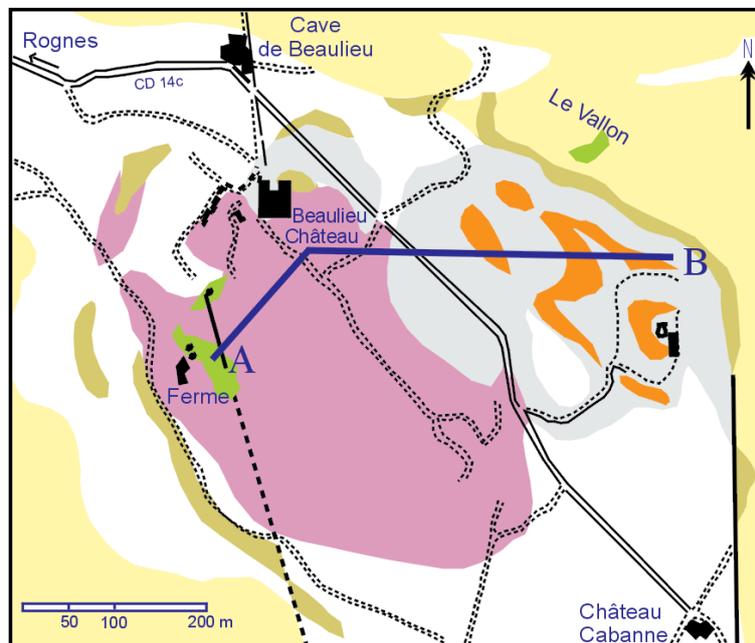


The only volcano in Provence

The vineyards of Beaulieu nestled in the crater of the only volcano in Provence have thrived now for over 2000 years.

Le "volcan de Beaulieu" d'une superficie de 2 à 3 km², se situe à une dizaine de kilomètres au nord/nord-ouest d'Aix-en-Provence. L'éruption s'est produite il y a 17,5 millions d'années pendant la période que les géologues appellent le Miocène. Il peut sembler curieux de parler de volcan alors qu'aucun cône n'est visible, comme c'est le cas dans le Massif Central avec le Puy de Dôme ou le Vésuve en Italie. Mais Beaulieu est un volcan en "creux", un ancien cratère, de forme ovale, rempli de lave.

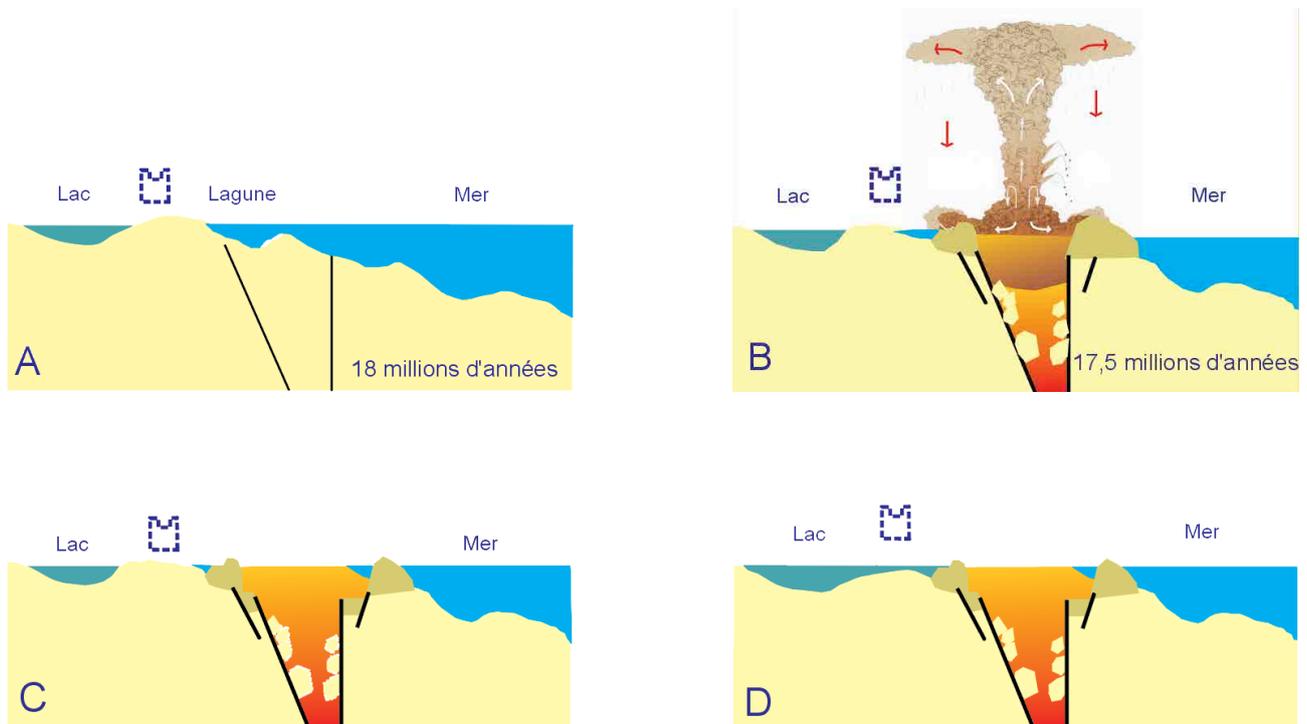


The existence of the 'Beaulieu Volcano' has been recognised for many years. It was referred to as early as the 18th century by H. de Saussure (the first man to climb Mont Blanc), who also remarked the presence of terrestrial animal fossils in the region.

Interest in the volcano peaked in the 1960s, culminating in research projects on deposits in the area, carried out by S. Gueirard in 1964, E. Colomb in 1968 and J.C. Baudron in 1975. These studies resulted in the dating of basalt in the area to an era millions of years ago. More recently, a petrographic analysis was conducted on the different types of basalts, and their origin was established by F. Cheval (1989).

Why is there a 17.5 million year old volcano in Provence and what effect did it have?

At the time the volcano erupted, what today is the estate of Beaulieu was part of the western Mediterranean coastal region. This explains why geologists found lagoon, marine and paludal deposits close to ground surface. At this time, the geography of the western Mediterranean was going through significant transformations at the same time as Corsica and Sardinia, which had been aligned along the Pyrénées-Maures axis, and then moved into the position where they stand today. This displacement, which took place over tens of millions of years, was due to the opening of a fissure caused by fault lines. Following a thinning down of the earth's crust, a basaltic layer of a thickness of between 25 and 30km formed between France and the two islands.



The lava, at a temperature of 1100°C to 1200°C, was able to reach the surface through some of these fractures, producing a formidable explosion once it came into contact with water. This explosion would have created an atomic-like mushroom cloud with a cylindrical column several kilometres high, composed of a mixture of steam, particles, and solid fragments from the different layers which the lava travelled through before reaching the surface. There were also volcanic projections including ashes and "volcanic bombs". Several of these bombs were found to the south of the château de Beaulieu and more were discovered by Mr. Pierre Touzet when ploughing the vineyards. The lower part of the cloud, which is a glowing wave rolling down the slopes of the volcano, is composed essentially of fragments that spread out horizontally. These fragments consist of different sized blocks, often angular and composed of basalt or rocks brought to the surface through the volcanic chimney opening at ground level which is mainly limestone in this region. This rock formation can be found all around the volcano and corresponds to phreatomagmatism (phrato: well, underground water / magma: molten rock paste, rock formed by solidification within the earth).

During this enormous explosion, the volcanic chimney becomes significantly larger and the outer edges of the volcano collapse filling with lava and creating the crater. The exact depth at which this lake of lava formed, is unknown. In 1968, seven drilling operations were carried out to a depth of 80 metres, which is the minimum thickness. Volcanologists and geologists, however, believe the thickness could be up to 200 metres. The analysis of the different rock layers taken from the drilling shows two types of basalt, a 'heavy' basalt at considerable depth and an upper layer of 'light' basalt, which represents the foamy surface of the lava lake.

The 'light' basalt is mainly present in the area to the north and northeast and has been used mainly as railway track ballast. The remaining basalt would have come from a lateral chimney and the lava flow would have taken place partially under water (on a path near the Beaulieu farm we can see small balls of lava similar to modern examples of underwater lava).



The search for mammal fossils began in 1979 after the discovery of several fragments of large bones made by F. Sarrugue, from the Museum of Aix-en-Provence. The bones were from an Anthracotherium (an

animal resembling a large pig or hippopotamus). The fragments were taken to the Paleontology laboratory at the University of Montpellier II where a study was carried out in 1994. This endeavour was made with a volcanologist (A. de Goër de Herve) a geochronologist (H. Maluski), a geologist (G. Clauzon) and 3 paleontologists (J.-P. Aguilar, J. Michaux and J.-L. Welcomme). The results served to confirm once again that the basalt dated back millions of years, but also to describe the geology of the site as well as the workings of the volcano, and to establish the presence of new fossil sites.

The geological samples proved to be more complex than initially imagined, showing evidence of lake sediment preceded by lagoon and marine layers. Shark teeth as well as evidence of terrestrial rodents were found in the lagoon sediment deposits around the crater, whereas large and small mammal remains were discovered along with fragments of turtle shells in deposits from the upper fresh water layer. Paleontologists identified rodents such as squirrel and mammals related to rabbit and hare, as well as different types of insectivores, some similar to moles and others resembling the shrew. Remains of larger mammals are unfortunately less spectacular showing the presence of two small carnivores (similar to the polecat and genet today) a rhinoceros, a large pig/hippopotamus, and three ruminants including two cervides (antler bearing animals), one of which is the clearest example of these large mammals as proved by dental remains and fragments of wood. This group of mammal wildlife was identified in detail in 2002.

In 1977 the site of Beaulieu was the subject of an international expedition. The dating of the wildlife to an epoch dating back millions of years makes Beaulieu an important reference point for paleontologists who use this information to map chronological tables.

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