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# Mount Etna

## Europe's biggest volcano

Mount Etna is known as in Sicilian dialect Mungibeddu, 'The Mountain'. This eruption occurred on 30 July 2011.

Where can you find pristine rock which has never seen the sun, a fertile soil for a vineyard, and ski slopes with a sea view? **Stefania Hartley** tells us about Mount Etna on the Italian island of Sicily.

### Key words

volcano

geology

igneous rock

tectonic plates

Etna has impressive credentials. It is the biggest and tallest active volcano in Europe, over 3000m in height, and one of the most active volcanoes in the world. It is a candidate for UNESCO's World Heritage list.

Etna has been designated a Decade Volcano by the International Association of Volcanology and Chemistry of the Earth's Interior. 'Decade volcanoes' are 16 volcanoes deemed worthy of particular study in light of their history of large, destructive eruptions and their proximity to populated areas.



Panoramic view of snow-capped Etna rising out of the clouds



Etna erupting, seen from space in July 2001. Sicily lies off the toe of Italy.

### The geology of Etna

Etna has several layers of solidified lava, ash and pumice on its slopes and changes height periodically, following an eruption.

Etna is a type of volcano known as a stratovolcano. Other stratovolcanoes include Vesuvius and Krakatoa. Most volcanoes have iron-rich magma, but these three stratovolcanoes have a high silica (silicon dioxide) content which makes the magma more viscous. This means that the lava covers a shorter distance before it solidifies and gives stratovolcanoes a characteristic conical shape with steep sides.

The thicker magma has another, more catastrophic effect too – it makes it difficult for trapped gases to escape from the magma chamber. Pressure builds up inside the magma causing periodic explosive eruptions. As part of the volcanic mountain suddenly gives way there is an explosion of hot gases and a rain of extremely hot large boulders, known as volcanic bombs, and finer ash called pyroclastic flow. Two clues that this have happened in the past on Etna include ‘graded beddings’ where larger rocks are found at the bottom with smaller rocks, dust and ash on the top, and pumice stones.



Robert DuHamel

Pumice stone is so light that a piece 15 cm long can balance on a rolled up banknote. You can see the holes in the stone made by expanding gases.

Pumice is such a light rock that some samples can float on water. It is formed when super-heated, highly pressurised rock explodes violently out of the volcano. The unusual foamy structure forms because of rapid cooling and rapid depressurisation which happen at the same time. The depressurisation creates bubbles by lowering the solubility of gases including water and carbon dioxide which are dissolved in the lava. This causes the gas to come rapidly out of solution, like bubbles of carbon dioxide when a carbonated drink is opened. It cools quickly leaving large air bubbles which give it a low density. You may have used pumice to rub dead skin off the soles of your feet.

## A brief history of Etna

Etna started its life as an underwater volcano during the Quaternary era, about 600 000 years ago. The area lies above the convergent plate margin where the African plate and the Eurasian plate meet. This causes the presence of other volcanoes (nearby in the volcanic Aeolian Islands, for example) and devastating earthquakes.

Etna has experienced a variety of eruption styles and for some time has also had basaltic (iron-rich) lava. Since the 1970s more explosive eruptions known as ‘paroxysms’ have been observed, especially from the craters at the summit. These have included lava fountains and gas and ash columns.

## Igneous rocks

Igneous rocks are rocks originating from magma or lava. Magma that cools down inside the Earth’s crust will cool down more slowly than if it was on the Earth’s surface. The rock thus formed is called intrusive and it typically contains large crystals because the crystals have had time to grow. If, instead, the magma comes out to the surface (where it is now called lava) it will cool down more quickly. Such extrusive rock will have small crystals as the crystals will not have had time to grow much before the rock solidified. If magma is rich in iron it will be less viscous than the silica-rich magma typical of Mount Etna. The table shows the types of igneous rock which are typical of these different conditions.

	Iron-rich	Silica-rich
Intrusive	Gabbro	Granite
Extrusive	Basalt	Rhyolite



Rock samples for sale in a tourist shop near Mt Etna



An erupting hornito on Etna seen from behind in November 2006. Hornitos (from the Spanish ‘little oven’) are small cones formed on the surface of a basaltic lava flow when the lava is forced up through an opening and accumulates around it.

Magma or lava? When molten rock is under the Earth’s surface we call it magma; when it comes to the surface it is lava.

The summit consists of four craters but eruptions can also happen from the craters along the side of the volcano, all the way down to a few hundred metres above sea level. The top craters are generally active continuously for many years while the side craters have interruptions in activity which, in the last forty years, have lasted only 2 years on average.

In December 1991 the longest eruption of the 20th century started which lasted 473 days and prompted the inhabitants into quick action. Diggers worked round the clock to create an earth barrier 20 m high to protect the nearby town of Zafferana Etnea. The barrier kept the lava away from the town for two months. In 2001 this technique was not sufficient to keep the lava flow away from inhabited areas. On that occasion the Italian navy had to use 7 tonnes of plastic explosive inside the main canal.

### Agriculture on Etna

So, who on earth would want to live near such a dangerous beast, above such an unstable spot on our planet? As a matter of fact 25% of the total population of the island of Sicily does! Catania, the 10th biggest town in Italy, is situated just a pumice stone's throw from Etna's craters and it has been periodically destroyed by it. You might think that the fatalistic attitude of Sicilians has made them particularly resigned to live under the shadow of an active volcano, but in fact it is the fertile soil that is the attraction.

When the volcanic rock breaks down it releases valuable minerals and a rich volcanic soil is created. Vineyards, apple orchards, and groves of olive, pistachio and hazel trees all thrive along the slopes of Etna.



Olive trees growing below Mt Etna

The importance of agriculture and the human influence on the landscape of the volcano, with all the richness of tradition and culture, has been acknowledged by the organisation which manages the nature park. While in Zone A no human settlements are allowed, Zone B has smallholdings with beautiful old farm houses, terracing works, storehouses, millstones, and wine-processing structures as well as the old landlords' villas. (Zones C and D are different still, mostly devoted to tourist facilities.)

### Flora and fauna

As you can imagine, living on a volcano can be an unsettling experience for a plant: as well as the harshness of the weather and the lack of water (at higher altitudes) you also have to factor in periodic lava flows which could burn down entire forests. At lower altitudes there are oak forests as well as orchards. From 2000 m above sea level beeches (reaching here their southernmost distribution limit) and a very special tree: the *Betula aetnensis*. This is a rare relict species, endemic to Etna. This species of *Betula* (birch) has had to adapt its vascular system in order to survive extreme heat and cold. It is only found on the East and West slopes of Mount Etna, between 1300 and 2100 m, where other trees cannot survive.



Trekking on Mt Etna – note the limited vegetation and the ski lift used in the winter.

Higher still are astragalus, senecio, violets, cerastium and pioneer plants. Beyond the limit of the astragalus, between 2450 and 3000 m, the conditions are so harsh and the rock so new that no vascular plants are to be found.

Although wolves, wild boar and deer have long disappeared from Etna, there are still porcupines, foxes, wild cats, martens, rabbits and hares together with weasels, hedgehogs, dormice and several species of mice and bats. As well as many insects, snakes and birds of prey are common: the poisonous viper has increased in numbers in recent years due to the fall of the numbers of its predators.

*Stefania Hartley is a science teacher who grew up in Sicily.*

### Look here!

Etna is one of the most accessible active volcanoes in the world:

[www.parks.it/parco.etna/Eindex.php](http://www.parks.it/parco.etna/Eindex.php)

Take a look at these live webcams on Etna:

<http://tinyurl.com/b3x37wr>