

Aa

Aachen (French name: Aix-la-Chapelle) SO 46N 06 06E A spa city in W Germany, in North Rhine-Westphalia near the Belgian and Dutch borders. It is an important industrial centre with iron and steel and textile industries. *History:* it was the N capital of Charlemagne's empire and many Holy Roman Emperors were crowned in the cathedral (founded in 796 AD). It was annexed by France in 1801 and passed to Prussia (1815). Extensively damaged during World War II, it was the first major German city captured by the Allies (1944). Population (1996 est): 247 923.

Aalborg See Alborg.

Aalto, Alvar (1898-1976) Finnish architect and designer. His reputation is based on the Paimio tuberculosis sanatorium (1933). Other buildings include a hall of residence at the Massachusetts Institute of Technology (1948) and the Helsinki Hall of Culture (1958).

aardvark (Afrikaans: earth pig) A nocturnal African mammal, *Orycteropus afer*, also called ant bear. It is about 1.5 m long, lives in grassland, and has a long snout, large ears, and a thick tail. Its strong claws are used to dig burrows and tear open the mounds of termites, which are picked up with its long sticky tongue. The aardvark is the only member of its order (*Tubulidentata*).

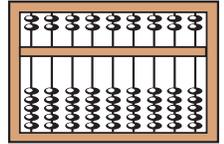
Aaron In the Old Testament, the elder brother of Moses. Although he allowed the golden calf to be built, his descendants became the priests of the Jews.

abacus 1. A calculating device consisting of balls strung on wires or rods set in a frame, probably of Babylonian origin. Its use declined in Europe with the introduction of Arabic numerals in about the 10th century AD. 2. A detail of column.

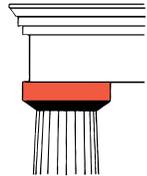
Abadan 30 20N 48 15E A city in SW Iran, on an island in the Shatt (river) ai-Arab. Much of Iran's oil is brought here by pipeline for refining or exporting. Population (1991 est): 87 774.

abalone A marine gastropod mollusc belonging to the widely distributed family *Haliotidae*, of rocky coasts, also called ear shell or ormer. Up to 30 cm long, their dishlike shells have a row of holes along the outer edge through which deoxygenated water and waste products are expelled from the body. The large foot is considered a delicacy and the shells are used as mother-of-pearl for ornaments.

Abbado, Claudio (1933-) Italian conductor, associated with La Scala, Milan, since 1971 and the Vienna State Opera (1986-91). In 1989 he succeeded von Karajan as conductor of the Berlin Philharmonic.



Abacus
Calculating frame.



Abacus
Detail of Doric column.
The abacus is shown in red.

'Abbasids A dynasty of caliphs, which ruled Islam (750–1258). Descended from Mohammed's uncle al-Abbas (566–652), they seized power from the Umayyads in Damascus and moved their capital to Baghdad. The 'Abbasids imposed strict religious orthodoxy.

Abbevillian A culture of the Lower Palaeolithic in Europe. It is characterized by crude stone hand axes made by hammering flakes off a flint with another stone. Named after Abbeville in France, the Abbevillian also appears in Britain but in Africa similar early hand axes are designated Acheulian.

Abbey Theatre A Dublin theatre opened in 1904. Annie Horniman (1860–1937), a friend of W. B. Yeats, initiated the building of the theatre as a home for the Irish National Dramatic Society, a company founded by the actors Frank Fay (1870–1931) and his brother W. G. Fay (1872–1947). The Abbey Theatre gained an international reputation as a repertory theatre dedicated to performing mainly plays by Irish playwrights on Irish subjects. The original playhouse burnt down in 1951, but a new theatre was built and opened in 1966.

abdomen In mammals (including humans), the region of the body extending from the lower surface of the diaphragm to the pelvis. The abdomen contains the intestines, liver, pancreas, kidneys, gall bladder, and—in females—the ovaries and womb. In arthropods, the abdomen is the posterior section of the body, which is usually segmented.

Abdullah (1882–1951) Emir of Transjordan (1921–46) and first King of Jordan (1946–51). He fought with T. E. Lawrence in the Arab revolt against Turkish rule during World War I. He was assassinated in 1951.

Abel See Cain.

Abel, Niels Henrik (1802–29) Norwegian mathematician. One of the great mathematical problems of Abel's day was to find a general solution for a class of equa-

tions called quintics. Abel proved that such a solution was impossible, but died before his achievement was recognized.

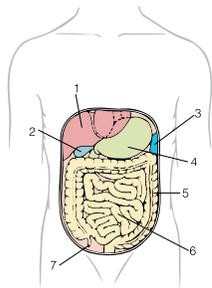
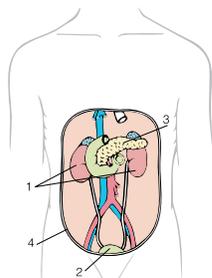
Abelard, Peter (1079–1142) French philosopher. His ill-fated marriage with Heloise, niece of a canon of Paris, ended when Abelard was castrated by thugs hired by the canon (1118). He retired to a monastery and she became a nun. A quarrelsome disputant, Abelard was perpetually in trouble with the church authorities; his *Sic et Non* (*For and Against*), for example, outraged opponents by listing points on which acknowledged authorities differed. See also scholasticism.

Aberdeen 1. 57 10N 2 04W A city and port in NE Scotland, in City of Aberdeen council area, on the North Sea coast between the mouths of the Rivers Don and Dee. Aberdeen is an old cathedral city with a university dating from 1494 (King's College). Fishing has always been important, as has the working of local granite; the "Granite City" provided stone for London's cobbled streets in the 18th century. Other industries include shipbuilding, paper making, textiles, chemicals, and engineering. Aberdeen's proximity to North Sea oil has transformed it into an important service centre for the oil industry. Population (1996 est): 217 260. 2. **City of Aberdeen** A council area in NE Scotland, established in 1996. Area: 186 sq km (72 sq mi). Population (1999 est): 213 070.

Aberdeen Angus A breed of polled (naturally hornless) beef cattle, originating from NE Scotland. Short, stocky, and usually black (some have red coats), they are hardy and adapt well to different climates. Angus bulls are commonly mated with dairy breeds to produce a polled beef cross.

Aberdeen terrier See Scottish terrier.

aberration 1. A defect in a lens or mirror that causes blurring or distortion of the image. **Spherical aberration** is caused by rays from the outside of the lens or mirror being brought to a focus at a different point from those nearer to the centre. In **chromatic aberration**,



Abdomen

The many organs of the abdomen are shown above in two drawings.

Upper picture

- 1 liver
- 2 gall bladder
- 3 spleen
- 4 stomach
- 5 large intestine
- 6 small intestine
- 7 appendix

Lower picture

- 1 kidneys
- 2 bladder
- 3 pancreas
- 4 peritoneum

different colours are focused at different points, since the refractive index of glass varies with the wavelength. *See also* astigmatism. 2. An apparent displacement in the position of a star or other heavenly body due to the motion of the observer with the earth in its orbit round the sun.

Aberystwyth 52 25N 4 05W A town and resort in Wales, in Ceredigion on Cardigan Bay. A college of the University of Wales was established in 1872 and the National Library of Wales, in 1911. Population (1991 est): 11 154.

Abidjan 5 19N 4 00W The former capital of Côte d'Ivoire, off the Gulf of Guinea. A small village until developed by the French in the 1920s, it was the capital in 1934. It is now an important port, linked to the sea by the Vridi Canal. Population (1995): 2 797 000.

Abkhazia (or Abkhaz Republic) An administrative division of Georgia. Most of the population is Abkhazian or Georgian and lives along the narrow subtropical coastal lowland. The region is predominantly agricultural; the chief mineral is coal. *History:* invaded by the Romans, it later gained independence before coming under the Ottoman Turks in the 16th century. It became a Russian protectorate in 1810 and an autonomous republic of the Soviet Union in 1921. In 1992 it declared independence, leading to a conflict (1993–94) in which Georgian troops unsuccessfully attempted to regain control. Area: 8600 sq km (3320 sq mi). Population (1993 est): 516 600. Capital: Sukhumi.

Abolition Movement The campaign to abolish slavery in the USA. Opponents of slavery formed an antislavery society in 1833. They helped runaway slaves escape to Canada via their secret Underground Railroad route; such publications as *Uncle Tom's Cabin* by Harriet Beecher Stowe unveiled the slavery issue, which was settled by the Civil War.

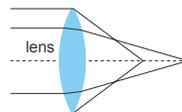
Abominable Snowman A creature, also called Yeti (Tibetan: Snowman), that is believed to live at high altitudes in the Himalayas. There have been no authen-

ticated sightings, but footprints in the snow have been photographed (which may have other causes).

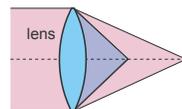
Aborigines The dark-skinned hunters and gatherers who inhabited Australia before European settlement. They were a diverse people culturally but, in general, material culture was rudimentary, while kinship organization and terminology were complex. Aboriginal mythology was generally rich and elaborate and included accounts of creation during the primordial dawn, which they call "Dream Time." There are roughly 136 000 people of Aboriginal descent in Australia. The small proportion who maintain a nomadic way of life are threatened by encroachments upon their lands. A movement to protect Aborigines' rights has gathered momentum; in 1993 Aborigines were granted the right to reclaim land formerly held under native title but this was curtailed by further legislation in 1998.

abortion The expulsion or removal of a fetus from the womb before it is capable of independent survival. In the UK a fetus is not legally viable until 24 weeks old. Expulsion of a dead fetus at any later time is called a stillbirth. Abortion may be spontaneous (a miscarriage) or induced for therapeutic or social reasons. In the UK (excluding Northern Ireland) induced abortion is legal if it is carried out under the terms of the Abortion Act (1967) and the Abortion Regulations (1991): two doctors must agree that termination of the pregnancy is necessary (e.g. to prevent the birth of a severely deformed or abnormal child or to preserve the health of the mother) and the operation must be performed in approved premises. Methods used include dilatation and curettage, suction of the womb using an aspirator, and the administration of certain drugs (e.g. mifepristone).

Aboukir, Battle of (25 July, 1799) The battle in which Napoleon defeated the Ottoman Turks during his occupation of Egypt. The 7000-strong French army defeated the unruly Turkish force of 18 000.



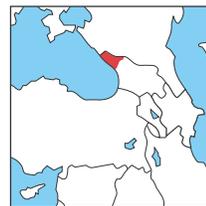
Spherical:
peripheral rays are refracted more than the central rays



Chromatic:
violet rays refracted more than the red rays.

Aberration

Two types of optical aberration.



Abkhazia

Africa. Its timber is used in general turnery. Family: *Betulaceae* (birch family).

Aldrin, Jr, Edwin Eugene (1930-) US astronaut, the second man to walk on the moon. Known as “Buzz,” he was an air force pilot during the Korean War before becoming an astronaut in 1963. He undertook a 5fi-hour spacewalk in 1966 and was lunar module pilot (under Neil Armstrong) in Apollo 11 when it made the first moon landing in 1969.

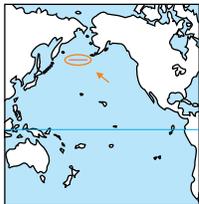
ale See beer and brewing.

aleatoric music Music that incorporates elements of chance in its structure. The word, from Latin *alea*, a game of dice, was first used in the 1950s to describe John Cage’s experiments in determining pitch, rhythm, structure, and dynamics by the use of the I Ching. Boulez, Stockhausen, and others have experimented with this type of music. Computers have also been used to generate aleatoric music.

Aleppo (Arabic name: Halab) 36 14N 37 10E A town in NW Syria. The Crusaders tried in vain to capture it, and from 1516 to 1919 Aleppo was part of the Ottoman Empire. After World War II, it was incorporated into independent Syria. It is now an industrial centre and the terminus of a pipeline from Iraq; its university was founded in 1960. Population (1994 est): 1 591 400.

Aletsch Glacier The largest glacier in Europe, in Switzerland in the Bernese Oberland lying SE of the Aletschhorn mountain. Length: 26 km (16 mi).

Aleutian Islands A chain of volcanic Alaskan islands lying between the Bering Sea and the Pacific Ocean, divided politically between Russia and the USA. The chief settlements are on Unalaska. Russian exploitation of supplies after 1741 greatly reduced the population, but fishing and seal, otter, and fox hunting are now regulated. There are strategic US military stations on the islands and underground nuclear tests have been made (since 1971).



Aleutian Islands

Alexander (III) the Great (356-323 BC) King of Macedon (336-323), who between 334 and his death conquered most of the world known to antiquity. Alexander, who was a pupil of Aristotle, inherited a plan to invade Persia from his father Philip II; having secured his position in Macedon and Greece, he put this plan into action. In 333 he defeated the Persian king Darius III at Issus; in 332 he reduced Tyre in his greatest victory. Alexander then proceeded to conquer Egypt and Babylon (331). Moving on to Media and then east into central Asia, he finally embarked on the Indian expedition (327-325). He crossed the River Indus and conquered the Punjab. Forced to turn back by his reluctant army, he died at Babylon shortly after the marathon return journey.

Alexander I (1777-1825) Emperor of Russia (1801-25), succeeding his unstable father Paul I. Alexander made some educational and administrative reforms but was more concerned with foreign policy. He signed the Treaty of Tilsit, which lasted until Napoleon’s unsuccessful invasion of Russia in 1812. Alexander later turned to religious mysticism, hoping to establish a new Christian order in Europe by means of the Holy Alliance (1815) with Austria and Prussia.

Alexander II (1818-81) Emperor of Russia (1855-81). After the conclusion of the Crimean War (1856) Alexander embarked upon a programme of modernization. He emancipated the serfs (1861) and reorganized administration, the army, the judicial system, local government, and education. These reforms were not wholly successful because Alexander lacked personnel able to implement them. He presided over Russian expansion into Central Asia and the victorious war against Turkey (1877-78). He was killed by a bomb thrown into his coach.

Alexander III (1845-94) Emperor of Russia (1881-94). Owing to the assassination of his father Alexander II and the influence of the lawyer K. P. Pobedonostsev (1827-1907), Alexander increased police powers, persecuted revolutionaries, and permitted education to decline.

Alexander IV (Rodrigo Borgia; c.1431-1503) Pope (1492-1503), notorious for his immorality, nepotism, and extravagance. Father of four illegitimate children, he used papal wealth to further the career of his son, Cesare Borgia, who pursued Alexander's territorial ambitions in Italy. He was a generous patron of the arts.

Alexander Nevsky, 1220-63, grand duke of Novgorod and Vladimir-Suzdal, Russian national hero and one of the saints of the Russian Orthodox church. In 1240 he defeated a Swedish crusading force near the river Neva, thus acquiring the name Nevsky ('of the Neva'). 1242 he defeated the Teutonic Knights on the ice of Lake Peipus.

Alexandra (1872-1918) The wife from 1894 of Nicholas II of Russia. A German princess and granddaughter of Queen Victoria, Alexandra fell under the evil influence of Rasputin. His disastrous domination of her government while Nicholas was supreme commander of the Russian forces in World War I precipitated the Russian Revolution and the execution of Alexandra and her family by the Bolsheviks.

Alexandria (Arabic name: al-Iskandariyah) 31°13'N 22°55'E The chief seaport and second largest city in Egypt, between Lake Mareotis and the Mediterranean Sea. It handles most of Egypt's trade and the chief export is cotton; industries include oil refining and cotton ginning. *History*: founded in 332 BC by Alexander the Great, partly on the island of Pharos, which was linked to the mainland by a mole, it remained the Egyptian capital for over a thousand years. It was a Greek and Jewish cultural centre with a famous library founded by Ptolemy I Soter in the 3rd century BC. In 30 BC Alexandria fell to the Romans, becoming their most important regional capital. It declined following the discovery of the Cape of Good Hope passage and the removal of the capital to Cairo. It was bombed by the British in 1882, Pompey's Pillar being one of the few ancient monuments to escape destruction. Two obelisks that also survived, Cleopatra's Needles, were removed and



one is now in London, the other in New York. Population (1994 est): 3 382 000.

alexandrine A verse metre consisting of a line of 12 syllables usually with major stresses on the sixth and final syllables. The name is derived from 12th-century French poems about Alexander the Great. It was the dominant verse form in 17th century French poetry and was used by Racine and Corneille.

alfalfa A perennial flowering plant, *Medicago sativa*, also called lucerne. Growing to a height of 1 m, it resembles clover, having clusters of small purple flowers. Native to Europe, it is widely grown as forage for cattle and because of its ability to fix nitrogen. Family: *Leguminosae*.

Alfred the Great (849-99) King of Wessex (871-99). He prevented the Danish conquest of England, defeating them at Edington (878) after a campaign of guerrilla warfare based at Athelney. The legend of the king, travelling incognito, burning the peasant housewife's cakes, and being severely reprimanded by her, possibly refers to this unsettled period of his life. After his victory he allowed the Danes to keep their conquests in Mercia and East Anglia provided that Guthrum, their king, was converted to Christianity. Alfred built a navy of warships to defend the south coast against further Danish invasions (885-86; 892-96) and protected

Alexander the Great Alexander's campaigns 334-323 BC. After the victory at Issus he advanced into Egypt and then across the Persian Empire as far as the Indian Border.

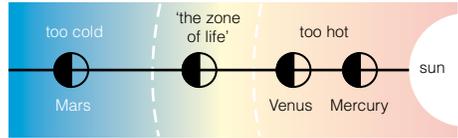
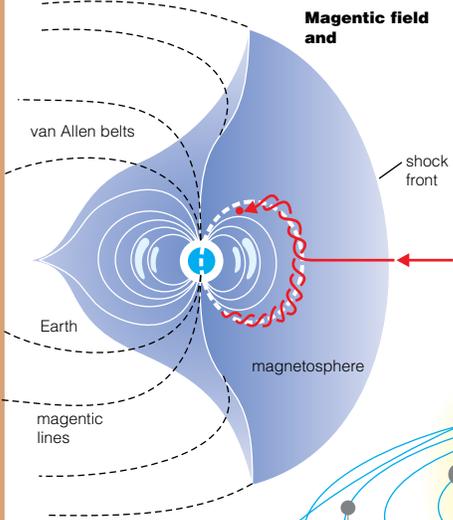


Alfalfa

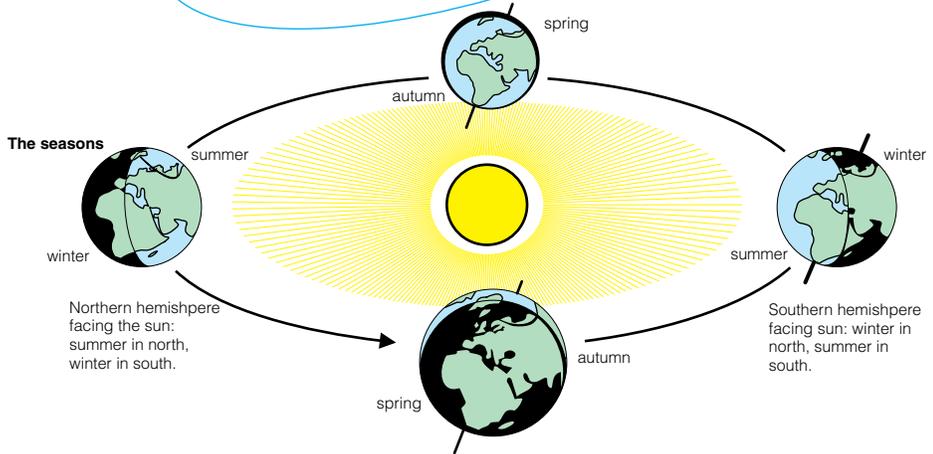
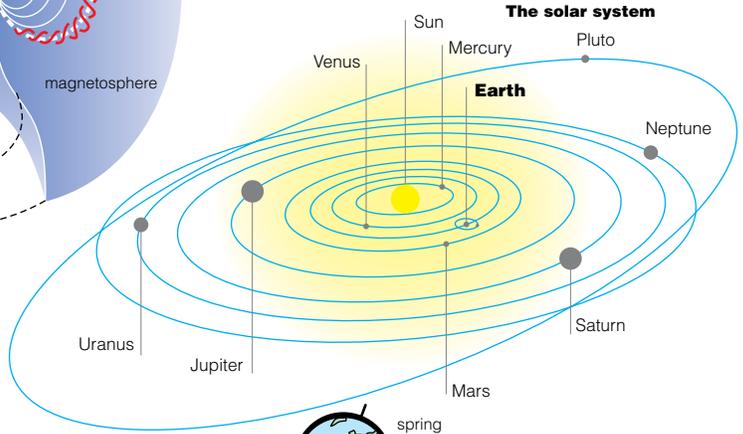


Alexandria The city is situated in the Nile delta.

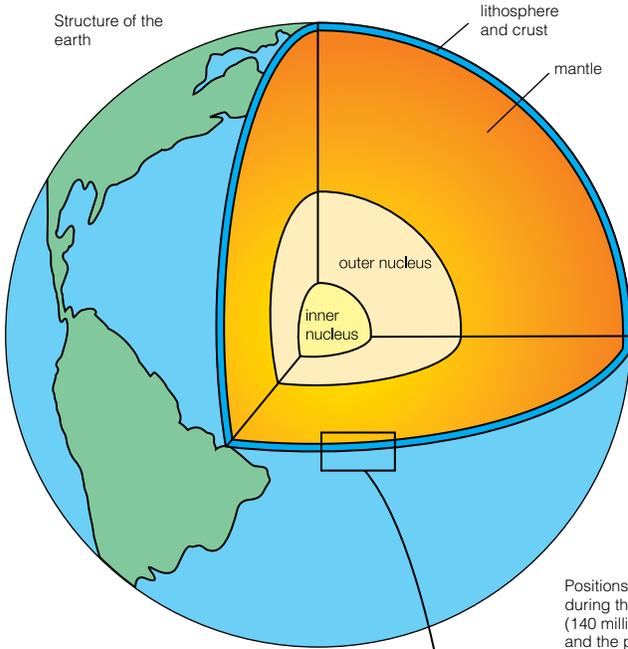
Earth



Only earth sustains life
 Beyond the Earth's orbit it is too cold, between the Earth and the Sun it is too hot for liquid water to exist, which is a pre-requisite for life.

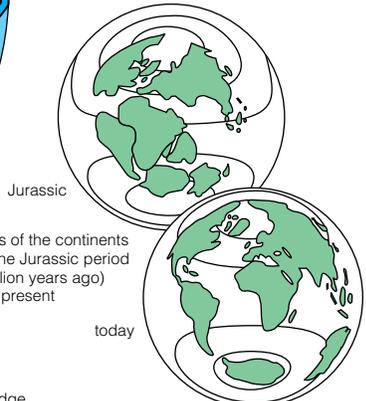


Structure of the earth



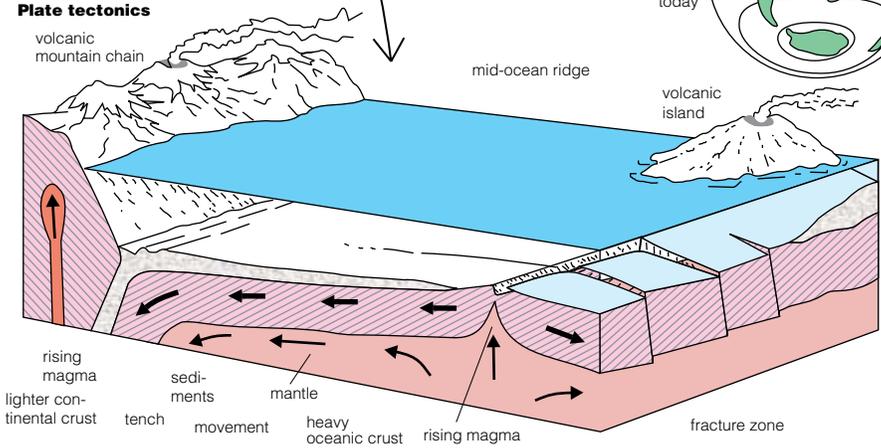
Facts about the earth

<i>Distance to sun, average:</i>	149.6 mill. km
<i>at aphelium:</i>	152 mill. km
<i>at perihelium:</i>	145 mill. km
<i>Orbiting time:</i>	365.3 days
<i>Mean orbiting speed:</i>	29.7 km/sec.
<i>Axial inclination against orbital plane:</i>	66°33'
<i>Rotation period:</i>	23 h 56 m 4 s
<i>Radius at poles:</i>	6356.8 km
<i>at equator:</i>	6378.2 km
<i>Length of equator:</i>	40 055 km
<i>Mass:</i>	5.976x10 ²⁴ kg
<i>Density:</i>	5.52
<i>Area:</i>	510 mill. km ²



Positions of the continents during the Jurassic period (140 million years ago) and the present

Plate tectonics



volcanic mountain chain

mid-ocean ridge

volcanic island

rising magma
lighter continental crust
sediments
mantle
heavy oceanic crust
trench movement
rising magma
fracture zone