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Issue No 4
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P3A Geology Newsletter

"The geologist takes up the history of the earth at the point where the archaeologist leaves it, and carries it further back into remote antiquity." Bal Gangadhar Tilak

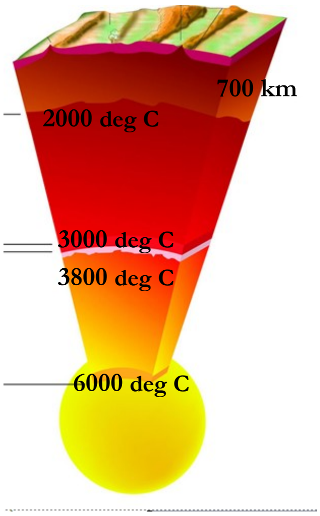
Paphos Third Age (P3A)

http://paphos3rdage.org/

Inside this issue:

Earth's core far hotter than thought

New measurements suggest the Earth's inner core is far hotter than previous experiments suggest, putting it at 6,000C - as hot as the Sun's surface. The solid iron core is actually crystalline, surrounded by liquid. However, the temperature at which that crystal can form has been the subject of long-running debate. To examine how the iron crystals form and melt, experiments used X-rays to probe tiny samples of iron at extraordinary pressures in a diamond anvil. Computer models that simulate the Earth's insides were used to try and determine the temperature at the earths core. Measurements in the early 1990s of iron's "melting curves" - from which the core's temperature can be deduced - suggested a core temperature of about 5,000C. The core temperature is crucial to a number of disciplines that study regions of our planets interior that will never be accessed directly, guiding our understanding of everything from earthquakes to the Earth's magnetic field.



European Synchrotron Radiation Facility

Will Global Warming mean more earthquakes?

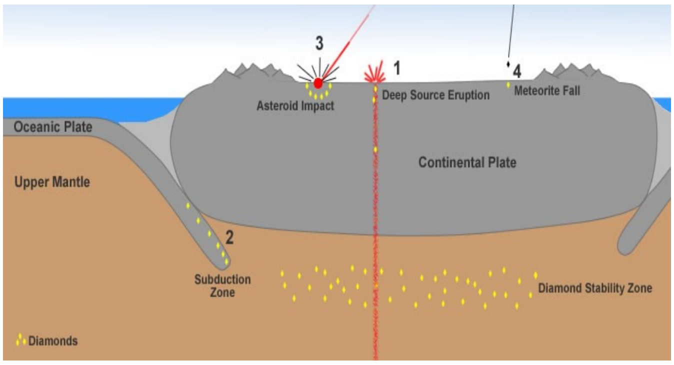
Ice is extremely heavy—weighing about one ton per cubic meter—and glaciers are massive sheets of ice. Glaciers exert enormous pressure on the portion of the Earth's surface they cover. With glaciers melting at an increasing rate, due to global warming—that pressure is reduced and eventually released. The surface of the earth released of the massive weight springs back causing increased stresses. The areas of particular concern are Alaska and Iceland. It is thought that many of the earthquakes that occur in Canada today are related to the ongoing rebound effect that started with the end of the last ice age 10,000 years ago.

Physical Properties of Minerals cont.—Cleavage.

Minerals have a characteristic atomic arrangement. Weakness in this crystalline structure causes planes of weakness, and the breakage of a mineral along such planes is termed cleavage. The quality of cleavage can be described based on how cleanly and easily the mineral breaks. In order of decreasing quality they can be described as: Perfect, Distinct, Good and Poor.

In a transparent mineral, or in thin-section, cleavage can be seen a series of parallel lines marking the planar surfaces when viewed at a side. Cleavage is not a universal property among minerals; for example, quartz, consisting of extensively interconnected silica tetrahedra, does not have a crystallographic weakness which would allow it to cleave. In contrast, micas, which have perfect cleavage, consist of sheets of silica tetrahedra which are very weakly held together. Cleavage occurs in either 1, 2, 3, 4 or 6 directions. Basal cleavage in one direction is a property of the micas. Two-directional cleavage is described as prismatic, occurring in amphiboles and pyroxenes. Galena or halite have cubic (or isometric) cleavage in three directions, at 90°; when three directions of cleavage are present, but not at 90°, such as in calcite or rhodochrosite, it is termed rhombohedral cleavage. Octahedral cleavage (four directions) is present in diamond, and sphalerite has six-directional dodecahedral cleavage

How Do Diamonds Form?



Contrary to what many people believe, most diamonds do not form from coal. Most diamonds have been dated much older than Earth's first land plants - the source material of coal. Also, coal seams are sedimentary rocks usually occurring as nearly horizontal rock units. However, the source rocks of diamonds are vertical pipes filled with igneous rocks. Four processes are thought to be responsible for virtually all of the natural diamonds that have been found at or near Earth's surface. One of these processes accounts for nearly 100% of all diamonds that have ever been mined. The remaining three are insignificant sources of commercial diamonds.

1) Diamond Formation in Earth's Mantle

Geologists believe that the diamonds in all of Earth's commercial diamond deposits were formed in the mantle and delivered to the surface by deep-source volcanic eruptions. These eruptions produce the kimberlite and lamproite pipes that are sought after by diamond prospectors. Diamonds weathered and eroded from these eruptive deposits are now contained in the sedimentary deposits of streams and coastlines.

2) Diamond Formation in Subduction Zones

Tiny diamonds have been found in rocks that are thought to have been subducted deep into the mantle by plate tectonic processes - then returned to the surface.

3) Diamond Formation at Impact Sites

Throughout its history, Earth has been repeatedly hit by large asteroids. The high temperature and pressure conditions of such an impact are more than adequate to form diamonds.

4) Formation in Space

NASA researchers have detected large numbers of nanodiamonds in some meteorites (nanodiamonds are diamonds that are a few nanometers - billionths of a meter in diameter). About three percent of the carbon in these meteorites is contained in the form of nanodiamonds.

Methods of Diamond Formation

Plate boundaries

Tectonic plate interactions are of three different basic types:

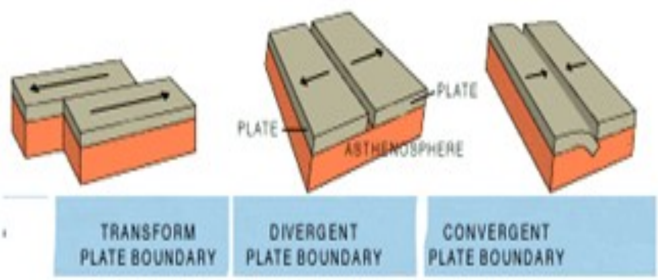
- **Divergent boundaries** are areas where plates move away from each other, forming either mid-oceanic ridges or rift valleys.
- **Convergent boundaries** are areas where plates move toward each other and collide. These are also known as compressional or destructive boundaries.

  Subduction zones occur where an oceanic plate meets a continental plate and is pushed underneath it. Subduction zones are marked by oceanic trenches. The descending end of the oceanic plate melts and creates pressure in the mantle, causing volcanoes to form.

  Obduction occurs when the continental plate is pushed under the oceanic plate, but this is unusual as the relative densities of the tectonic plates favours subduction of the oceanic plate. This causes the oceanic plate to buckle and usually results in a new mid ocean ridge forming and turning the obduction into subduction

  Orogenic belts occur where two continental plates collide and push upwards to form large mountain ranges.

Transform boundaries occur when two plates grind past each other with only limited convergent or divergent activity.



Cyprus Rock & Mineral Samples

In the last Geology Newsletter I asked for a volunteer, or volunteers, to assemble a sample box of Cyprus rocks & minerals. This would be useful to Geology group newcomers, as props in presentations and in aiding future rock and mineral identification. Even in his final days in Cyprus, before departing back to the UK, Alan Wagstaffe came through once again and produced a box of labelled samples. Rather than hide this away in the Geology store cupboard, would anyone be prepared to take possession of the box and to add to it, as and when we find and identify new samples? Please contact myself, Jan or Anneke. We all wish Alan & Val all the very best for their '4th Age' in the UK, you will be greatly missed.

Types of Volcanic Eruptions

Volcanic eruptions commonly display a distinctive pattern. Some mild eruptions merely discharge steam and other gases, other eruptions quietly extrude large quantities of lava. The most spectacular eruptions produce violent explosions that blast great clouds of gas-laden debris into the atmosphere.

The type of volcanic eruption is often labelled with the name of a well-known volcano where characteristic behaviour is similar--hence the use of such terms as "Strombolian," "Vulcanian," "Vesuvian," "Pelean," "Hawaiian," and others. Volcanoes may exhibit one or more of these characteristics types of eruption.

In a Strombolian-type eruption, huge clots of molten lava burst from the summit crater to form luminous arcs through the sky. Collecting on the flanks of the cone, lava clots combine to stream down the slopes in fiery rivulets.

A "Vulcanian" type eruption produces a dense cloud of ash-laden gas which explodes from the crater and rises high above the peak. Steaming ash forms a whitish cloud near the upper level of the cone.

In a "Vesuvian" eruption, as typified by the eruption of Mount Vesuvius in Italy in A.D. 79, great quantities of ash-laden gas are violently discharged to form cauliflower-shaped cloud high above the volcano.

In a "Peléan" or "Nuée Ardente" (glowing cloud) eruption, a large quantity of gas, dust, ash, and incandescent lava fragments are blown out of a central crater, fall back, and form tongue-like, glowing avalanches that move down-slope at velocities as great as 100 miles per hour. Such eruptive activity can cause great destruction and loss of life if it occurs in populated areas.

"Hawaiian" eruptions may occur along fissures or fractures that serve as linear vents or they may occur at a central vent. In fissure-type eruptions, molten, incandescent lava spurts from a fissure on the volcano's rift zone and feeds lava streams that flow down-slope. In central-vent eruptions, a fountain of fiery lava spurts to a height of several hundred feet or more. Such lava may collect in old pit craters to form lava lakes, or form cones, or feed radiating flows.

"Phreatic" (or steam-blast) eruptions are driven by explosive expanding steam resulting from cold ground or surface water coming into contact with hot rock or magma. The distinguishing feature of phreatic explosions is that they only blast out fragments of pre-existing solid rock from the volcanic conduit; no new magma is erupted. Phreatic activity is generally weak, but can be violent in some cases.

The most powerful eruptions are called "plinian" and involve the explosive ejection of relatively viscous lava. Large plinian eruptions can send ash and volcanic gas tens of miles into the air. The resulting ash fallout can affect large areas hundreds of miles downwind. Fast-moving deadly pyroclastic flows ("nuées ardentes") are also commonly associated with plinian eruptions.

Glossary & General

GEOLOGIST AT LUNCH

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Acknowledgements:

BBC

ESRF

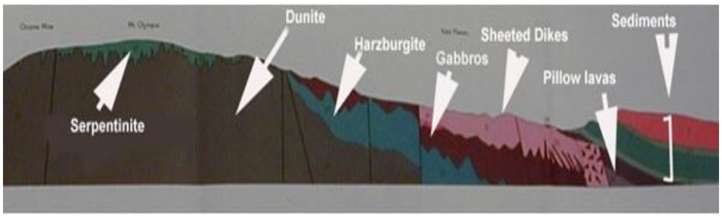
Wikipedia

Geology.com

Geology Group News

The P3A Geology group meetings will begin again in October. Jan & Anneke will keep you up-to-date with what is happening but they need your support.

Keith Adair would like a volunteer(s) to assist in building our next seismometer, which will measure vertical displacement — no particular skills required.



For an introduction to the Rocks of Cyprus click on the link.

Need help with your P3A Geology presentations? The website Slideshare is the world's largest community for sharing presentations. With 60 million monthly visitors and 130 million page views, it is amongst the most visited 200 websites in the world. A simple search on the word *'Geology'* brings up 38,286 results for potentially useful slide presentations. Individual slides or whole presentations can be downloaded. There is a simple registration procedure and it is all free. So with Slideshare and Wikipedia it is simple to prepare your next P3A Geology presentation. If you would like to book your next presentation please contact Jan or Anneke. If you would like assistance with Power Point contact Ken

Glossary: *To continue in the next issue*

D

Devonian — A period of time between 354 and 417 million years ago.

Diagenesis — The process that changes sediment into rock. This happens by the water being squeezed out, mineral grains being organised or chemically changed and the whole being cemented by minerals precipitated from peculating mineralised water.

Diatoms — Single celled algae that have interlocking cell walls made of silica.

Dip slope — see escarpment.

Dolerite — A dark coloured igneous rock, intruded into the earth's crust, with medium sized crystals of feldspar, pyroxene and other, less common, minerals.

Doline — A depression or hole in the ground formed by the solution of limestone by chemical weathering.

Dolomite — A mineral of magnesium carbonate. See dolostone.

Dolostone — A rock that comprises over 90% of the mineral dolomite. The rock used to be called dolomite, but as it was possible to confuse dolomite (the rock) with dolomite (the mineral), it was decided that the rock should have a different name.

Dry valley — A valley that was formed by rivers when the water table was high or when the ground was frozen, but now abandoned by the river.