

(With reference to Tunguska)

SKY AND SPACE NOTES-

September 1986 by professor Colin Keay, University of Newcastle.

The final formative event of our Earth was a long drawn out bombardment of primordial material of much the same composition as the Earth's crust, for that is what it became. The bombardment continues to this day, although its rate is now almost insignificant. About once a century we are struck by an interplanetary object large enough to flatten a city. The Tunguska devastation in 1908 was caused by one such object.

Smaller objects rain upon us all the time. Late in July a large fireball dropped a meteorite the size of a basketball just north of Lismore. The elasticity of the soil was such that it bounced into scrub and was lost, leaving only the evidence of the initial impact. Later in the month a very bright fireball was photographed from the Siding Spring Observatory and from Tamworth, the two photographs revealing that it probably dropped a meteorite into the Pilliga scrub region. A very high proportion of these scientifically valuable objects are never found.

Then there are the near misses. The Earth presents a very tiny target when viewed against the vast backdrop of space. About once every few years we detect asteroidal objects passing within six million kilometres. One of these could wipe out half a continent. Simple arithmetic shows that the chance of the Earth being struck is one in a million or thereabouts. In other words we stand to meet with one of these agents of destruction every few million years.

Warning of such disasters is now possible, even if mass evacuation on a sub-continental scale is not. On the fourth of May this year a small asteroid called 1986 JK was discovered approaching the Earth. Later in the month it became the closest interplanetary object to be studied by radar as it passed less than 4.4 million kilometers from us. As a result of optical and radar observations the orbit of 1986 Jk is now known well enough to predict that it will again pass close to us in 1995.

Asteroids having orbits which cross that of the Earth are collectively called Apollo asteroids. Of these, Hermes appears to be the one which has strayed closest to us, actually passing within the distance of the Moon's orbit. Icarus, having a diameter of about one and a half kilometres, is the largest of the group and has the distinction of passing closer to the Sun than any other asteroid. Its elongated orbit also brings it on occasion within a million kilometres of the Earth.

Comets as well as asteroids may have very close encounters with our planet from time to time. Comet Halley passed barely six million kilometres from us on its most spectacular visit in the year 837 AD. Many smaller comets pass even closer. In fact there are a growing number of reports of very faint rapidly moving comets being sighted through telescopes. They appear as diffuse blobs moving as fast as ten degrees (20 moon-diameters) per hour. Just this very kind of cloudy object could have been responsible for the Tunguska event in which no actual fragments were ever found.

In the evening sky there are two planets grabbing all the attention at the moment. They are Venus and Mars. Both are visible long before any stars come out, although Mars will fade somewhat as the month goes by. The ringed planet Saturn is about midway between Mars in the east and Venus in the west, but nowhere near as bright as either. During the evening the giant planet Jupiter rises in the east to outshine Mars but not Venus. By the end of August we will see three brilliant planets in line across

the sky from east to west. The remaining planet, Mercury, is making a very lack-lustre appearance in the pre-dawn twilight: its not worth getting up for.

Real threat of rain of death

Newcastle Herald 6th July 1999 by Dr Colin Keay

Hundreds of large space objects, known and unknown, are potentially hazardous to Earth

The odds of dying in an air disaster, either as a passenger or bystander, are less than dying through the impact of a cometary or asteroidal object from space.

This actuarial assessment is hard to swallow at first sight. The first is frequent, the second rare.

But the odds are weighed by the horrific death toll if an impactor, as large as that which caused the Siberian Tunguska explosion in 1908 or the little-known Brazilian jungle devastation in 1931, happened to strike a city.

When this assessment of danger was brought to the attention of the United States Congress, it voted additional funding to NASA for assisting American search programs, currently the most effective ones for hunting the objects in space most likely to strike our planet in the future.

Recently there was serious discussion of this subject in the British Upper House, the House of Lords, which recognised the gravity of the matter.

The UK spokesman for science, Lord Sainsbury of Turville, said the Government was not prepared to go it alone in mounting a British search for potentially hazardous space objects, but would join in a European effort if and when one was organised.

Australia had a very productive effort running for several years until the government withdrew funding in 1996 and some of the disbanded team left for jobs overseas.

However, the Americans are very concerned that the lack of a southern hemisphere search program leaves our globe wide open for space attack from the south.

So there are rumours that an Australian team may be revived with the help of American funding, to Australia's shame.

The Americans realise that their own efforts will be enhanced by both discoveries and verifications from observers in the opposite hemisphere.

There are still many people, not only politicians, unconvinced that a significant problem exists.

Movies like *Deep Impact* and *Armageddon* have helped alert the public, but being from Hollywood and alongside *Star Wars*, they are not taken too seriously.

There are also many new books presenting, from a variety of angles, the case for improved space-threat awareness.

One new book, just published by Virgin Publishing, is *Impact Earth* by Austen Atkinson. It is not the greatest example of this new genre because it shows many signs of hurried production. But this gives it the advantage of being right up to date in many matters.

For example, it has an 11 page listing of a couple of hundred largish objects that are potentially hazardous. These, however are only the few per cent that are known.

The whole point of the space-watch efforts is to search out, in the vastness of space, the potential devastators that we might not know about until they hit us.

Of course, the chances are low that we'll go the way of the dinosaurs.

Yet there is a growing realisation among historians, archaeologists and others studying the past that the prehistory of the human race must have been punctuated by some really momentous events.

Was Noah's flood from a tsunami generated by an impact event? What caused the ice ages? Was the destruction of Sodom and Gomorrah and ancient Tunguska-type impact?

Eyes shut to impending doom

21st December 1999 Dr Colin Keay

At this time of year the evening sky is filled with beautiful stars and constellations.

A joy to see if the rain stays away.

What cannot be seen are thousands of cosmic missiles hurtling past us with the destructive energy of hydrogen bombs.

At least three have struck our planet this century with devastating effect, the largest in 1908 having the destructive power of a dozen H-bombs.

This very day a similar one is actually zooming right past us but fortunately our planet is a small target and it will miss.

Another two are due to make close approaches on March 18 and 26.

Last month a different three shot past on the 4th, 16th and 23rd.

How do we know so much about their movements?

Thanks are due to the new American skywatch programs that are discovering these dangerous objects at a disturbing rate.

Australia's similar program was axed by the Government at the end of 1996, which means that new threats from the southern direction will not be noticed beforehand if they head for this not-so-clever country.

Death by meteorite more likely than lottery win

18th January 2000 Dr Colin Keay

In 1998, Congress was told that the chances of an American being killed by an impact from space were about the same as being killed in an air crash – roughly one chance in 20,000.

When this estimate was confirmed by other experts, Congress decided to give NASA some extra money for improved search programs to detect menacing bodies in space.

Last year, when Lembit Opik, MP, warned the House of Commons that the risk of being killed by an object from space was 750 times greater than the chance of winning their National Lottery, the British decided to do something about the problem.

A month ago an expert task force was set up to report back. It will be surprising if the task force, headed by former chairman of the European Space Agency Council Dr Harry Atkinson, does not recommend urgency.

The Australian Government sleeps on, having quashed our contribution four years ago, but NASA is now assisting a revival of the search for threatening near-Earth objects at our Siding Spring observatory.

Death from space is a low probability, high consequence risk. It is the kind of danger that can make insurance companies fat on premiums until the fateful day when they are bankrupted financially if not destroyed physically.

During the 20th century there were two major impacts on land that could have totally destroyed a city the size of Newcastle had they hit here and not where they struck in Siberia and Brazil.

Why not examine your own insurance policy and see if impacts from space, including tsunamis caused by a large impact in the ocean, are in fact covered?

About once a year a house or vehicle suffers damage from a meteorite. Deaths are rare. So much so that there is an urban myth asserting nobody has ever been killed by a meteorite.

Injured, yes, but no deaths.

This is wrong on two counts.

For large city-destroying impactors the death toll would be horrendous.

Smaller ones can and do kill people, despite the myth.

John Lewis, in his book *Rain of Iron and Ice*, lists many instances.

The most recent occurred in 1929, when a member of a bridal party in Yugoslavia was struck and killed.

The Siberian Tunguska blast in 1908 reportedly killed two reindeer hunters in the vicinity, and the previous year in Weng-li, China, a stony meteorite killed a whole family.

In 1879 at Dun-Le-Poelier in France a farmer was reported killed by a meteorite, and five years earlier at Ming-tung Li in China a huge stone fell from the sky, crushed a cottage and killed a child.

In 1825 at Oriang in India a meteorite killed a man and injured a woman.

The current average of around four deaths from meteorites per century was hugely inflated in the 15th century.

Three different sources record a remarkable bombardment from space in 1490 at Ch'ing-yang, Shansi, China, where 'stones fell like rain', killing more than 10,000 people.

Some of the stones weighed more than a kilogram.

Earlier Chinese accounts describe occasions when tens of people perished from stone or iron meteorite bombardments.

Unless someone has a better explanation, I believe the largest death toll from a space impact occurred with the destruction of the twin cities of Sodom and Gomorrah in biblical time

Or was that a myth?

Threat from space nearer and more common than we think- 28th March 2000

By Dr Colin Keay, Astronomer, University of Newcastle

When the fragments of Comet Shoemaker-Levy slammed into Jupiter, blasting scars in the jovian atmosphere greater in diameter than the Earth, there was a sudden appreciation of the awesome consequences of impact phenomena in our solar system. It has revived old conjectures about the early history of the Earth-Moon system. Dr Andrew Glikson, of the School of Earth Sciences at the National University in Canberra, has produced a thought-provoking paper in which he gathers evidence for major impact cataclysm more than a billion years after both bodies were formed. He argues that ancient structures in South Africa and in the Pilbara region of Australia are linked to some large cratering episodes and lava producing some of the maria on the Moon.

The Earth would not have been a comfortable home some 3.2 billion years ago when the bombardment of interplanetary leftovers peaked for a second, or maybe third, time after the initial heavy bombardment lasting half a billion years or so after the birth of our planet and its moon.

In a less violent way, thank goodness, the cosmic bombardment continues to this day. The missiles are smaller but still there are many capable of wiping out millions. Planetary researcher and historian Ed Grondine has gathered together an impressive list of more than twenty events dating back as much as 5,000 years for which the destructive impact of an object from space is a highly plausible explanation. Some were massive enough to cause the downfall of great civilisations.

Nothing quite as drastic has struck during the past century but there have been at least four impactors that, had they entered the atmosphere and exploded above the Sydney Harbour Bridge, would have caused more than a million deaths. Because only one of the four he listed was over the ocean, and oceans cover three quarters of the globe, the total of oceanic events must approach ten, giving a grand total of thirteen potentially lethal strikes during the century.

While the recent impacts are warnings of what could happen to us, it is the historical incidents that are most intriguing. Cosmic destructors may go a long way towards explaining the sudden collapse of some ancient civilisations.

Grondine's identifications include the destruction of the Hittites at the time of Joshua; the destruction of the Etruscan town of Volsini around 520BC and another event a millennium later caused massive climatic change and finished off the Roman Empire; shortly after another destroyed the Bordeaux region of France and the city of Orleans. That must have been a bad time because a few years later the Ainu in Japan were annihilated by what is now thought to have been a cosmic missile.

It is interesting to note that the Tunguska impact in Siberia in 1908 has until recently been regarded as a rare event. And so too was the impressive Arizona meteor crater 50,000 years ago. Thinking has now advanced to the realisation that the Earth is under real threat from space by vagabond objects delivering destructive powers anywhere between the Tunguska and Arizona incidents. It is only a matter of time before the next one arrives.

