January 2013

Issue No 2
Page 1

P3A Geology Newsletter

"Geologists have their faults"

Paphos Third Age (P3A)

http://paphos3rdage.org/

Inside this issue:

All of my Faults are Stress related

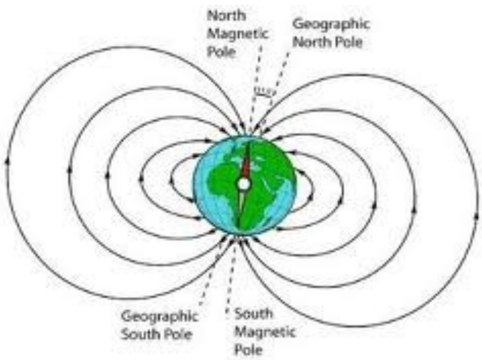
The Earths Magnetic Field Flip-Flops

The Earth's magnetic field protects us from electromagnetic radiation as well as being a convenient means of providing navigational information. However, periodically it flips and North becomes South and vise-versa. The last time this happened was about 780,000 years ago. These changes in polarity are recorded by magnetically sensitive material (Magnetite). In molten lava the irons electrons spin randomly. As the molten lava cools it retains the magnetic polarity of the earth at that time.

How the Earth's magnetic field is created is complex but thought to be due to the turbulent motion of the fluid iron in the Earths outer shell, circulating around the solid inner core. The magnetic field strength and direction can vary dramatically in localised areas around the world. In 2011 Tampa International Airport on Florida's west coast had to re-designate its three runways due the localised change in magnetic field direction. During the 20th century, the north magnetic pole moved at an average speed of 10 km per year, recently accelerating to 64 km per year (40 miles). Unlike the true north pole which moves very slowly due to tectonic plate movements. This increase in the rate of change leads to speculation that another flip is imminent 'within the next 2,000 yrs'. The Earth's magnetic field generally takes between 1,000 and 10,000 years to reverse.

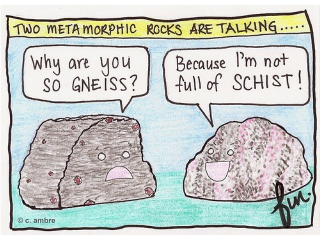
Why Magnetic Field Flip-Flops

NASA—The Earths Magnetic Field



The Earth's magnetic field, magnetic poles and geographic poles.

Geology Apps for Smart Phones



Check out the Geology related Apps on iTunes and other websites for non Apple smart phones. I have 10 Geology related apps on my iPod Touch. Two report earthquakes, where minimum magnitude and your location can be pre-set. Other apps installed are: Common Rock Reference; Mohs Scale of Hardness; The Rock Cycle; Mineral Identifier; Geologic Time Scale; Virtual Microscope; Mars Globe & Moon Globe.

Many of the apps are free to download.

Mobile geosciences apps.

Android Geology Apps

Google Geology Apps

Landslides in Cyprus

Cyprus is well-known for its interesting and often complex geology, particularly in the south-west part of the island. Here, the remains of former sea-floor deposits and massive submarine slides, (referred to as 'olistostromes' and including massive breccias called mélange) are exposed in the Paphos District situated between the Troodos Mountains and the sea. These deposits tend to be heavily deformed and are rich in the types of clay minerals that are prone to landsliding. This tendency is exacerbated by the steep terrain and the long history of powerful earthquakes in the region. Many types of landslide can be seen in a relatively small area, from deep-seated rotational landslides, through translational block movements and topples, to shallow mudflows. The terrain is characterised by steep-sided plateaux made up of 'Melange' and 'Kannaviou Clay' capped by thick chalk sequences. These chalks act as reservoirs releasing water into the clay and sandstone slopes below

Translational rock slide in chalk, central Paphos District

British Geological Survey—Landslides in Cyprus

Fossil Raindrops determine the atmosphere of early Earth.

Elliptical outlines of raindrop imprints

2.7bn year old "Fossil raindrops" were discovered in Ventersdorp in the North West Province of South Africa in the 1980s. They are pits in the surface of a rock that was volcanic ash. Rain created small depressions that was covered by further ash and lithified (turned to stone). The covering layers have now been eroded away exposing the 'fossilised raindrops'. Scientists have used the depressions drops left to calculate how fast they were going as they impacted the ground. This has allowed them to determine the density of the air in ancient times. This type of study is referred to as palaeobarometry. 2.7bn years ago the earth span much faster, the Moon was closer and the Sun was much weaker. There were no animals or plants in existence back then; the air was simply not breathable. The maximum size a raindrop can reach is dependent on the aerodynamic forces and not air density. Therefore , if the air were denser, the drops would fall slowly and the depressions would be smaller than they would in the present atmosphere of the earth. BBC-Fossil Raindrops

"I don't drink water, because if water can erode rock, think what it can do to flesh. " — Jarod Kintz,

Maori stones hold magnetic clues

A NZ researcher is working on a project to retrieve information about changes in the Earth's magnetic field stretching back over the past 10,000 years. Magnetic variation data is not as well studied in the southern hemisphere. Scientists are studying the changes in the Earth's magnetic field using the stones that line Maori steam ovens (hangi ovens). These were pits in the ground into which were placed very hot stones, covered with baskets of food and layers of fern fronds soaked in water. The cooking process heats the stones to around 1,000 deg C, which is above the Curie point. A magnet will lose its magnetism if heated above the Curie temperature. Magnetic minerals in these stones will realign themselves with the Earths current magnetic field direction and this will be fixed as the temperature of the rock drops below the Curie temperature. To go back further in time volcanic rocks that erupt at temperatures higher than the Curie temperature are used. Determining changes in the earths magnetic field is a key means of determining the rate of the spread of the divergent plate boundaries.

BBC-Maori Stones

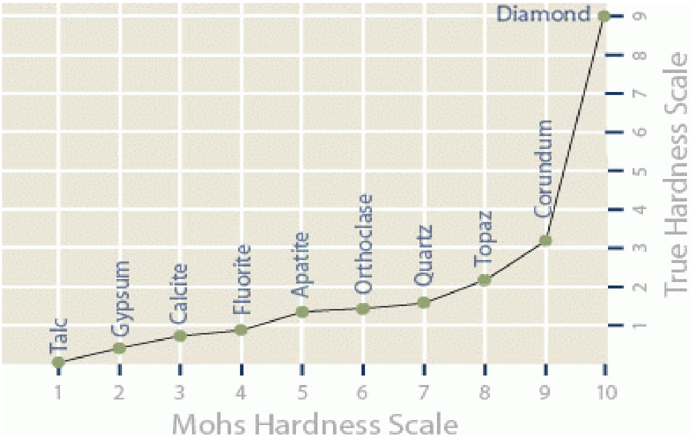
Physical Properties of Minerals

The **Mohs scale of mineral hardness** is based on 10 standard minerals and characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material. It was created in 1812 by the German geologist and mineralogist Friedrich Mohs and is one of several definitions of hardness in materials science. The method of comparing hardness by seeing which minerals can scratch others, however, is of great antiquity, having first been mentioned by Theophrastus in his treatise *On Stones*, c. 300 BC.

Moh's Hardness Scale

Hardness	Mineral	Description
1	Talc	Fingernail scratches it easily.
2	Gypsum	Fingernail scratches it.
3	Calcite	Copper penny scratches it.
4	Fluorite	Steel knife scratches it easily.
5	Apatite	Steel knife scratches it.
6	Feldspar	Steel knife does not scratch it easily, but scratches glass.
7	Quartz	Hardest common mineral. It scratches steel and glass easily.
8	Topaz	Harder than any common mineral.
9	Corundum	It scratches Topaz.
10	Diamond	It is the hardest of all minerals.

As can be seen from the graph below the relationship between hardness values is not linear.



In other words, the difference in hardness between 4 and 5, for example, is not the same as the difference in hardness between 8 and 9. A more limited but practical scale can be easily and cheaply obtained by observing that:

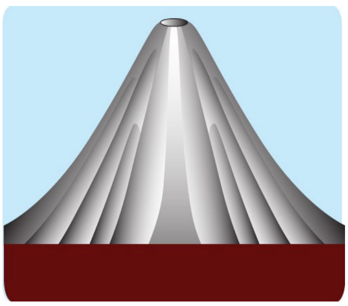
- your fingernail has a hardness of 2.5,
- a penny has a hardness of about 3.5,
- glass and a steel nail have nearly equal hardnesses of 5.5
- and a streak plate has a hardness of 6.5.

Hardness of Minerals & Rocks

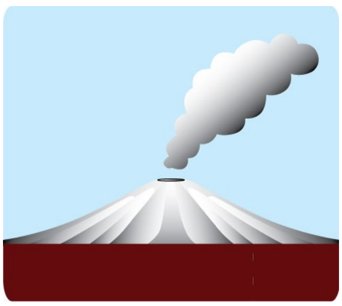
Types of Volcano

The shape of a volcano is primarily determined by the type of lava that has erupted. There are a number of different types of volcanoes including calderas, craters, fissure vents, pyroclastic cones, stratocone (composite) and shield. For simplicity, we will look at stratocone and shield volcanoes.

Stratocone volcanoes erupt viscous lava which does not flow easily, building up around the vent . This produces steep sided triangular cross section volcanoes. Examples of stratocone volcanoes are Soufrière Hills, Montserrat, Mount Fuji (Japan), Mount St Helens (USA) and Mount Pinatubo (Philippines)



Shield volcanoes produce thin lava that spreads far from the source forming a volcano with gentle slopes. Mauna Kea and Mauna Loa are shield volcanoes. They are the world's largest active volcanoes, rising nearly 9 km above the sea floor around the island of Hawaii.



Unfortunately there are a number of different methods of classifying volcanoes and you will find a large variation between different websites and books.

Make your own volcano cut-out models. Click HERE to go to the BGS website.

British Geological Society-Types of Volcano

What is Rock and 'The Rock Cycle'?

Rocks are naturally formed and are simply composed of crystals or particles of one or more minerals. For example, the common rock, granite is a combination of the quartz, feldspar and biotite minerals. The Earth's outer solid layer, the lithosphere, is made of rock. Rocks are named according to the way in which they were formed and there are three types: **igneous**, **sedimentary** and **metamorphic**:
Rocks are generally classified according to several characteristics such as mineral and chemical composition, the texture of the constituent particles, and permeability. They are further classified according to particle size. Future articles will address these points in more detail.
The transformation of one rock type to another is described by the geological model called the rock cycle. The rock cycle is a fundamental concept in geology that describes the dynamic transitions through geologic time among the three main rock types: sedimentary, metamorphic, and igneous. The diagram below illustrates, how each of the types of rocks are altered or destroyed when forced out of its equilibrium conditions. The original concept of the rock cycle is usually attributed to James Hutton, the eighteenth century *father of geology*. In 1967, J. Tuzo Wilson published an article in Nature describing the repeated opening and closing of ocean basins. This concept, a part of the plate tectonics revolution, became known as the *Wilson cycle*. The Wilson cycle has had profound effects on the modern interpretation of the rock cycle as Plate tectonics became recognized as the driving force for the rock cycle.
The Rock Cycle

A diagram of the rock cycle. Legend: 1 = magma; 2 = crystallization (freezing of rock); 3 = igneous rocks; 4 = erosion; 5 = sedimentation; 6 = sediments & sedimentary rocks; 7 = tectonic burial and metamorphism; 8 = metamorphic rocks; 9 = melting.

Acknowledgements

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BBC News at bbc.co.uk/news

Wikipedia

Glossary: *To continue in the next issue*

B

Barrier reef — A coral reef that started growing close to the shore (fringing reef), but due to earth movements is now growing some distance away from it.

Basin mires — Developed in a waterlogged basin which may be completely enclosed or only a very restricted through-flow of water.

Bed — Layer of sedimentary rock. Beds are built up one on top of the next, separated from each other by bedding planes. Each bed represents a single phase of more or less continuous sedimentation, before a change in conditions or an interruption of sedimentation, forms the bedding plane.

Bedding plane — A surface occurring in sedimentary rocks that represent an event that interrupted sedimentation for a time.

Blanket mires — Formed on extensive flat or gently sloping ground usually in 'upland' ground.

Blind valley — Formed by erosion at a swallow hole, resulting in an uphill facing cliff and a dry valley further down hill.