGS if you are the owner of this image and would like it removed.



Vesuvius: Volcano in waiting

There is much worldwide concern about Mount Vesuvius because of the restlessness of the volcano and the density of the population.

Vesuvius

Location

Mount Vesuvius is located on the Bay of Naples nine kilometres east of Naples itself.

Largest eruption

Vesuvius erupted in AD 79 destroying Pompeii and Herculaneum.



Current status

Vesuvius is expected to erupt again sometime in the 21st Century.

Local environment

National park

Mount Vesuvius lies within Vesuvius National Park which was founded in 1995. The park was established to protect the natural environment and animal and plant species. The park also contains a considerable number of archaeological ruins which need preservation.

It was so long ago...

24th August 79AD

Geographers are interested in Vesuvius, not so much because of its fateful eruption two millennia ago, but because it is a volcano that is likely to erupt again very soon. Volcanologists have determined that the conditions are ripe for a significant eruption sometime in this century.

The concern is that the population in the Bay of Naples and surrounding area is often as much as 3 million. It varies because it is a popular holiday resort and at times of the year the area can have a high population of tourists. In the event of eruption it would be very difficult to evacuate large numbers of people, many of whom may not speak Italian.

What are the current plans for evacuation

Much research has been done to investigate the likely eruptive scenarios and to devise a strategy for evacuation. The plan is based on an anticipated eruption which is of the scale seen in 1631 when an eruption buried many local villages. Additionally local authorities have been encouraging the demolition of buildings that have been constructed in areas that are regarded as high risk areas. Although there has been much building in this zone in the past, further building in these areas has been stopped. Careful tracking of magma movements is an ongoing process.

The evacuation plans have been criticised because the size of the anticipated eruption may be much smaller than what actually occurs. One of the problems facing the implementation of the evacuation plan is knowing when it would need to be implemented. In the event of a resulting eruption delay would cause great loss of life, but if a call were made too early a warning might turn out to be a false alarm causing enormous upheaval to the local economy.

And the worst kind of eruption?

Strombolian or Plinian?

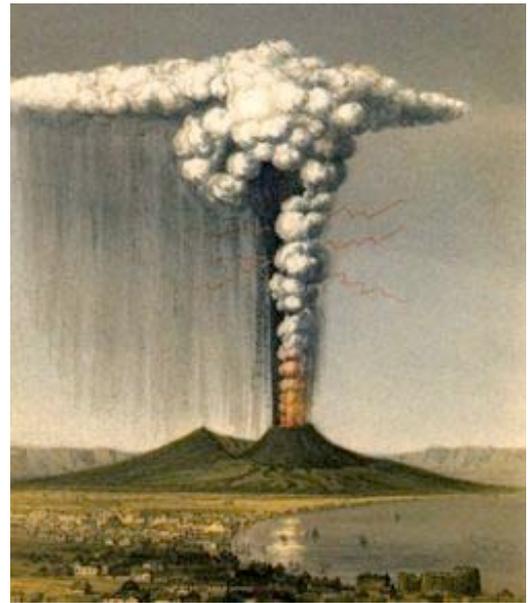
Whilst three million people live in the area around Vesuvius in the Bay of Naples, around 300 000 live so close that they would be most likely killed if there were an eruption around the size of that which occurred in 1631.

Scientists can roughly predict the quantity of lava that might erupt from a volcano using its eruption history. It is believed that Vesuvius is ripe for another eruption between now and the next thousand years.

If the eruption were to occur now, it is estimated that the volcano would expel around as much as it did in 1631, which would devastate an area of at least 7km from the main vent. As before, a pyroclastic cloud would be formed and other areas would be covered with the outfall of volcanic rock called tephra. This kind of eruption is called a Plinian (strongly explosive) eruption and is the kind that struck in AD79, 1631 and is the same kind of eruption that occurred in Krakatoa in 1883.

However, some scientists believe that it is less likely that the next large eruption of Vesuvius will be a Plinian one (mildly explosive); instead suggesting that the volcano might erupt with a Strombolian eruption which typically involves the release of lava.

The kind of eruption the Vesuvius has next will depend on many complicated factors including how gaseous the magma is that is bubbling more than 10km beneath the earth's surface.



The Pyroclastic Flow

A force not to be reckoned with



A pyroclastic flow is a truly devastating event. It is like a vicious burp from a volcano, but one that travels at more than 80km/hr (and sometimes very much faster) and is full of red hot rock particles and super-heated gas (up to 1000°C)

Pyroclastic flows are caused by any number of events within the volcano itself which causes a sudden outburst. The volume of gas and rock expelled can range from a few hundred cubic metres to thousands of cubic kilometres (though this is very rare). It was the pyroclastic flow that instantly killed so many in Pompei and Herculaneum and it is expected that another eruption would create a similar flow.

Humans in its path would be killed instantly, in fact with many being vapourised by the heat.

The picture here is of a pyroclastic flow on Mount St Helens USGS.
