

ESSINGTON LEWIS LECTURE – Thursday, 19th November 2009

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The current ice age started 34 million years ago with the covering of Antarctica by an ice sheet. This great climate change was driven by the separation of South America from Antarctica thereby establishing a circum polar current that isolated Antarctica from warm water.

Water contains 22 times as much heat as the atmosphere and it is the oceans that are the bellwether to climate change, not the atmosphere. The Antarctic ice sheet has waxed and waned and did not disappear during long periods of warmth. During periods of ice sheet waning, Antarctica isostatically rose. When the ice sheet thickened, Antarctica sank.

The ice on this remarkable continent lies in a basin, as does the Greenland ice. Ice has to flow uphill to reach the sea, hardly a process driven by melting. The only way ice moves from the highlands to the sea is by plastic flow. Television images of the calving of icebergs from ice sheets are misleading and deceptive.

Ice moves as a result of snow precipitation in the highlands, ice accumulation, plastic flow of ice towards the sea (some of which is uphill), and the eventual brittle failure of ice at the end of a glacier to form an iceberg. Images of ice calving from glaciers are the end result of a process that has taken thousands of years, not a result of modern temperature.

Ice flows by surges, a process that is unrelated to the ambient air temperature. Melt waters, subglacial lakes, land instability and subglacial volcanicity may initiate some surges. Huge subglacial eruptions took place in Roman times, there are still hot rocks, hot springs and hot gas vents beneath the ice.

This is a far more complicated and interesting story of ice sheet dynamics than the one painted by the popular press, i.e. global warming is melting the ice caps. Even if there were global warming, it is hard to see that an air temperature rise of 2°C could melt ice at -30°C but in these times of irrationality, facts and logic are now no longer important. We now seek to believe six impossible things before breakfast.

During the current ice age, there have been numerous glacials and interglacials. We are currently in an interglacial. During the penultimate interglacial, it was a few degrees warmer than now and sea level was about 7 m higher than at present. It was during this interglacial that most of the mineral sand deposits along the east and west coast of Australia formed. Mineral sand deposits in the Eucla and Murray-Darling Basins formed during earlier still stands in interglacials.

About 116,000 years ago, the climate changed from an interglacial to a glaciation. This was orbitally driven and such orbital cycles which put Earth further from the sun are on 100,000, 41,000 and 23,000 year cycles. Solar cycles every 1500, 210, 87, 22 and 11 years also drive climate change as do volcanoes.

Volcanoes are fascinating. We live on a warm, wet, volcanic planet that, for less than 20% of time, had ice sheets. Since the formation of planet Earth on a Thursday 4,567 million years ago, volcanoes have been exhaling the two main greenhouse gases – water vapour and carbon dioxide. Both these compounds have been constantly recycled through the Earth since then by sediments, metamorphism, rock melting, surface and biological processes.

We currently live in a period of volcanic quiescence. We see less than 15% of the planet's volcanoes. The rest lie beneath the oceans along 64,000 km of mid ocean ridge and at least 220,000 individual non-ridge volcanoes. These emit up large volumes of carbon dioxide, up to 47% by weight of erupted material, affect ocean circulation and add heat to the oceans.

This carbon dioxide dissolves in the cold high-pressure bottom waters and is released to the atmosphere hundreds to thousands of years later by upwelling processes.

Submarine volcanoes, like clouds, do not feature heavily in climate models hence it is no wonder that such models can not even predict events a decade into the future. As for making long term climate predictions, modellers should spend less times at their computer, get outdoors with a polymath and be humbled by the complexity of random non-linear chaotic processes that characterise Earth processes.

When minor Earth processes such as volcanoes and earthquakes can be understood, predicted by models, and then mastered by human ingenuity then the modellers can apply their skills to far more complex processes such as climate.

It is volcanic processes that have formed some of Australia's largest ore deposits such as the epithermal gold deposits of the Drummond Basin, the Broken Hill Zn-Pb deposit, the polymetallic base metal deposits of western Tasmania and the Yilgarn. Volcanic activity gives us the clocks in the rocks that enable geologists to piece together the jigsaw of Earth history. After more than 100 million years of intense tropical weathering, Australia's soils are nutrient poor. It is the more recent volcanoes of the Atherton Tableland, New England District and Western District of Victoria that have given us rich soils in high rainfall areas.

Minor eruptions such as Mt St Helens blasted out 1 cubic kilometre of aerosols. Krakatoa in 1883 blasted out 30 cubic kilometres of aerosols. These are weather-changing eruptions. It is the terrestrial supervolcanoes in Yellowstone and Taupo that over the last few million years have blasted out up to 10,000 cubic kilometres of aerosols. Most of the planet's supervolcanoes are submarine, these are neither monitored nor measured.

Some 74,000 years ago, the Indonesian supervolcano Toba blasted out almost 3,000 cubic kilometres of aerosols. The human population was greatly reduced. We nearly became extinct. The Earth then was in an orbitally driven cooling cycle and planet Earth suddenly cooled, sea level dropped and large areas of tropical vegetation were destroyed.

By 18,000 years ago, the Earth had reached the zenith of glaciation. Scandinavia was covered by 5 km of ice. The weight of the ice pushed down the land. Now that the ice has melted, the landmass is rising and has risen about 340 metres in the last 12,000 years. Holland is sinking. Scotland is rising after carrying an ice sheet 1 km thick, eastern England is sinking and western England is rising as shown by Harlech Castle.

The Romans tried to stop the ingress of the sea in eastern England and moved to higher terraces in Londinium because of this sinking. London is still sinking. The children's nursery rhyme *London Bridge is Falling Down* derives from this sinking.

During the zenith of the glaciation, the Amazon comprised copses of trees and grasslands, sea level was 120 metres lower than now and one could have walked from PNG to Tasmania, from England to France or from Russia to Alaska.

We very quickly were released from the grip of glaciation, at one time temperature rose by 15°C in 20 years and between 12,000 and 6,000 years ago, sea level rose at least 120 metres. This is a sea level rise an order of magnitude higher than the current alarmist predictions of sea level rise. This sea level rise is well recorded in coral atolls which, contrary to popular thinking, thrived with rising sea level. This is not new, it was well explained by Charles Darwin in his 1842 book on coral atolls.

This sea level rise was both gradual and catastrophic. When the Marmara Sea was tens of metres higher than the Black Sea, an earthquake along the North Anatolian Fault triggered the ingress of huge volumes of seawater about 7,400 years ago into what was a lowland grassy basin with a kidney-shaped fresh water lake.

This was a centre of civilisation as, during cold times, populations had moved from the cold windy Anatolian Highlands into a fertile basin. These people brought with them their bovine worship matriarchal society and their technology such as copper smelting. The sudden ingress of water, depopulation and fleeing from what was a natural process was viewed as punishment by God.

Sinners drowned, valuable possessions were loaded onto rafts and the Epic of Gilgamesh, the precursor to the Noah's Ark story, was written on clay tablets to describe this terrifying event. History does not record the daily humdrum of life and humans struggled to rationalise catastrophic natural events as supernatural events.

Sea level 6,000 years ago was 2 metres higher than at present and temperature was a few degrees higher than now. During glaciation, temperature fluctuated wildly and rapidly whereas during interglacials, temperature changes were less dramatic and were driven by solar changes, oceanic oscillations, lunar nodal tidal oscillations and volcanicity.

Desertification occurred in cold times and a 300-year drought in one of these cold times destroyed the Akkadian and Harappan civilisations. The history of the current interglaciation shows that humans and economies thrived in warm times and desertification, depopulation and empire collapses took place in cold times. This is the opposite of the catastrophic alarmist story we are being told by the popular media.

One volcano changed the world. It was Santorini in 1470 BC. This eruption is well described in contemporary literature and in Exodus in the Bible. This eruption may have led to the myth of Atlantis. A huge eruption followed three large earthquakes, the dominant Minoan culture in the eastern Mediterranean was greatly weakened from the tsunamis, ash falls and aerosols. Crop failures and disease followed and the weakened population was overtaken by the Mycaeneans and then the Athenians.

Science started in ancient Greece. This was a profound shift in thinking processes because great acts of Nature were previously regarded as acts of God. The Greeks tried to explain Nature by evidence and logic and mostly did not resort to supernatural explanations.

Science, technology, engineering and culture flourished in both Greek and Roman times, partly from the new thinking processes and partly from a protracted period of global warming. The Romans planted had citrus trees and grapes in England as far north as Hadrian's Wall and olives along the Rhine River. There was no catastrophic sea level rise during centuries of warmth, and the land was doing what the land does – rise and fall. The Roman port of Efeses is now 15 km inland and 7 metres above sea level and Roman ports ion eastern England are now inundated.

The Dark Ages was a period of global cooling, famine, disease and depopulation. Science was subjugated and fundamentalist religion dominated thinking processes. The 400 year long Medieval Warming was a wonderful period in the history of humans. Greenlanders grew barley, wheat, sheep and cattle in areas now covered by permafrost and could navigate the seas to what is now Newfoundland because of less storms and calm seas.

This period of warming was not due to industrialisation and there was no significant change in sea level. It was far warmer than now. In Europe, famine became rare. There were good harvests year-in-year-out, the population increased and there was great prosperity. Excess wealth was spent on building the great monasteries, cathedral and universities. Such structures took generations to build showing that this wealth was not generated by one or two good seasons.

Our planet runs hot and cold, the Roman and Medieval Warmings were clearly not due to industrialisation and, in order to try to omit these warmings, various tree ring proxies have been used selectively by Mann, Briffa *et al.* to change history such that it is in accord with the current catastrophist cacophony.

The changing of history is the method of despots, not scientists. To selectively use data and attempt to change history to support an ideological political position is very dangerous and has greatly damaged science. If the selective use of data and demonising of dissent are the main weapons of the alarmists, then one has to really question the popular paradigm of human-induced climate change. People now mistrust science more than ever.

For centuries, science dispassionately provided information that was valuable. It was neither good nor bad. Much of science has now been captured by special interest groups that don't always serve our best interests. The list is long.

African leaders that prefer to let their people starve rather than use genetically modified grain, westerners using dietary supplements and natural remedies that many studies have shown have almost no value and may actually cause harm and westerners that object to childhood vaccination which history has shown us that, with plumbing, is the most effective public health measure.

Over 1000 years ago in Bologna, the modern western university came into being. It was to train men (and only men) for the Church. The track spread to Paris, Oxford, Cambridge, Edinburgh, Glasgow, St Andrews and Trinity College (Dublin) followed by the American colleges. In Australia, we are part of that vibrant intellectual tradition.

Only the Church has survived longer than universities who have such longevity in spite of social, political, cultural, economic and spiritual upheaval. Universities have managed well in the transition from theology-dominated to classics-dominated to the modern science-, technology- and engineering-dominated. They are now evolving into business-dominated studies.

Detachment and the freedom to canvass other options for society have allowed universities to survive rather than becoming an arm of government propaganda or a "Hamburger University". They have provided the spiritual, legal, medical, scientific, administrative and, more recently, the commercial practitioners needed for society. This is how universities have satisfied their paymasters and universities have best served by critical detachment.

At times in history, this detachment requires scholars to question the ways of the paymasters such as in the Medieval Renaissance and Reformation. Many of us here saw this in the spring of 1968 in Prague, Paris and the USA where alternative politics, lifestyles and cultures were enthusiastically propagated. A university must maintain its real independence so that scholarship can be undertaken without fear of favour.

The Little Ice Age appeared in only 23 years. It was probably driven by solar changes and certainly the most bitter periods of the Little Ice Age were when there was little sunspot activity. The Enlightenment and Reformation again refreshed the way we think. Evidence from experiment, measurement and logic replaced theological thinking and explanation of natural phenomena by magic.

A turning point in thinking processes was the All Saints' Day earthquake in 1755 in Lisbon. The faithful in churches were killed by falling masonry were killed, those that ran outside to escape were engulfed by the tsunami in the Tagus River. Most of those who were not in churches survived. How could an omnipotent omnipresent all loving God do this?

It was Rousseau who argued that earthquakes were not an act of God but were natural. This was a revolution in thinking and led to divisions between the Church, philosophy and natural philosophy, a process we now call science. These divisions are still exploited by anti-theological and anti-scientific groups such as young Earth creationists.

It was the thinking derived from the Enlightenment, science, technology and engineering that gave us warmth, food, employment, health and wealth with the end result being that all people on Earth now live longer, eat better, have more wealth and have better health.

It is the current environmental fad that is preventing impoverished third world countries from converting from wood or dung energy to reticulated cheap electricity for cooking, heating, light and communication. And the easiest and cheapest electricity is that derived from coal. Some 40% of people on earth have no electricity and more than 40% of the world's electricity derives from coal.

Despite the populist concerns, the world is in fact turning to coal-fired electricity in China, India and many OECD countries. The failure of Australian governments to make decisions about heavy duty base load power, be it nuclear or coal, is placing stress on the existing power generating facilities. The clock is ticking and summer brownouts are the bellwether of things to come.

In NSW, 95% of the electricity derives from coal, these stations are old and new stations need to be built otherwise major international competitive industries such as aluminium will move elsewhere. NSW has two large aluminium smelters, both in areas of high unemployment.

We have seen before that major environmental campaigns have a huge effect on the third world. The banning of DDT on environmental grounds has resulted in the avoidable deaths of millions of people by malaria in the third world. Malaria is not a disease of the tropics, it is a disease of poverty and has been almost eliminated in Europe by public health measures.

Since the Little Ice Age, we have had three periods of warming. All of these have been at the same rate and same magnitude and occurred from 1860-1880, 1910-1940 and 1976-1998. So warm was it in the 1930s, that the North West Passage was open for even primitive vessels. Coolings from 1880-1910, 1940-1976 and 1998 to the present were at times of increasing carbon dioxide emissions hence even in our own life it is hard to see a relationship between carbon dioxide emissions and temperature.

The ice sheets show us that carbon dioxide peaks at least 800 years after temperature peaks and geology shows us that five of the six great ice ages were at times when carbon dioxide was far higher than at present. In past times of high carbon dioxide up to 1,000 times higher than at present, there was no runaway greenhouse and no acid oceans. It appears that we now view the world in the absence of knowledge of the past. This we ignore at our peril and yet we do.

Environmentalists uncomfortable with history, archaeology and geology ignore these disciplines and enter a state of denial when confronted with the uncomfortable and unnerving reality. Some of the realities are:

The delta at Bangladesh is subsiding. This is a normal process and each year some 20 sq km is inundated. This is not a result of sea level rise.

The number of intense hurricanes in the Atlantic has declined over the last 30 years. The increased damage is because of the building of numerous expensive buildings in hurricane-prone coastal areas.

Droughts and bushfires in Australia are normal, as Dorothy McKellar told us. They are driven by processes in the oceans. More recently, most bushfires derive from arson and not natural processes.

Increased erosion on Tuvalu derives from water extraction creating subsidence, beach sand mining and destruction of atolls for construction materials. Sea level in the 1970s in the Maldives was 70 cm higher than at present.

The Great Barrier Reef has withstood previous coolings and warmings of several degrees. Human impacts are in the vicinity of resorts, commonly populated by many who wish to witness pristine nature.

Alpine glaciers were smaller in Roman times than now and in the Holocene Maximum nearly 7,000 years ago, they probably disappeared.

I suspect we have entered a new age of irrationality and we have very quickly eroded the gains of the Enlightenment. In universities, nuclear science and engineering education has been dismantled. If Australia ever wants to increase employment, wealth, health and infrastructure by establishing a nuclear power industry, then we cannot even train the people to run it.

Very few people in the community are aware of where everyday commodities come from. Electricity, food and the trappings of a comfortable western life are all taken for granted.

Very few people in Australia are aware that if it were not for the 300 Mt annual export of coal, coal-fired electricity and 250 Mt of iron ore exports annually, then we would be living a third world life.

Very few people are aware that without mining and agriculture, Australia's two biggest export industries, then we would go broke.

Universities, the CSIRO, ABC and civil service are politicised to the point where fearless independent advice and information is a rarity. We now have a government that is Hell bent on fixing mythical problems to the point where if it ain't broke, fix it until it is. In fact, those with a contrary view are demonised as seen in the Lowy Institute lecture by the Prime Minister. Australia is considering a total new financial system yet there has not been a financial or scientific due diligence, only dogma.

When scientists ask for the scientific evidence to support such a change, they are labelled as a denier by the Prime Minister. No reasoned debate, just a label. The Prime Minister argued that people like me are confused, such a comment is reserved solely for my wife and not the PM.

He has not been able to point out where I am wrong, he imputes that being sceptical is bad and that people like me are supported by vested interests. The US government has spent \$79 billion on climate research, some \$126 billion sloshed around the world last year in carbon trading and the PM seems unable to mention beneficiaries such as Goldman Sachs, JP Morgan, ABN Amro, Deutsche Bank and HSBC.

Why did he ignore these vested interests? My critics in institutions in this country all have vested interests. My critics are not fools, they will not bite the hand that feeds them. Critics on blogs and ever changing WWW sites are dripping with vitriol and hatred, they cannot spell and they cannot write English. This demonstrates a lack of clarity of thought.

Those scientists labelled as deniers by the PM use geology, archaeology and history and have access to some 100,000 radiosonde measurements, 6,000 boreholes and 30 years of satellite measurements. Yet they are called deniers as an attempt to bully them into submission because maybe the Prime Minister wants to stop debate, discussion and dissent in a democratic society.

He claims that people like me cannot name the evidence to support their view. This really shows that the PM does not read the available literature. Even reading history for a non-scientifically trained PM would show him that climates always change, that there were numerous warming events before industrialisation and that it is cooling that creates global problems. My publisher tells me that the PM's office purchased a copy of my book *Heaven and Earth*. If he just read Chapter 2 on history, his dogma would be less evangelical.

The fact that we have a Carbon Pollution Reduction Scheme shows that there is a complete lack of understanding photosynthesis. This is basic school child science. Carbon dioxide is plant food, it is not a pollutant. Without carbon dioxide there would be no life on Earth. It is pretty clear who is confused and has a lack of basic science education.

The PM states "Sceptics offer no alternative official body of evidence from any credible government in the world". What about India or Russia? Furthermore, evidence does not come from governments, it comes from measurement. It appears that logic is not a strong hand. Even the IPCC states that warming will be only a degree or so.

If the PM used some basic geography, he would know that if someone moved from Hobart to Darwin then there is an average temperature rise of 18°C. Darwinians may have a higher mortality rate due to fermented liquids but not due to warmth. The mining industry has benefited from many Finns moving to Mount Isa with an average temperature increase of at least 22°C. They did not die from warming.

All Mr Rudd is doing is establishing another financial feeding frenzy that will be far more catastrophic than the sub-prime induced global financial crisis. And who bought us the crisis? The same that are queuing up for carbon trading.

And we are told by Senator Wong that it is in the national interest. It may well be but she does not mention which nation because a resource and agricultural economy like Australia can only be made less competitive by another layer of taxation just to woo the city-based green vote.

Mr Rudd incorrectly states that we contrarians think the evidence for human-induced climate change is inconclusive. That is incorrect. We are patient folk and after more than two decades we are still waiting for the evidence. The withholding of data by climate institutes for validation has certainly not helped the catastrophists cause.

What is even more concerning is that in Copenhagen, the government wants to sign a document that passes 0.7% of our GDP (i.e. \$7 billion) annually to countries affected by this mythical human-induced climate change. This money has to go through many sets of sticky hands and, correct me if I am wrong, but blowed if I can understand how money can change a natural process.

These funds will be administered by an unelected government which has the ability to fine Australia if we are naughty environmental children. The PM has not even told us what Australia would be signing. He has not told us that this treaty takes away Australia's sovereignty.

If it were not for Lord Monkton, who has had enormous experience with international treaties, we would still be in the dark. Mr Rudd needs to realise that the critics of the alarmism are involved in a process that started in Greek times, a process that was strengthened in the Enlightenment and a process that has given us the modern world. Mr Rudd's method of labelling critics as deniers is more appropriate in non-democratic political systems.

In the biggest industry in Australia, we need the best brains to keep Australia economically afloat. Many of the students I teach have not been prepared well enough in the basics of mathematics, chemistry and physics yet they have passionate opinions about the environment. My mining engineering students are certainly better prepared than my science students.

Scratch the surface and one sees that the students' opinions are not underpinned by evidence. I often ask my students a question from the Enlightenment: How do we know what we know? This is a question that should be asked of the current Prime Minister.

My students now not only need to be trained in the basics of science and engineering to practise as mining engineers, geologists and metallurgists, but they need the thinking processes and communication skills to deal with irrationality which we have just recently seen derives from the highest office in the land.

Professor Geoffrey Blainey wrote about the great pendulum swings of opinion in Australian society. From what he wrote about Essington Lewis, I don't think that Essington Lewis would have been silent in today's world of irrational anti-industrial ideology which can only dismantle the gains from 200 years of creativity, hard work and resultant economic growth.