Farnham Geological Society

[**www.farnhamgeosoc.org.uk**]

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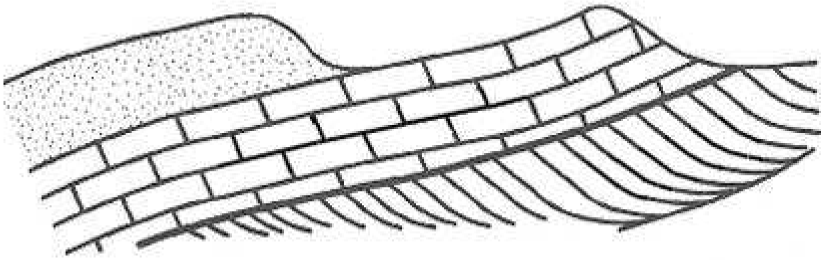

A local group within the GA

Vol. 13 No.2 **40th Anniversary Newsletter** June 2010

Issue No: 75

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Editorial

This month sees the 40th Anniversary of the Farnham Geological Society (FGS) so I have included, in this, the Society's 75th Newsletter, a summary of how the Society started from humble beginnings in 1970, thanks to the imagination of four individuals, and how it is run as the busy, thriving group it is today.

It is a tribute to those early individuals that they had the foresight to commence the Society which has become such an important asset to Farnham and neighbouring areas. The FGS is now a local group of the Geologists' Association and we are privileged to have Danielle Shreve, president of the GA, giving one of the commemorative talks. Ted Finch, one of the founder members and the original Field Trip Secretary has agreed to come to the July meeting to talk about the nodules found in the sand pits in those early days.

The theme for the 40th Anniversary Celebration which is being held on Saturday 26 June, is Climate and Climate Change. The speakers, all recognised authorities on their subjects, together with the titles of their talks, are: Dr Danielle Schreve, Royal Holloway (*Quaternary climate change and fossil mammals: evolution, environment and extinction),* Prof. Susan Marriot, Univ. of Bedfordshire (*Late Silurian and early Devonian climates as revealed by the Old Red Sandstone of South Wales)* and Prof. Malcolm Hart, Univ. of Plymouth (*Was the Cretaceous greenhouse world always so warm?).* The afternoon field trip around the Hog's Back also considers the effects of climate on the local geology and landscape.

The February talk (summarised below) demonstrated that climate change has also affected our neighbouring planet Mars, but in this case more than 3 billion years ago (>3Ga). Our Chairman has written an article on the same theme and another member experienced climate extremes at first hand whilst on holiday in Madeira, bringing the subject right up to date with thoughts on modern climate.

During the hot lazy days of summer I am hoping to update the photographic record of the field trips past and present and thus would be grateful for all members to contribute photographs, with comments and notes, preferably all in digital format, but between us, Mike and I can cope with most formats.

Acknowledgements:

FGS gratefully acknowledges financial support from the JAPEC Fund of the Geologists' Association for the 40th Anniversary Celebration event. FGS also gratefully acknowledges the generosity of Audace Technology of Woking who has very kindly donated a laptop for general use by the Society.

Liz Aston

History of The Farnham Geological Society

The Beginnings

David Caddy, editor of the newsletter in 1988, gave a full account of the early history of the Society and this is summarised below.

The Farnham Geological Society was officially established on 1st January, 1971; however it had been in existence for about a year previously. The Council for Extra-Mural Studies at the University of London was running courses on geology in Farnham. Ron Roberts, from the Geological Museum, started the courses, succeeded by Dr. John Hawkins and then Ted Finch. These courses were well attended, had excellent lecturers and ran numerous field trips. One popular venue was the Coxbridge sandpit at Wrecklesham with exposures of the Folkestone Beds/Gault Clay junction and this is where, in 1969, Ted Finch, Audrey Hewins and Jack Shepherd suggested that a Farnham Geological Society might be formed, independent of the geology courses.

Audrey Hewins was on a trip to the nearby sand pits where she found a solid silver picture frame on a pile of rubbish; this was sold to Guildford Museum and the money used to finance the society.

The founder members included Julian Bentick, Gordon Dearing, Ted Finch, Audrey Hewins, Maurice Hewins (not Audrey's husband) and Richard Pinker. They used to meet at each other's homes and from these humble beginnings, the FGS arose.

The Inaugural Meeting was held on Monday 6th April 1970 in the Council Hut, South Street, Farnham. There is no record of how many people attended that meeting or joined the Society. The first Chairman was Stanley Smith, Secretary Audrey Hewins and Field Trip Secretary was Ted Finch.

A Constitution was drafted in June 1970, but issues over insurance delayed publication and the final Authorised Version, although undated, was probably typed and circulated around 25th October, 1972.

The first field meeting was held on Sunday 12th July 1970 when 12 members met at Burrington Coombe in the Mendips under the leadership of Ted Finch. Eleven localities were visited, ranging from Silurian, through Carboniferous, to Jurassic. Other visits were made to Coxbridge sandpit, Seale chalk quarry, Lyme Regis, Isle of Wight, Ringstead Bay, Portland Island, Church Stretton, to name but a few. Maurice and his wife Judith had a baby whom they took with them on early Field Excursions, e.g. to Bracklesham Bay. Other early members include Jack Shepherd, who was an intrepid rockhound and always carried a 7 lb sledgehammer in his quest for chalcedony nodules; and Chris Shepeard who went on to edit the Historic Farnham Articles in the 'Herald'.

Lectures were on such varied subjects as continental drift, gemstones, the expanding Earth and Icelandic geology. Other activities included wine, cheese & rock, wine & fossil, and slide parties as well as social gatherings around Christmas time.

The Society produced a newsletter in the autumn of 1970 which was "optimistically numbered one". The following newsletter, in the Spring of 1971, had to be delivered by hand due to a postal strike! Neither of these were dated and the early ones were often written by hand.

Our Treasurer Peter Luckham has searched out the first page of the accounts, the first few lines of which are reproduced below:

1970		Bank Income Cash						Bank Expenditure Cash					
		£	s	d	£	s	d	£	s	d	£	s	d
June 1	Donation				3	0	0						
	Sale of Map boards					3	0						
	Advert - Farnham Herald											15	0
	Postage, Tel										1	5	0
	Duplicating											18	0
	Receipt Book											4	0
	Cash in hand											1	0
					3	3	0				3	3	0
	Cash in hand b/down					1	0						
June 8	Entry Fee – Mrs Lowes	1	0	0									
	Entry Fee – Mr & Mrs Hewins	2	0	0									
	Entry Fee – Meadows Taylor	1	0	0									
	Entry Fee – P Smith	1	0	0									
	Entry Fee – Dixon	1	0	0									

Total subscriptions received at the bottom of the page = £23.0s.0d.

The intervening years

At the end of the first official year the membership was 27; at 31st December 1972, it had risen to 50 and by March 1986 it stood at 66.

In the beginning, a small room at the Farnham Adult Education Centre housed the Society's collection of specimens. This collection of geological specimens also grew through the years as specimens were found, or otherwise acquired. Several finds on field trips have been interesting. An ichthyosuar tail was found by society members during a trip near Whitby. The FGS Committee wished to keep it, but as it had neither the facilities nor the expertise to look after it, it was donated to Bristol Museum where it is still housed today.

On a very early trip to Coxbridge Sandpit (Farnham) a fish was found in an ironstone nodule by one of the members' children, luckily it was saved from serious damage by Maurice Ewing, and proved to be a new species that was named after the family 'Watkinseii'. It too ended up in a museum, having been photographed and described extensively by Ted Finch.

During these years, meetings have covered all aspects of geology: from palaeontology, stratigraphy and fossil extinctions, to igneous, metamorphic and structural processes, and to environmental and planetary topics.

1974 – Field Trip to Pembrokeshire
More photos are on the website

1987 – Field Trip to Whitby and the unearthing by FGS members of an ichthyosaurus tail

The range of field trip locations has expanded over the years from local to more distant parts of the UK, Scotland, Wales, Lake District, Devon and Cornwall and to foreign parts including USA, France, Italy, Ireland, Austria, Hungary, Portugal, Greece and Germany.

Celebrations have been made over the years and field trips, which have always been such an important part of life at the FGS, have taken place to celebrate the milestones. Shirley Stephens has kindly dwelt on her memories and provided the article below, which gives an insight into both the overseas trips and into the previous anniversary celebrations.

Previous FGS Anniversary Celebrations: by: Shirley Stephens (Modern photos added by the editor)

In 1981 we went to Italy to celebrate our FGS 10th Anniversary. This field trip, led by Dr Paul Olver was to see the volcanoes of Southern Italy and Sicily. He had recently obtained his PhD on acid volcanic rocks from selected areas of Italy and North Wales. This was his first field trip to this area with a group, so we were guinea pigs! He pointed out his Olver's unconformity in Southern Lipari, described by him in his Doctorate. The unconformity represents a crucial event in the history of the Recent acid volcanism on Lipari, as it defines two periods of pyroclastic eruptions - each associated with viscous dome intrusions - the unconformity occurring due to the uplift and deformation of the earlier pyroclastics by the rising dome lava prior to the deposition of pyroclastics belonging to the second phase of acid volcanism (Paul Olver's comments).

Thirty one of us travelled the entire way by train, stopping in Naples to see Mt. Vesuvius, and Catania to see Mt. Etna and then crossed to Lipari where we stayed a week to see the volcanics on the Aeolian Isles including Stromboli. Thirteen of us are still members of the FGS – what fun we had! Paul organized us into compartments of 6 couchettes and told us to keep our doors locked for fear of thieves! Standing on the platform on Naples Station one night, the train arrived at a different platform and we all raced across several tracks to reach the right one! The corridors of the train were very narrow and those with huge cases, got stuck when passing another equally huge suitcase.

Overnight the train drove on to the Messina ferry and then split into two. The following morning some of us went on to the deck for coffee and somehow Lyn climbed into the wrong train when we returned, and found she was going the wrong way! She rejoined the group after riding back in a carriage transporting chickens and ducks.

That day, because we were too late for breakfast, we lived on our humps until dinner in the evening, apart from an ice cream at Syracuse. We could find nothing open due to their siesta.

On Lipari, Audrey Price slipped, getting off the coach and scraped her leg and finished up in hospital for the night. The ferry to Panarea the next day moored off the beach and while we all waded ashore, a sailor gave Audrey a piggyback so as not to get the dressing wet. When we climbed up to the Vulcano crater, some people forgot Paul's advice (not to sit down because of the sulphur) so when they went on to the beach afterwards, the seawater reacted with the sulphur and many found that sulphuric acid had burnt holes in their trousers and haversacks! The young lads with us climbed down into the crater and left a message in volcanic bombs – Farnham 1981.

The twin peaks of Salina and the complex topography of Lipari appear above a small valley formed by an outer and inner crater rim of Vulcano's Fossa crater. Photo courtesy of Jürg Alean.

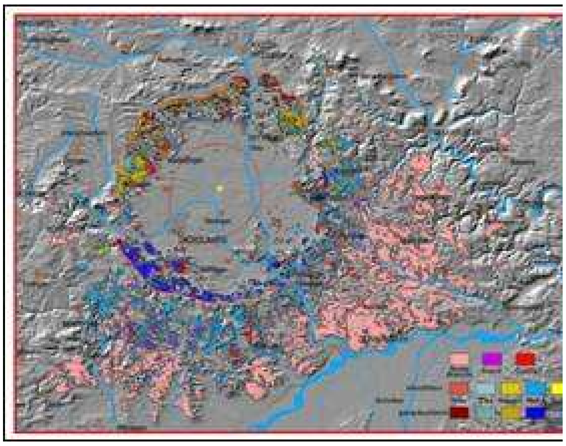
Crater of Vesuvius with a message from FGS field trippers left in rocks on the crater floor – Farnham 1981.

Of the three 20 year olds (who lowered our average age) one was our son Jeffrey who never told anyone that he belonged to us! Very few knew until we got to Rome, on our way back home, after the overnight ferry from Palermo. He found himself in our family room! Then we were not double booked on the train back to Paris but treble booked! But the Italian Tourist Authority soon boarded the train and sorted out the problem.

We've had several excellent anniversary fieldtrips since – our 20^{th} to the Auvergne in1990 led by Reg Bradshaw from Bristol University; our 25^{th}, in 1996, to Western USA: Yellowstone and Canyon Lands with Ivan Dyreng from Utah University. On this trip, Veronica Kilgour celebrated her 80^{th} birthday on the North Rim of the Grand Canyon and at her party, everyone in the restaurant sang Happy Birthday.

Our 30^{th} Anniversary in 1999, was to see the Total Solar Eclipse in Hungary (this included Germany for the Solnhofen limestone and the Nördlingen Ries Crater (believed to be of meteoritic origin), and Austria where we panned for emeralds) with Dr Paul Olver. Our 35^{th} Anniversary to Languedoc was led by Roger Suthren from Derby University when we stayed in Alet and Lodeve.

Paul Olver & Mary Clarke on Sag hill, Szombathely, Hungary, wait for the solar eclipse. Sheets were placed on ground to watch shadow bands pass across just before totality. Shirley describes it as 'a bubbling stream of air'.



Relief model of Ries Crater impact structure 100 km E of Stuttgart, Nördlingen town lies on crater floor. The crater is 25 km across and about 15 million years old.

The FGS today

The objective of the Society is "to promote interest in geology and its allied sciences" and tributes must be paid to the Meetings and Field Trip Secretaries who, over the years, have brought so many interesting talks and trips to the membership. It is through their hard work that the membership has grown to its current strength – over

100 members - a mixture of professional and amateur geologists and enthusiasts, including the honorary members of Ted Finch, Julian Bentinck (both founder members), Paul Olver and John Wilson. Most members come from Surrey, Hampshire, Berkshire, Sussex, Dorset and Middlesex but Associate Members come from as far afield as Hereford, Milton Keynes, Brecon, Nuneaton. The FGS is a member of the Geologists' Association (GA) - one of 17 such Local Groups.

The Meetings and Field Trips remain the core strengths of the Society and the variety and quality of the lectures and field trips are exemplified by this year's programmes. Currently, Janet Catchpole is Meetings Secretary and during her reign the meetings have been both varied and stimulating – from nuclear alchemy and forensic geoscience to diamonds, and from trilobites, graptolites and pterosaurs to granites, mantle rocks, comets, the Moon and Mars. This year's talks are no less varied and include: Antarctica, SE Asia and Thailand, Carboniferous Coal Forests, Cloning a Mammoth, the Santorini Supervolcano, Mineral Collecting and Geology & Disease.

The current Field Trip Secretary, Graham Williams has organised excellent field trips for the last six years with between seven and nine trips organized each year to UK and overseas locations. His objective has always been to learn a bit of geology whilst having a good day out. There are descriptions of many of these trips in previous newsletters, as below:

- Feb 2006 - an excellent record of trips in 2005 by Graham on the Building of Southern England,
- Languedoc & Wiltshire (vol 9 pt 3); Swanage & Brownsea, Shropshire, and Normandy (vol 10 part 1)
- Hampshire & West Sussex (vol 10 part 2); Anglesey & SW Ireland (vol 10 part 3).
- Mupe Bay (vol 11 part 3); Brittany & Normandy (vol 12 part 1).
- Isle of Man, Shere, (vol 12 part 3); St Austell Granite (February 2010, vol 13 no 1).

This year's trips include East Midlands, Madeira, Isle of Portland, Poxwell Pericline & Ringstead Bay, Dorset, Pas de Calais and Pinhay, Beer & Seaton.

The collection of geological specimens has also grown and had various homes over the years and is currently housed at members' homes.

The newsletter has continued through the years and blossomed when David Caddy became editor in March 1987. Peter Cotton then took over in 2002 and he revolutionised the layout and content with the invaluable computer skills of Mike Weaver. It is published together with much other information on the Society's website, which was developed and is maintained by Mike (www.farnhamgeosoc.org.uk) and now includes copies of many of the historical newsletters in pdf format. The Society is in the process of developing a photographic record of its field trips and this can be gained via a link from the website.

Lastly, a look at the current committee which comprises a Chairman John Gahan, Secretary Shirley Williams, Treasurer Peter Luckham, supported by Janet, Graham and Mike, all as mentioned above, and by Janet Phillips, Janet Burton, Susan Williams and myself. All FGS enthusiasts and a good representative cross section of the membership.

Liz Aston

FGS field trip to Aberdeen & the Grampians Sept 2009
Led by Don Milne & Graham Williams

On 31st August, Don Milne gave about 20 of us an overview of the geology of the Aberdeen area and we set out for the Stonehaven coast. We went to Garron Point where the metamorphosed Dalradian grits of Skatie Shore are in fault contact with the Highland Border Complex (serpentinised lava and shale) which extended along to Cowie village. The fault is the Highland Boundary fault (Figure 1, fault runs from top to bottom through notch in middle ground); a major fault separating the hard Precambrian Dalradian Group of the Highlands terrane from the softer, sedimentary Devonian Old Red Sandstone (ORS) of the Midland Valley area.

After lunch at Stonehaven, we went to the Tolbooth museum to see fossil exhibits, specifically *Pneumodesmus newmani*, a centimetre long fragment of a millipede arthropod found in Cowie sandstone, dated at 428Ma (Late Silurian). We then went to the coast between Downie Point and Castle Haven to view conglomerates interbedded with lavas (Figure 2). In places, the ORS conglomerate clasts are thought to include pebbles of Dalradian rocks.

Next day we had a longer drive up to Elgin, to Tynet Burn to see the Middle ORS fish bed localities east of Focharber (Figure 3). We had lunch in Elgin and saw ostriches in a field on the way (maybe too much Talisker?). We visited Elgin museum which had a wonderful display of Permian and Triassic reptilian fossils, e.g. *Stagonolepis robertsoni* and *Saltopus elginensis* (Britain's oldest dinosaur, but a drawing and model here as the only example is in the Natural History Museum) and fossil footprints. We then drove to the Permo-Triassic Hopeman aeolian beds (Figure 4) and the Stotfield chert.


Fig 1: Highland Boundary Fault separating hard Dalradian rocks (RHS) from softer Old Red Sandstone rocks (LHS).


Fig 2: Conglomerates overlying lavas in Old Red Sandstone beds near Downie Point.


Fig 3: Typical outcrop of Old Red Sandstone


Fig 4: Hopeman aeolian beds of Permo-Trias age

On 2nd September, we drove to St Cyrus, where we saw lavas with a variety of textures interbedded with conglomerates of the Lower ORS (Crawton Volcanic Group) - the interbedded lava flows (basalts and andesites) are shown in Figure 5 and the last flow (Figure 6) showed white amygdales and vesicles (bottom RH corner of photograph), occasionally up to 10cm diameter. This Lower ORS sequence is in fault contact with Upper ORS sediments, which showed cycles of sedimentation – each cycle had conglomerates at its base, these passed up into cross-bedded and parallel-bedded sandstones of alluvial origin and then into red siltstones and marls with calcareous nodules of a fossil soil.

Excellent coastal features were seen including blow-holes and stacks and a small inlet in Fowlsheugh Bird Sanctuary previously used as a harbour. We progressed to Dunnottar castle where Joan and Mike described how the small garrison held out against Cromwell for eight months to save the Scottish crown jewels (it also has connections with William Wallace and Mary Queen of Scots).


Fig 5: Devonian conglomerates overlying/interbedded with lavas, forming the Lower ORS, Crawton Volcanic Group.


Fig 6: Hammer head lies on topmost lava with amygdales (almond shaped vesicles usually filled with calcite or quartz in bottom RH corner).

The next day we had a long and memorable drive over Tomintoul to Cromarty, with a short stop at Whisky Castle for souvenirs and at Carrbridge to visit some roches moutonées before continuing on to the Great Glen Fault locality on Black Island and Hugh Miller's Museum (Hugh was an eminent geologist in the early 1800's as could be seen by the excellent fossils in the museum). Driving along the Cromarty Firth shore, large oil installations, rigs and equipment were visible across the water. We ran out of time and had to return through extremely heavy rain to complete a 300 mile round trip and just in time for dinner, on Sue William's birthday!

On the 4th we stopped at a quarry on the way to Rhynie and found some gabbro, then went on to see the famous Rhynie chert (originally deposited as sinter from hot springs, researched by Aberdeen University and described in detail at http://www.abdn.ac.uk/rhynie/intro.htm) in an ORS outlier. Graham produced some thin sections to view with a hand lens. We briefly stopped at the Glenfiddich distillery at Dufftown for a tour.

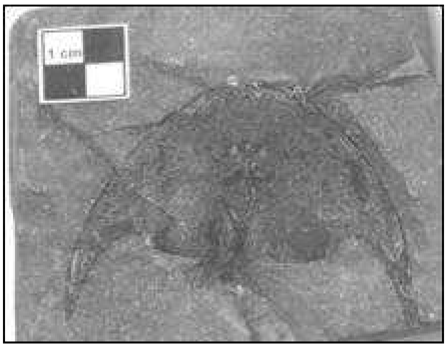
At Bin Quarry SSSI, Huntly, two members of the party were given permission to retrieve samples of igneous rocks from the quarry face where the exposed thickness is ~100m. The Huntly intrusion is a famous layered mafic and ultramafic igneous intrusion, and at Bin Quarry layering of the cumulate horizons dips steeply SE. The layers (cumulates) are exceptionally well-developed with small-scale (cm) variations from peridotite (pure olivine rock) to troctolite (plagioclase and olivine rock) and olivine-gabbro (plagioclase-augite-olivine). Some layers show grading into adjacent layers. The composition of these three mineral phases varies from one body/locality to another across the area, but the bodies are nonetheless considered to be fragments of a large stratiform intrusion that was disrupted much later by earth movements.

On the last day we stopped at a quarry to view metamorphic rocks then drove around Aberdeen to see the position of the Rubislaw granite quarry in the centre of the city. As most of the building stone used to build Aberdeen had been extracted here it was a huge flooded crater surrounded by a high fence. We then drove around Aberdeen looking at the different building stones. Driving along the coast another very large pit provides granite and metamorphics for road stone etc. We returned to the hotel at the end of another brilliant trip organised by Graham. I departed for Dundee for a couple of days with a boot full of rock!

Ian Hacker

Addendum - ***Earth Heritage Magazine, 31, 2008-09: Recent finds of Devonian Fossil fish*.**

Several small 19th Century quarries occur in the Den of Balruddery, east of Dundee. The quarrymen discovered remnants of fossil fish, a plant with spore capsules and a huge lobster and these were collected by the landowner and are now housed in the National Museum of Scotland. Quarrying ended in the late 1800's and since then no more fossil material had been collected until a team from Aberdeen University commenced re-examing these quarries in 1999 and 2004. New fish specimens (a zenaspid fish, cephalaspid fish and fin spines of an acanthodian fish) have been found.



Head of cephalaspid fish from Balruddery

The Balruddery Den is described as a river-fed lake within a semi-arid desert environment, which existed during the Lower Devonian, around 410Ma. This Lake Forfar stretched for 32 miles from Dundee to Montrose and was under the ever-present threat form active volcanoes. The lake formed suddenly (probably when a river was dammed by a lava flow or by tectonic movements associated with the volcanism). Few plants had evolved and the only land animals were arthropods. Predatory fish coexisted with crustaceans living in the rivers and lakes and varied in size from tiny to true giants. Successive volcanic eruptions generated ash layers and volcanic clasts are common in the sediments, indicating that sporadic violent volcanic activity affected this system.

Barry Eade

Carbon Dioxide and Climate Change

Abstract

Created in the Earth's atmosphere, dissolved in seas and oceans, combined in carbonates and other crustal rocks (sinks), carbon dioxide (CO_2) is the very essence for sustaining all life on Earth. This paper looks at the origins and interactions of CO_2 with the atmosphere and its reactions to volatization (heat) that sublimates CO_2 to its vapour phase (gas) thereby absorbing it into the atmosphere. The question is does carbon dioxide cause climate change as is widely understood by many scientists or do global environmental changes occur because of additional causes (known/unknown) or because of a combination of many factors, a few, or just CO_2? This brief report examines the origin, scientific interaction, and contentious issues relating to CO_2 in our atmosphere. The conclusion arrived at is that CO_2 (a heat reactive trace gas with a geologically short residency time of negligible quantity by volume (ppmv)) is insufficient to account for the degrees of warming to effect climate changes on our planet.

CO_2 Analysis

An atypical source of CO_2 can accumulate in the Earth's atmosphere which originates from high energy cosmic rays generated in deep space (galactic and intergalactic) - and to a lesser degree variable radiation from the sun. Cosmic rays enter the Earth's atmosphere and collide with atmospheric atoms thereby activating energetic neutrons. In turn these neutrons collide with nitrogen atoms converting them to carbon: [$^{1}n+^{14}N+>^{14}C+^{1}H$] [(1)] – carbon-14 ($^{14}C$) is a radioisotope widely used for dating purposes by scientists. Organisms ingest carbon-14 and expel it as a gas (CO_2 – a respiratory chemical process), and when they die the carbon element retained converts to carbon-12 (^{12}C). Over-time this radioisotope reverts back to its original form as nitrogen-14 (^{14}N) via the beta decay (β+) process.

The atmospheric content of ^{14}C makes up ~1ppt of carbon in the atmosphere at the present time[(2)], but with a continuum of cosmic radiation ^{14}C is likely to increase (or vice versa). Similarly, like carbon-12, carbon-14 is absorbed as a dissolved gas with free oxygen [$O \rightarrow {}^{14}C = CO_2$] which then produces oxygen (0_2) as a process of photosynthesis. The significance is that carbon-14 can be created in the atmosphere as a result of increasing cosmic radiation. But this can change depending upon the sun's variable insolation, which in highly active conditions (sunspots) reduces the amount of cosmic radiation and hence the manufacture of ^{14}C - more sunspots produce more surface heat which in turn sublimates CO_2 from its natural sinks: ($O+^{14}C/^{12}C \rightarrow CO_2$) to the atmosphere. These changes affect surface environments, particularly at high latitudes where solar irradiance is variable, and during prolonged ice age conditions that bring about periods of warming known as 'interstadials'.

Significantly cosmic radiation affects the Earth's atmosphere in other ways too. Whereas atmospheric evaporation and condensation was once thought to be at the root of cloud production, additional cloud development in the low troposphere (<~3000m) is formed as a result of high-energy cosmic ray bombardments called muons[(3)]. As electrons are set free in the atmosphere, cloud condensation nuclei form and water vapour condenses to cloud. It is well known that nano-particulates of sulphurous dust (volcanism etc) in the atmosphere become the seeds for water molecules to form clouds in the usual way. However a space-rush of muons can become trapped in the tropopause to affect periodic climate cooling, particularly when the Sun's irradiance becomes energy deficient (too weak) and inadequately warms surface air. Atmospheric cooling is further encouraged as solar radiation is diverted back into space, known as the albedo effect. During these inactive sun phases (no sunspots) low-level cloud is formed and begins to dominate the Earth's lower atmosphere. As a result, climate zones become colder and more quiescent. Organic development is also affected and a radical change in surface conditions is likely to bring about the onset of glaciation. Such changes may once again encourage full ice age conditions to develop.

The second source of CO_2 is elemental (primordial) and stored in the Earth's natural sinks or reservoirs. This source is thought to relate to so-called 'anthropogenic climate change' (human induced) about which it is said causes reactions between carbon isotopes (in the carbon cycle) that combines with oxygen to form carbon dioxide. Again this purports to create unacceptable atmospheric warming conditions induced from solar radiation reacting with radiant gases (H_2O, CO_2, CH_4, etc.) - these reactant gases absorb and radiate heat in the thermal infrared (IR) wavelength, a so-called 'Greenhouse effect'.

Uniquely the gas singled-out for special attention is carbon dioxide (CO_2). This trace gas (0.0388ppm) is said to originate almost exclusively from anthropogenic industrialisation sources (recycled carbon) and is identified synonymously with the burning of fossil fuels. By definition there is also a notion of achieving a fixed 'Atmospheric Energy Balance'. Notwithstanding that the largest amounts of carbon dioxide are stored naturally in the Earth's sinks such as large water bodies (seas and oceans) and the Earth's crust and mantle[(4) (5)]. In times of high solar irradiance (active sun) increased surface warming releases carbon dioxide from the natural sinks to the atmosphere. Trace amounts are retained (with a relatively short residency time (4 →200 years?) mainly in the troposphere (lower-level mixing zone) until reabsorbed once again to natural sinks during times of cyclical cooling.

Discussion and Conclusions

The science controversy on climate change has always been about CO_2 dating from the 1940/50s[(5)] which has gathered pace since the 1980s to the present time - recently the warming gas methane (CH_4, volume = 1700ppb) has also been singled for special attention because it too generates a (higher) radiative response. However CO_2 is said to engender overwhelming warming conditions (some say catastrophic) because it is thought to be unusually dominant in the low troposphere (a life-supporting milieu) with a precariously long residency time. As a result carbon dioxide is said to be the sole contributor to unacceptable global warming or climate change and is additionally considered to influence prevailing weather systems (meteorological events) and thereby responsible for increases in natural disasters worldwide. Water vapour (H_2O – the dominant radiative gas) is the principle energy source of global weather systems. Significantly water vapour also accounts for ~ 4% of the Earth's total air environment budget and is by far the principal greenhouse gas, yet rarely (never?) referred to in climate change models, texts or diagrams - dilution of water vapour (by volume) compared with all other reactive gases is without doubt the most substantial where climate change fluctuations are concerned.

With regard to CO_2 and its forcing effect on climate warming (subscribed to by the Anthropogenic Global Warming (AGW) orthodoxy) it is never challenged, nor made aware of, that atmospheric carbon dioxide is measured utilising a logarithmic scale and that it does not absorb infra-red radiation over a linear range as some scientists appear to believe, or it seems fail to acknowledge. Because CO_2 is strongly logarithmic the first 1.5°C of CO_2 arises from the first 20ppm. The next 1.5°C requires a further 400ppm and then 1°C for a further 1000ppm. The significance of this is that with current levels put at 0.0388ppm a 100ppm increase will amount to ~0.1°C after 50 years and less so with each added 100ppm increment. Or put another way assuming a rising rate of 2ppm per annum (IPCC) temperatures will rise at 0.1°C for every 50 years[10]. Furthermore CO_2 forcing can only be calculated over a tiny portion of the infra-red (IR) spectrum (15 micron band) whereas gaseous H_2O (~4% of all atmospheric gases) is measured similarly over almost the entire bandwidth.

Wherever anthropogenic CO_2 intervention is documented today, it is said that warming trends will continue indefinitely due to industrial activities (IPCC on their 2006 website: CO_2 Concentrations 1840-1995-2100; 0.0353ppm to 0.0500ppm by the year 2040). In a paper dated October 1955 scientists put levels at anything from 0.0330 to 0.0440 ppm[5]. It seems little has changed from the research carried out over 50 years ago where CO_2 atmospheric pollution (so-called) was even then a hot topic among meteorologist and atmospheric physicists. Vast amounts of data were tested from a wide variety of locations using similar techniques as those of today. Interestingly scientists, who support anthropogenic cause and effect, stem mainly from climatology, meteorology and associated disciplines and it seems very few from geoscience backgrounds.

A wealth of insight and knowledge about climate science has been ignored by the media, politicians and AGW scientists, even though vast amounts of research by Earth scientists, astrophysicists, cosmologists, climatologists and related disciplines is today available from easily accessed websites and institutions. Much information is still being researched but what is available has been made accessible and attempts to address all known (and unknown) variables relating to the science. For example an informed paper of carbon science modelling/residency times and AGW CO_2 on the construction of 'Greenhouse Effect Global Warming' is available on the worldwide web (Segalstad 1997) together with another independent study (http://brneurosci.org/co2.html) which are both highly informative. These more rounded unprejudiced studies from well-informed climate scientists foretell of variable factors (too many to discuss here) that point to warming and cooling periods over much shorter time spans than was previously thought (in addition to episodically longer periods deduced from the geological record).

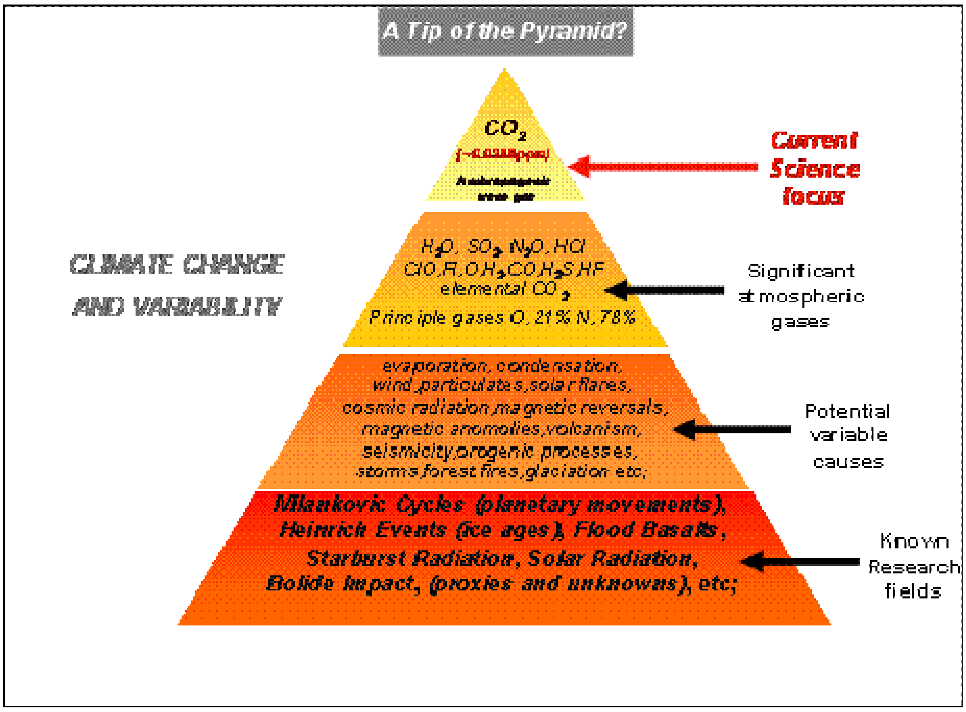


Fig 1: Science focus of anthropogenic CO_2 against known reactive gases, potential causes and climatic variables

Other studies (all easily accessible) include the influence of Heinrich Events (sedimentary marine core data), D-O Cycles (ice core data), and Milankovic Cycles (Solar System planetary cycles). And solar insolation alone amounts to 99% of all radiative forcing at the Earth's surface and is said to sublimate CO_2 to the atmosphere in relatively short-term reversible time frames. Simple experiments demonstrate that solar irradiance cycles contributes miniscule amounts of carbon dioxide to atmospheric warming – in short insolation is the driving mechanism of atmospheric heating and not trace amounts of CO_2 gas. Known climate change variables are listed in a pyramidal diagram (Fig. 1, in simple terms) attempts to demonstrate that the focus for anthropogenic cause and effect fails to persuade many scientists (the so-called sceptics) that CO_2 is the source of global warming. On this basis alone climate change science must be opened-up to a less confrontational more rigorous and rational debate than hitherto. That is to say science is not judgemental of itself and conclusions can only result from evidence-based research subjected to peer revue.

Finally the illustration (Fig. 1) is analogical and shows the tip of a pyramid representing CO_2 as disproportionate when expressed in parts per million by volume (ppmv) compared with other reactive gases. Dilution of CO_2 in the atmosphere is greater than 10^{60}, or one followed by sixty zeros measured to 10,000m = 17.25 billion cubic meters?). The diagram illustrates an imbalance compared with anthropogenic carbon dioxide (a remnant gas), especially when compared to known factors and other potential causes of atmospheric environmental change. While not intended to be scientific, such asymmetry may be more striking when the diagram is inverted - hardly a stable base of scientific certainty.

This trace gas sublimated from the so-called 'burning of fossil fuels' is improbable and (perhaps inconceivable) that such minute quantities of CO_2 expressed in ppmv of a compound molecule with a short atmospheric residency time and zonal variability(8) is the only single cause of climate change on our planet. It may well be that global warming is happening, but put in perspective is minuscule when it is unambiguously predetermined that carbon dioxide is the single cause of climate change - simply because CO_2 warming effects will be lost in the 'noise' of the atmospheric system(10).

It was said of scientists who favoured anthropogenic cause during the 1930s to 1950s, and of which could still be said today; '...…interesting extrapolations….. stimulates the interests of the speculatively minded' (5).

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John Gahan

The Ares Vallis Region and History of Water on Mars: Evidence for Mega-Floods, Lakes and Climate Change

Summary of February 2010 lecture given by Dr Nick Warner, Imperial College

Since the early telescopic observations of Mars in the late 19th and early 20th centuries scientists have recognized the potential for finding habitable environments on the planet's surface within which life could have evolved independently from Earth. Today, with the availability of high resolution data from orbiting instruments, rovers, and fixed landers, the true nature of the surface of Mars has been revealed. From these missions, we have begun to recognize modern Mars as a hyperarid, cold environment on which life (as we know it) is not likely to currently exist.

However, from analysis of images taken from the ancient terrains of the planet, the idea of an early warm and wet Mars has emerged. Specifically, in the southern highlands of the planet, where well developed, ancient stream networks have been identified. These features attest to the possibility of precipitation and/or groundwater release and require that, unlike today, liquid water was once stable on the surface.

This observation suggests that Mars may have once been "Earth-like", with a climate that facilitated evolution of microbial life within aqueous surface habitats. Current Mars research focuses heavily on this early period of Mars history, which is known as the Noachian period (4.5Ga - 3.7Ga). Importantly, observations of the preservation state of impact craters and the mineralogy of the planet's surface indicates that this early period of "Earth-like" climate conditions did not last beyond 3.7Ga.

Natural, long-term losses of the planet's atmosphere to space, a planet-wide decrease in volcanism, and catastrophic atmospheric erosion by impact cratering processes are blamed for a major climate shift which saw the end of warm and wet surface conditions and the beginning of the cold and dry climate that now characterizes Mars. This period of major climate change marks the beginning of the Hesperian period (3.7Ga - 3.0Ga) and continues with cold and dry climate conditions throughout the modern Amazonian period (3.0Ga – today).

However, our recent research, conducted by a team of planetary scientists from the Imperial College and University College London, has suggested the possibility for episodic (and possibly catastrophic) shifts of the Martian climate during the Hesperian period. These shifts, which were likely the result of transient increases in atmospheric pressure, may have warmed the planet so that liquid water was once again stable on the surface.

The evidence for this hypothesis comes from the latest satellite images obtained from NASA's Mars Reconnaissance Orbiter (MRO) and ESA's Mars Express (ME). These high-resolution images have revealed several flat-floored depressions that are 2 km - 10 km wide, 100 - 200 m deep, and are inter-connected by small channels (Figure 1). The channels indicate that water (or possibly brine) once flowed between these features. Remarkably, these depressions are morphologically similar to permafrost-thaw lakes that are now forming in the polar regions (Alaska and Siberia) on Earth. Using the technique of crater counting to obtain absolute and relative ages of planetary surfaces, we determined that the lake-like features formed during the Hesperian period.

Ares Vallis on Mars (Figure 2) is one of the largest water-carved canyons in the entire solar system. Stretching for 2000 km, the canyon was eroded approximately 3Ga. Recent improvements in image resolution and topographic data have helped to reveal a detailed history of flood events and suggest that individual pulses of floods occurred in this region over a period of 1Ga. Several crater lakes and small permafrost thaw lakes have been identified surrounding Ares Vallis.

Fig. 1: MRO image of an example permafrost melt lake on Mars with a small depression-connecting channel. The above dry lake bed is approximately 4-km-wide. Photo supplied with summary from Nick Warner, Imperial College London

Fig. 2: A valley arm merging into Ares Vallis, Photo sourced by ed.: ESA/DLR/FU Berlin (G. Neukum) http://www.esa.int/esa-mmg/mmg.pl?b=b&type=I&mission=Mars%20Express&single=y&start=356&size=b

These findings suggest that Mars was periodically warm and wet later in its history than previously thought. Brief periods of warm conditions during the Hesperian may have been facilitated by sudden releases of gases during large volcanic eruptions, mega-floods, and large impact events. On Earth, microbial life evolved sometime near 3.8Ga. We suggest that on Mars, episodes of climate warming occurred after 3.7Ga (Hesperian period) and created temporary surface aqueous environments where extant life may have found refuge or independently evolved.

Nick Warner

Were These The First True Geologists?

I didn't shout "Eureka!" – but I really couldn't stop myself from jumping out of bed. This was when I read that recent archaeological discoveries in Sweden have shown that not only were Neolithic people experts in mining for the best rock types for their tools, but that they appreciated the associated geological sequences; something I have often wondered about but thought could never be demonstrated.

A number of Swedish flint mines were meticulously excavated, and found to have been refilled carefully according to the geological sequence from which the desired materials had been taken. Thus the chalk rubble in the lower part of these shafts extends to the same level as the chalk bedrock, whilst the overlying layers through which the shafts were dug are filled with sediments reinstating the order of the geological succession. The natural order of the rocks was therefore restored after each mine went out of use. It seems that the parent rock from which tools were obtained was highly significant to these ancient people, and in taking material from it they were at great pains to restore the order. This to me is an amazing discovery, and I wonder if there are any further examples to be found, for instance in yet unexcavated shafts at the “Grimes Graves” mine complex in Norfolk...

Reference: Prehistoric Society Research Paper 3. Pub. Oxbow Books 2010.

Joan Prosser

Madeira Floods & Landslides, February 2010

Marybeth and I took a week’s holiday on the beautiful island of Madeira. We had two days before the storm to get out and about to enjoy the spectacular scenery on a trip to Sao Vincente on the north coast. On the way we had a geological stop at a Centre of Vulcanism to explore lava tubes and the visitors’ centre. We also spent a day in Funchal and got up to the botanical gardens and a small museum with a geological display.

We expected a few days with rain but nothing like the torrents of the 19th and 20th February. We were stranded in our hotel at Formosa Bay all day whilst the deluge continued non-stop. The sea was wild with waves crashing on the cliffs and depositing piles of flotsam and jetsam on the black sand beaches. Waterfalls cascaded down cliff sides and roared down ravines which usually had just small trickles. The road from the hotel was cut off by a fast flowing stream and debris from a landslide but I managed to get past it to take the picture below.

Wild Seas deposited huge volumes of debris on the shore

Flood damage to buildings and roads still flooded

The quick response during and after the disaster was amazing. Heavy moving machines were out clearing main roads 24/7 so rescue vehicles could get through to Funchal and other affected areas along the south coast. Roads and tunnels were blocked by landslides; and many homes and businesses destroyed. People were killed when their cars were swept off the roads or trapped in underground parking lots by mudslides and fast flowing water. Most of the tourist areas were unaffected and the airport was open again on Sunday. We managed to get out in a taxi on Tuesday and got up to the top of the second highest peak, Pico Puivo, overlooking Nuns Valley. Unfortunately the road and bridges to the valley were impassable but we did manage to make our way to Monte which had a view point overlooking Funchal.

Lyn Linse

Lecture Programme – July to December 2010

Date	Lecture	Speaker
July 9th	Members evening and presentations	Dr Alan Witts – Member of FGS Ted Finch – Member FGS
Sept 10th	SE Asia - Thailand	Dr Michael Ridd - Consultant
Oct 8th	30 years of mineral collecting	John Pearce – Sussex Mineral & Lapidary Society
Nov 12th	Can we clone a mammoth?	Dr Danielle Schreve – Royall Holloway College
Dec 10th	Diversity in stone: regional geology and links to building style	Dr Lesley Dunlop – University of Northumbria