

AFRICA SPLIT APART?

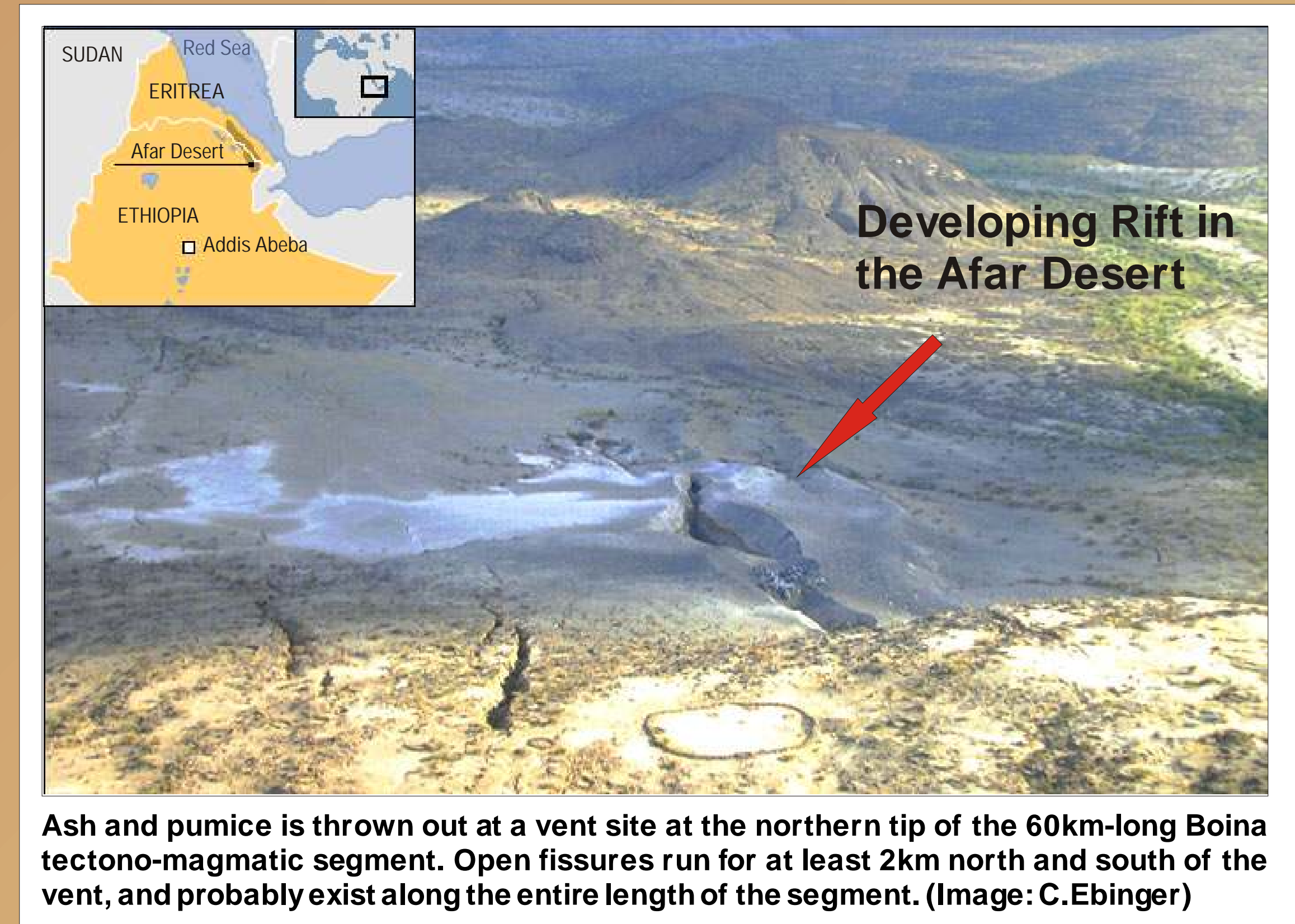
Geologists Witness 'Ocean Birth'

Scientists of the UK-Ethiopian Project Eagle (Ethiopian Afar Geophysical Lithospheric Experiment) claim they have witnessed the possible birth of a future ocean basin in north-eastern Ethiopia. The group watched an 8 m rift develop in the ground in just three weeks in the Afar desert region last September. It is one small step in a long-term split that is tearing the east of the country from the rest of Africa and should eventually create a huge sea.

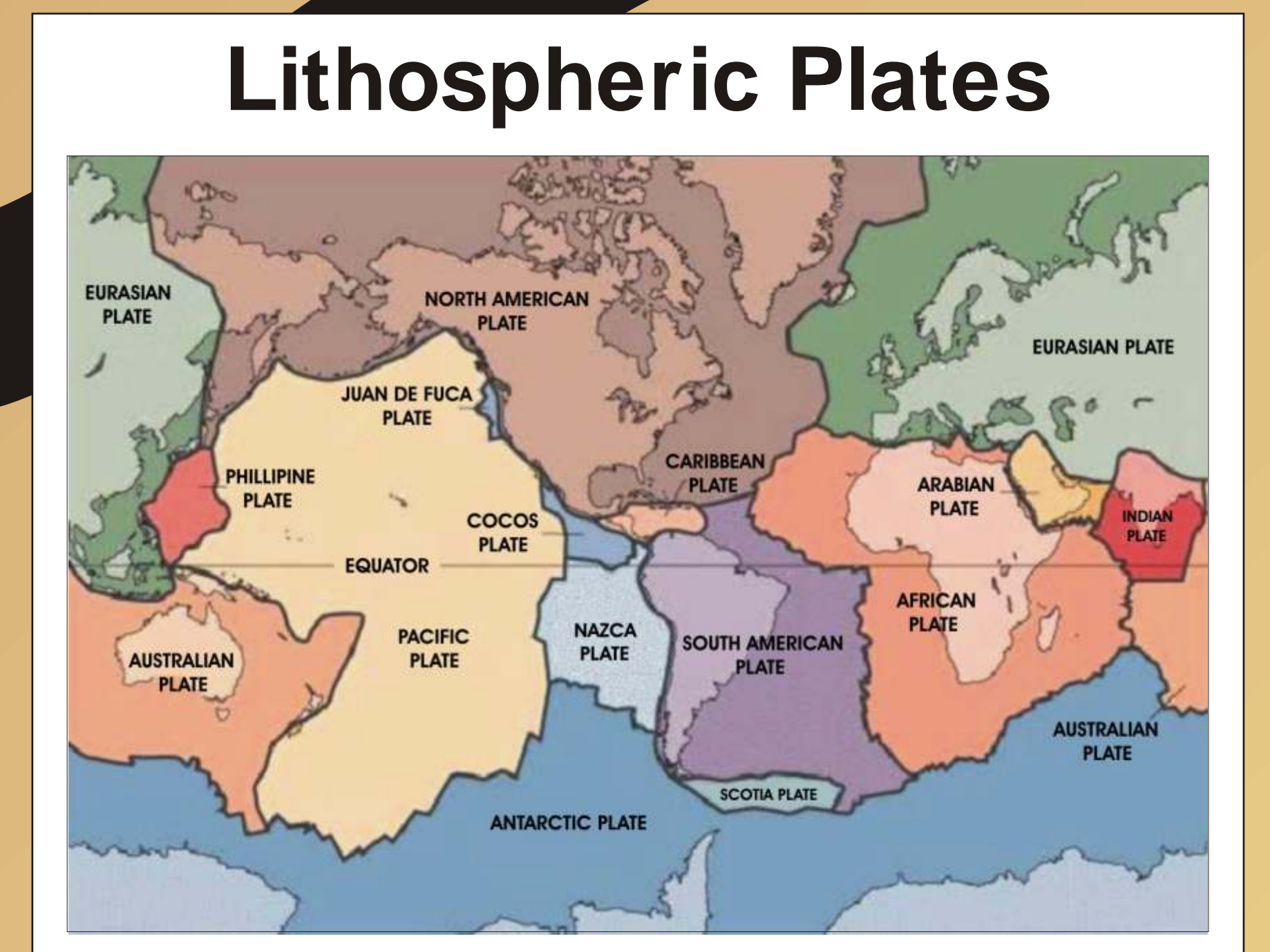
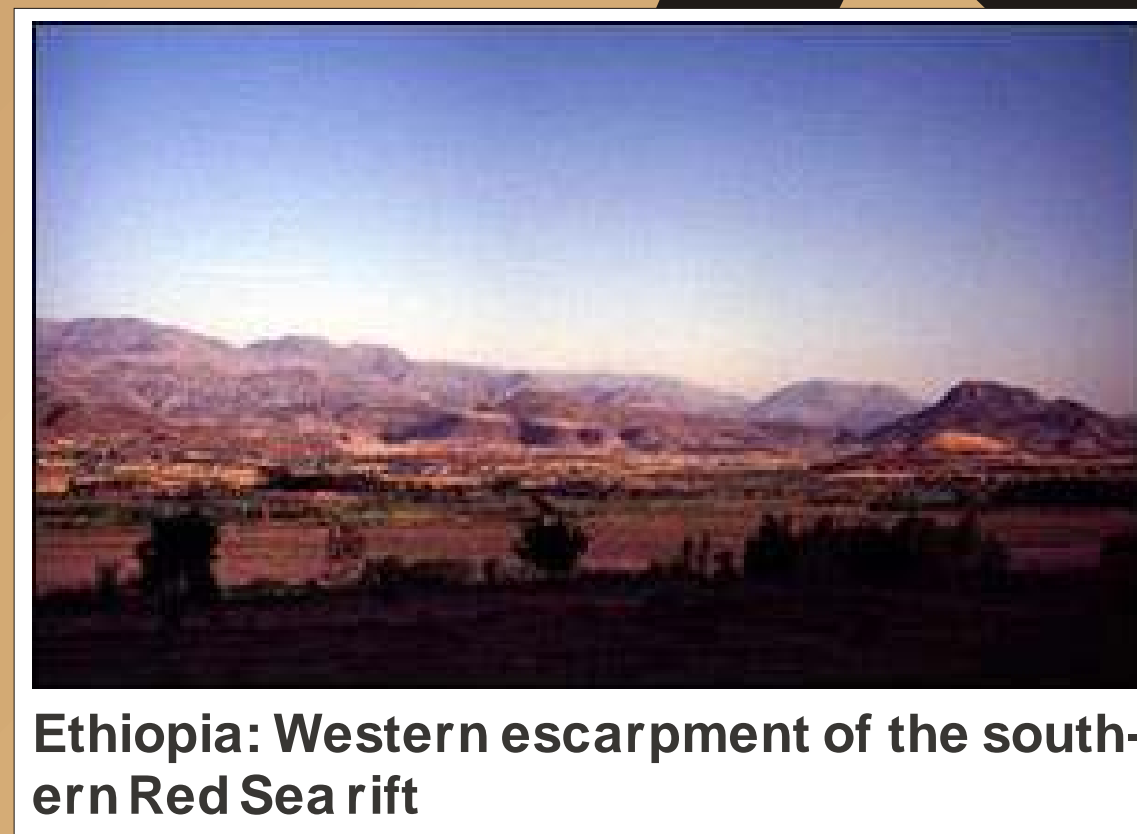
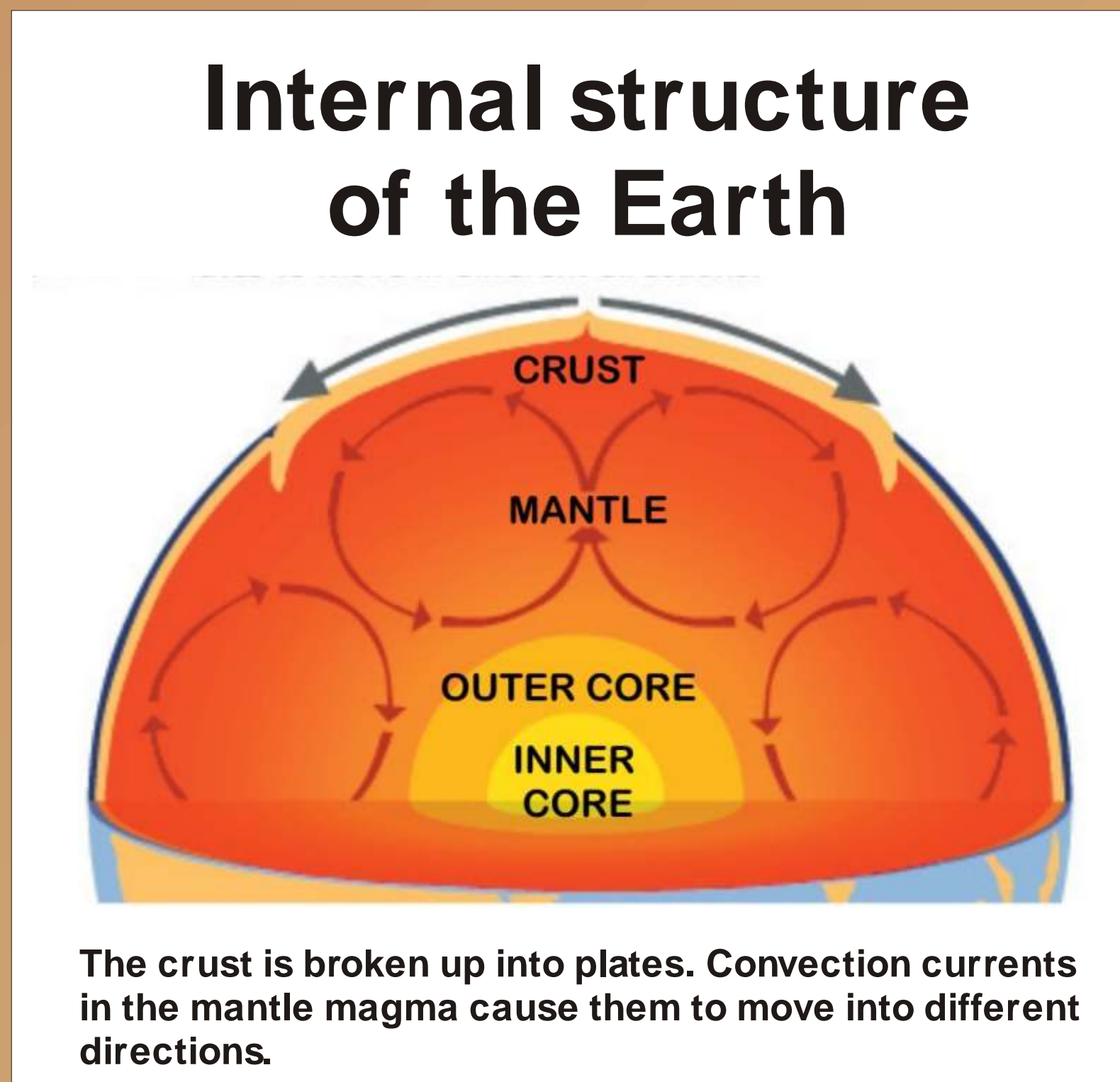
Earth Forces

In the far-distant past, oceans such as the Atlantic have formed when super-continent were torn apart, i.e. when the lithospheric plates upon which they are situated moved away from each other. For example, North America and Europe are still moving in opposite directions at about the pace fingernails grow. It has long been recognised that the Afar region, an inhospitable depression in north-eastern Ethiopia, has been contorted by similar forces in recent geological time. But the event in September is said to be unprecedented in scientific history.

It began with a big earthquake on the 14th of the month and continued with a swarm of moderate tremors. About a week into the sequence, they were followed by a volcanic eruption that threw a lot of ash into the air, while cracks appeared in the ground, some of them more than a metre wide. With the aid of satellite techniques scientists were able to see ground deformation, i.e. a 60 km long section opening up, whose central portion was about 8 m wide. The movements of September are only a small part of what would be needed to create a new ocean - the complete process taking millions of years - and in other parts of the planet, rifting and ocean development, was started only to stall at a later time. However, the Afar event has given geologists a unique opportunity to study the rupture process at close quarters.



Ash and pumice is thrown out at a vent site at the northern tip of the 60km-long Boina tectono-magmatic segment. Open fissures run for at least 2km north and south of the vent, and probably exist along the entire length of the segment. (Image: C.Ebinger)



Volcanoes Threaten to Divide Africa

A plume of hot mantle rock is rising beneath Africa, trying to split the continent apart. According to international researchers, it could eventually create a new ocean. The Ethiopian rift is one of the few places in the world where geologists can see the transition from continental to oceanic rifting, giving them their best chance of studying how a new ocean forms. The crack in the Earth's surface runs for 2,000 kilometres from Malawi in the South, through Tanzania, Kenya and Ethiopia, to link-up with the Red Sea and the Gulf of Aden. A look deep into the Earth's interior shows a huge plume of warm soft mantle rock rising diagonally from the core's boundary and running up beneath Southern Africa towards the Afar region of Ethiopia.

The mantle super-plume may be responsible for the high elevation of much of Southern and Eastern Africa. It may also account for the line of volcanoes that runs up the Great Rift Valley. For most of its length the East African rift valley is just that: a rift running through a continent. But as it gets further north, its character changes. By the time it joins up with the Red Sea it is more like a mid-ocean ridge, a line of cracks along which volcanic magma rises to create the floor of an ever widening sea.

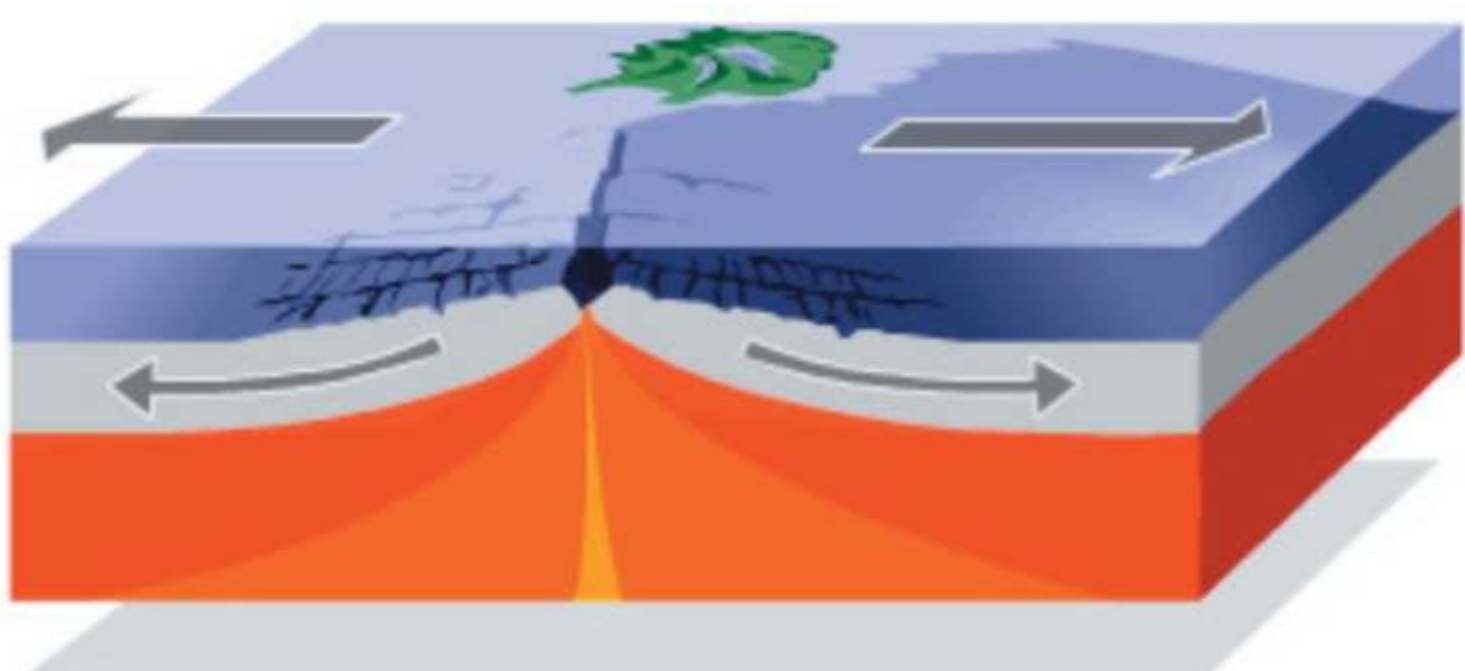
New Ocean

So far, the indications are that a mantle plume alone is not enough to open an ocean. There needs to be a sideways pull to rift the continent, allowing the hot magma to rise underneath to fill the gap and form the floor of the new ocean. Opinions vary over whether that will actually happen along the East African rift. With the Atlantic Ocean still opening and pushing on Africa from the west and India still colliding with Asia and the Indian Ocean opening to the east, there may be nowhere for the rift to expand. Further north however, the picture may be different. The continent in the northern part of Ethiopia is separating and there will be an ocean penetrating down into East Africa.

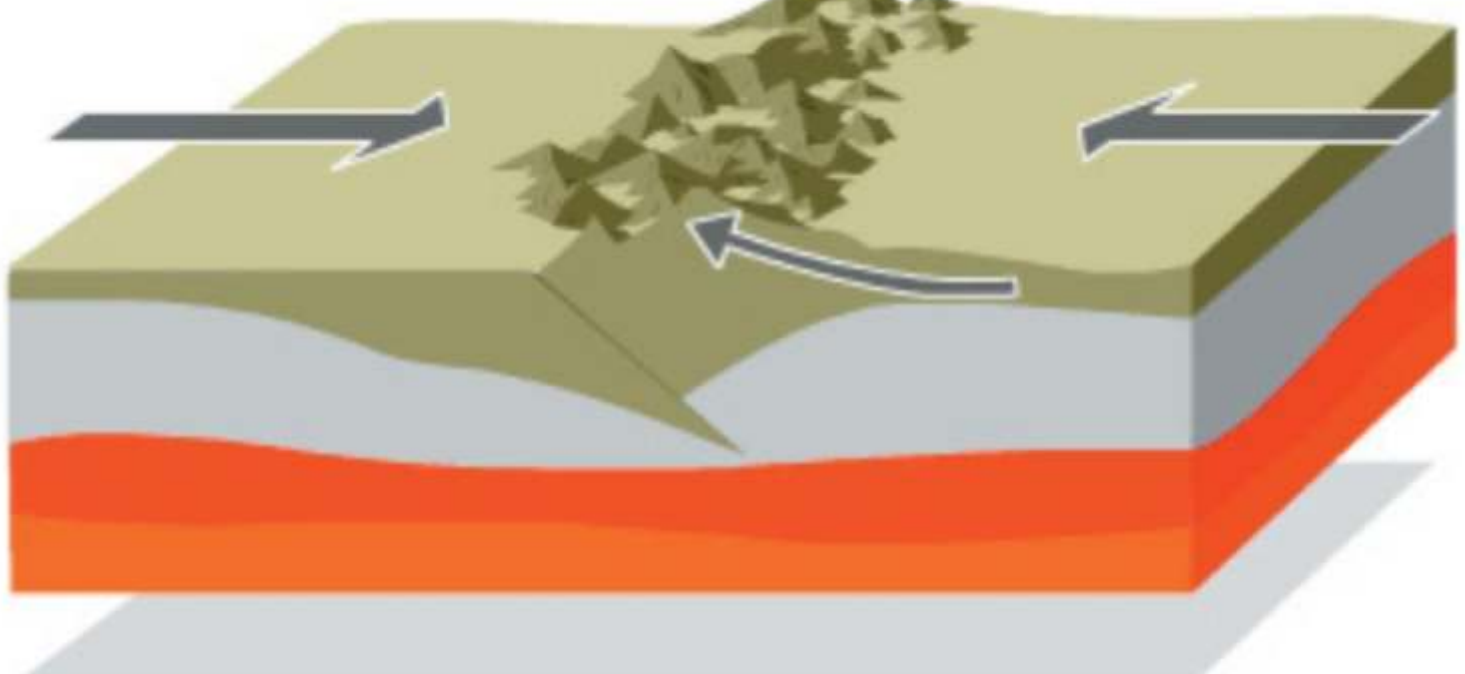
Earth Tremors

The EAGLE project aims to see deep into the Earth by using sensitive seismometers to record natural earth tremors and the vibrations from explosive charges detonated in boreholes. The seismic waves travel at different speeds through rocks of different temperatures and densities to bounce off distinct layers. In this way, the scientists hope to discover any reservoirs of hot, molten magma within the crust that could feed future volcanoes, as well as study thinning of the crust as it is pulled apart. These rift volcanoes are especially dangerous, because the silica-rich lava is resistant to flow, and the resultant explosive eruptions can cause great damage to a large region.

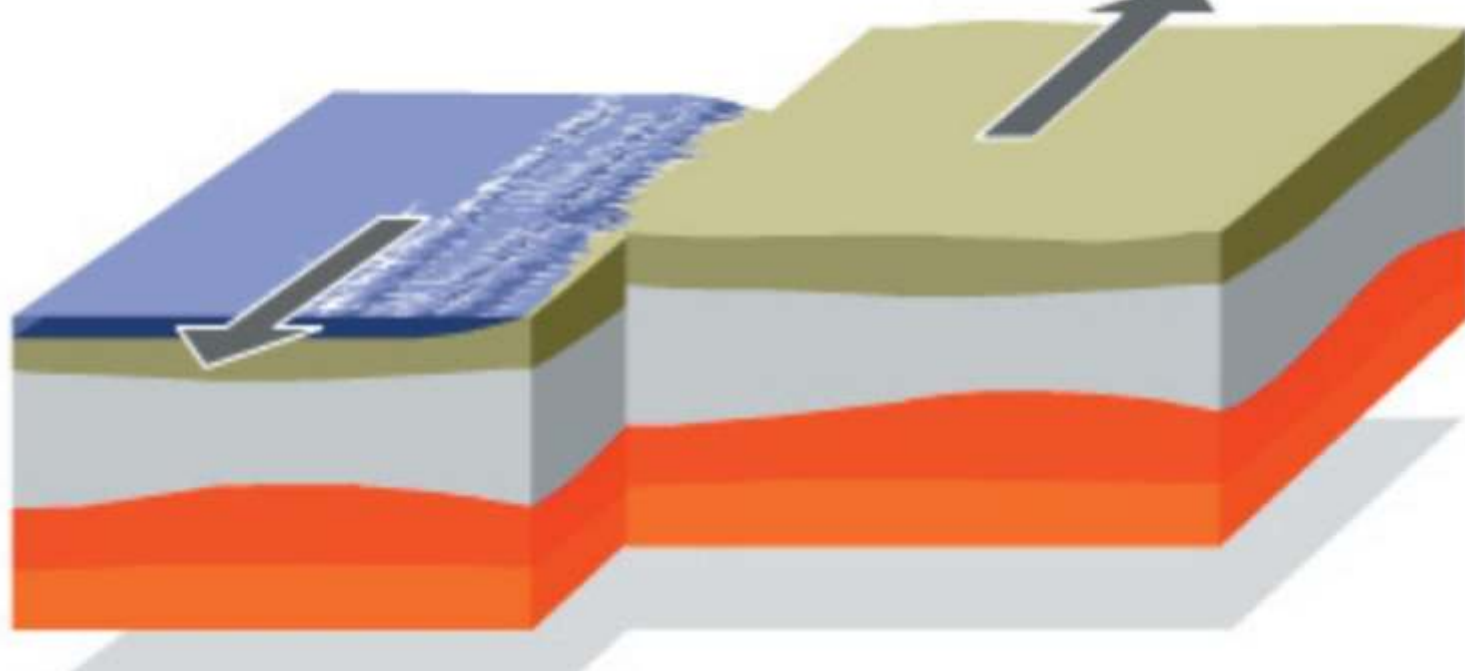
Where plates diverge, lava emerges from the mantle and cools to form new sections of crust. Diverging plate boundaries are often found under water.



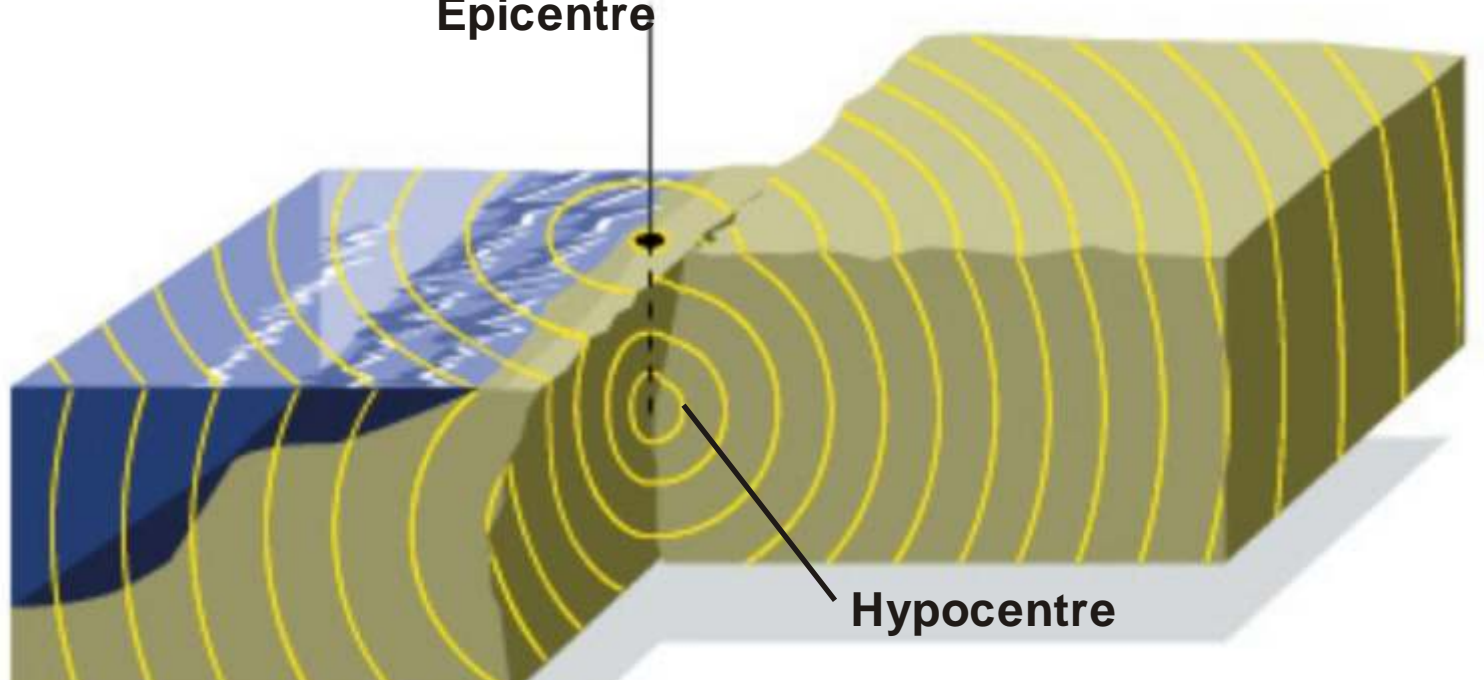
Where plates collide, rock layers are forced upwards, creating mountains.



Other plates move very slowly alongside each other. Faults are found at the edges of the plates, where the crust is moving in different directions.

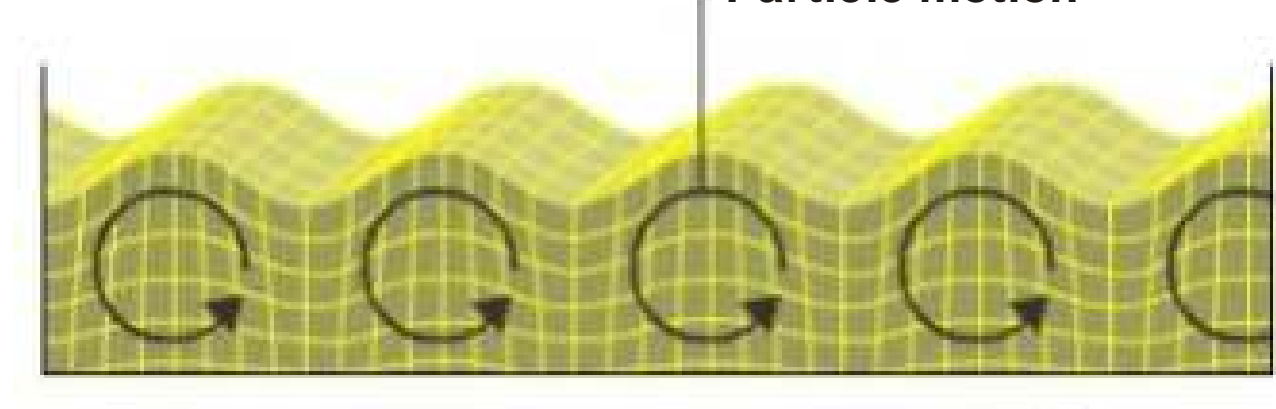


Surface waves radiate outwards from the epicentre - the point on the surface directly above the hypocentre - and arrive after the main P and S waves.

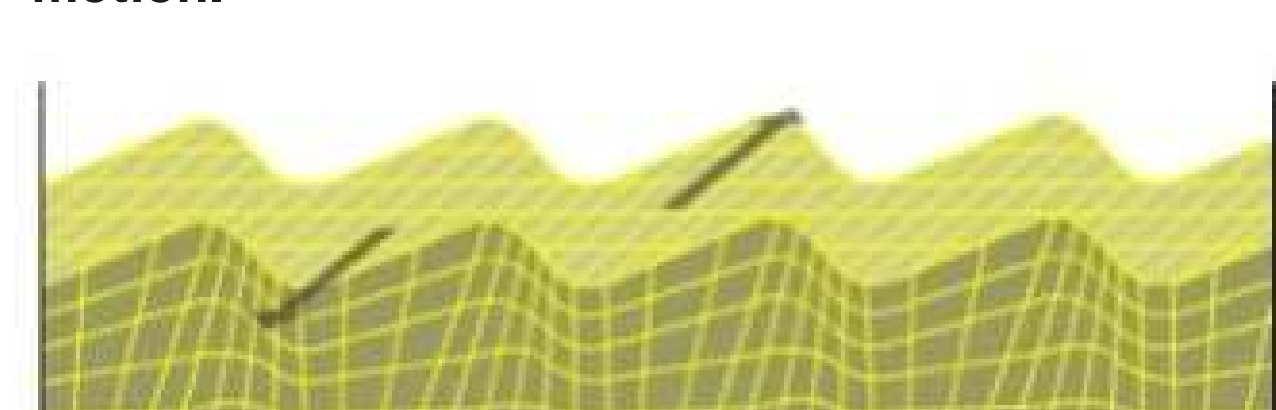


Mount Nyiragongo, near the Congolese border, belongs to the line of volcanoes that runs up the Rift Valley

There are two types of surface waves with different movements.



Love waves cause the ground to twist from side to side.



Movement along lithospheric plate boundaries causes volcanic eruptions, earth quakes and, under certain conditions, tsunamis. Other examples for active plate boundaries (i.e. where movement is taking place) are Iceland (diverging boundary) and the Pacific Rim (converging boundaries).