NOVEMBER

NEWSLETTER

2004

Friends of the E. de C. Clarke EARTH SCIENCE MUSEUM

What's On?

Our Friends' Xmas function!

<u>Sunday, November 28th 2004</u>

A talk and tour by Dr Alex Bevan of the WA Museum:

<u>The Simpson Collection of minerals and rocks at the Western Australian Museum</u>

followed by our "Friends" Xmas lunch celebration

when? The tour starts at <u>10.00pm</u> : please be prompt.

where? The Western Australian Museum in the Cultural Centre: meet in the <u>Museum bookshop</u> off the courtyard by the Old Gaol. The Museum opens at 9.30am.

how? By public transport to the City or by car: the best place to park is in the Alexander Library Carpark, enter from Francis Street on LHS just before William Street lights.

The Museum houses both the historically important Simpson Mineral Collection and its own original mineral collection, started in 1881.

Today, the combined collections total more than 30,000 specimens. Information on most of the collection is stored electronically. The Simpson Collection is a special reference collection of several thousand specimens collected during the period 1897 to 1939 by the late Dr E.S. Simpson.

Dr Alex Bevan, the Curator of Minerals and Meteorites for the past nearly 20 years, is currently also the President of the Royal Society of Western Australia. He is very knowledgeable about all aspects of the collections, and has agreed to show us round the Simpson Collection and some of the highlights of the Main Collections, and answer any questions.

As you will probably have read in the newspapers, the WA Museum Curators and other scientists, and the Museum Collections, are being moved to a Department of the Arts storage facility (a very large shed) near the Leach Highway in Welshpool. Fortunately the mineral, rock and meteorite collections and the curators and assistants have escaped this fate, and are housed in the basement of the heritage Jubilee Building.

After the Simpson and other Collections Tour we will have the

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FRIENDS' CHRISTMAS LUNCH IN THE OLD GAOL CAFE
See opposite for details and lunch menu for you to pre-order and details for RSVP ▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸▸

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After lunch I am happy to go round the wonderful **"Diamonds to Dinosaurs"** Gallery with people and talk about the exhibits, if anyone would like this. It is certainly worth a visit. You can also enjoy the **"Nature and Landscape Photography"** and **"Western Australia: Land and People"** exhibitions, and the **"Discovery Centre"** with its hands-on experiences, all in the same area of the Museum.

FRIENDS' CHRISTMAS LUNCH IN THE OLD GAOL CAFE

After our tour and talk, we will gather for lunch in the courtyard of the cafe. It is important that we **pre-order our lunches** as we will be a largeish group and service can be very slow when the cafe is busy. This is the menu: let Mignonne know when you RSVP what you would like so that she can send the order in to the cafe. The good news is that you can BYO!

Menu

Old Gaol Café at the

Western Australian Museum

Sunday 28th November 2004

Open from 11 am

Quiche (selection) & Salad $7.50
Lasagne & Salad $8.50
Cannelloni & Salad $8.50
Soup (very large serving) with bread roll $6.50
Coffee $2.70
Special Meal, Cake & Coffee $13.50

Lunch will need to be pre-ordered please indicate your selection on the R.S.V.P.
by Saturday 20th November 2004
Remember you can also B.Y.O.

*****Please R.S.V.P. to Mignonne Clark*****
Home 9341 6746 Work 9284 8156
or e-mail sacko@multiline.com.au

2005 is shaping up to be a very busy geology year for Friends - if there is an activity that you would like to recommend please notify Jenny, Mignonne or Allan by 20th November 2004.
An activities list will be handed out at our visit to the W.A. Museum Simpson Collection on Nov 28. **Please remember to jot dates down on your calendar.**

Blasts from the Past: meteorite craters in Australia and worldwide

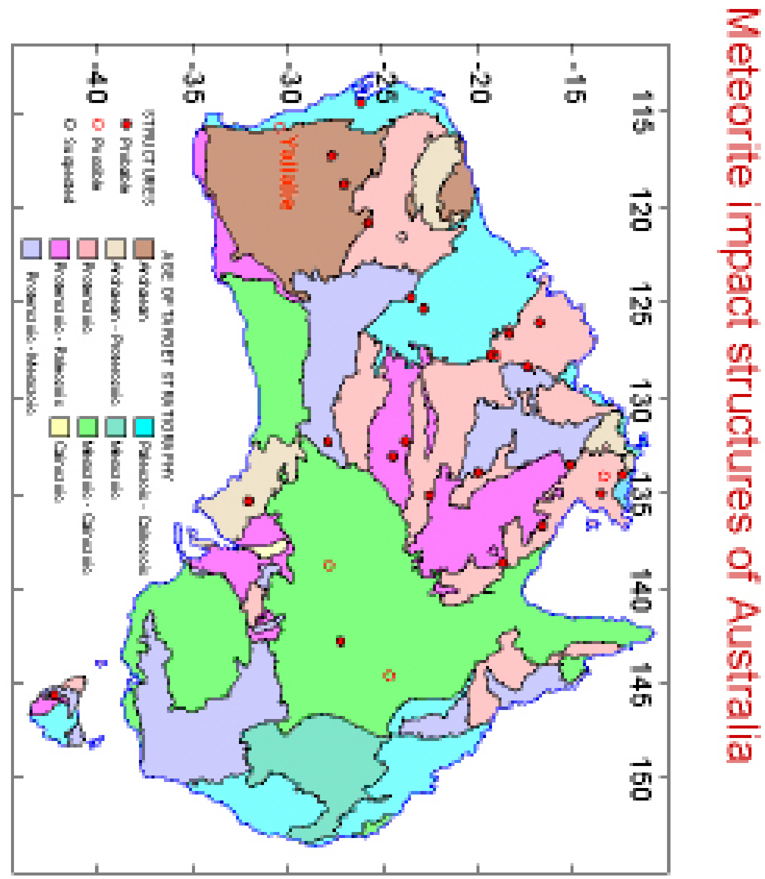
by Dr Alex Bevan of the WA Museum

Our September talk was well-attended, and included some guests from the Perth Observatory Volunteers Group. Alex gave his usual interesting overview of the type and number of visits of extra-terrestrial material to our planet, and the evidence we can see today of these most important of these events, with special reference to Australia.

The Solar System came into being around 4.55 billion years ago: first formed was our star, the Sun, which was surrounded by a rotating disc of material which would eventually come together to form the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Pluto has an irregular orbit and probably came from a region of icy debris at the outer edge of the Solar System). The orbital region between Mars and Jupiter, where we would expect to see a planet, contains a huge number of small planetoids and chunks of rock and dust which represent the failed attempt to form a planet in this region. The gravitational effect of the massive bulk of Jupiter destabilised anything of any size so that a planet never formed in this orbit.This zone, which we know as the Asteroid Belt, is the source of many of the meteorites and asteroids which pepper the planets and moons of the Solar System from time to time.

The deeply cratered surface of the Moon and of rocky planets like Mercury testify to intense bombardment by debris from the Solar System some 3.8 billion years ago. On Earth, although younger meteorite impact craters are known, slow but relentless geological processes have combined to wipe the record of this early event from its surface. In that same 3.8 billion years on Earth, continents have arisen, seas and oceans have opened and closed, mountains have been raised and ground down to their roots again by the action of wind, water and ice, and volcanoes have poured molten lava from the Earth's hot interior.

Nevertheless, around 140 structures of authenticated or probable meteorite impact origin have been recognised world-wide, and recently there has been an upsurge of interest in the role that giant impacts may have played in the evolution of the Earth and its life-forms. The surviving impact structures provide the only tangible evidence against which theoretical predictions of

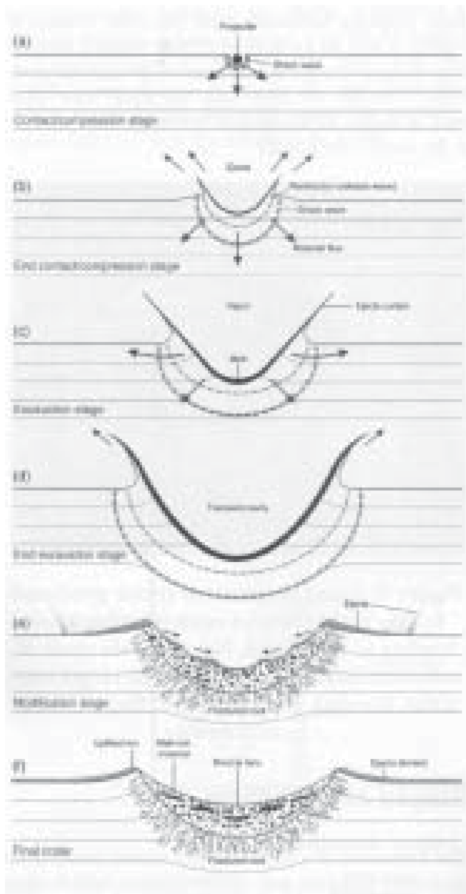


This map reproduced by permission of Dr Phil Hawke, School of Earth & Geographical Sciences, UWA. His PhD thesis covers many aspects of meteorite impacts, particularly their geophysics.

the effects of potentially catastrophic impact can be compared. Amongst other hypotheses, researchers have linked colossal asteroidal impact with the formation of the Earth's early ocean basins and the Moon itself, and mass biological extinctions in the geological past.

How are craters formed? How often have catastrophic impacts occurred on Earth and what effects have they had? Most importantly, can they happen again and do they pose a threat to civilisation?

Impacts can be of three types, which depend on the initial size of the impacting body. Objects smaller than say a large truck will not form a crater at all but fall to the Earth and perhaps, if they are large enough, bury themselves in the dirt. They have been slowed down by friction in the atmosphere and fall at the same rate as an object dropped from an aeroplane. Many objects shatter due to the stresses put on them during their passage through the Earth's outer envelope of gases, especially those of a stony nature, whereas iron meteorites are more likely not to break up in this way .

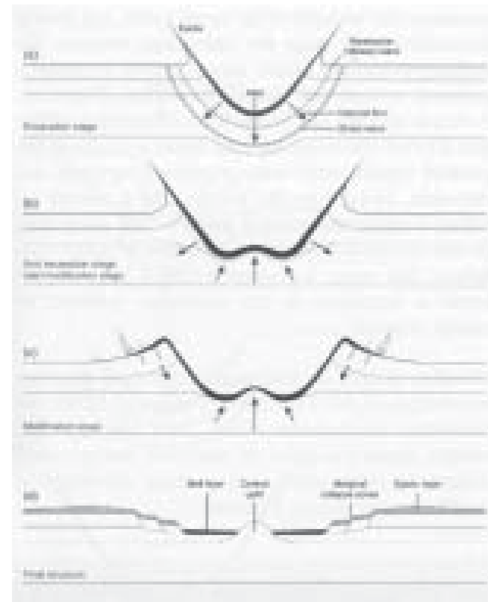


Stages in the formation of a simple impact crater (from French, 1998)

Larger bodies are not slowed down sufficiently by the friction and so there is a massive release of energy as they bury themselves in the ground and come to a sudden stop. This is like an enormous explosion and the meteorite can be largely vaporised, with perhaps a scatter of fragments outside the crater. Two types of crater can be formed depending on how big the impacting body actually is.

At the smaller size range, the explosion forms a simple crater, rather like a shell-hole in wartime. Material is excavated and blown out of the crater, and the edges of the rim may be peeled back and overturned. See the diagram (left).

Larger impacts (right) have a more severe effect on the Earth's crust. The shock waves cause the centre of the crater to bounce up: you may have seen this effect when something is dropped into water and a drop pops up from the centre of the ripple. Rocks can behave in the same way and there are craters on the Moon in which you can easily see this "central uplift" peak.



Stages in the formation of a complex crater (from French, 1998)

Australia is an ancient land. Some of the rocks in Western Australia have been dated at 3.63 billion years old, and others contain mineral grains which are a staggering 4.4 billion years old. Our land surface is also of great antiquity. Some of the river valleys which channel floodwaters down to devastating effect were formed a hundred million years ago. The agencies of weathering have worn down the great mountain chains and have sculptured the landscape, and many impacts in the past have been virtually obliterated by erosion. Compare that with the Moon, which has not the same kind of dynamic system as the Earth so most of the impacts there are preserved in a pristine state for us to study billions of years later.

How can we recognise meteorite craters and especially those worn-down impact sites, called "astroblemes" (literally this means "star wounds") on the Earth's surface? There are many clues we can use, many of which stem from shock and pressure effects on Earth's crustal rocks.

First, we might observe a **circular structure** of some kind. This can be a surface feature visible from say an aerial photograph or Landsat image. It can also be picked up on an airborne geophysical survey mapping the **geomagnetic** or **gravity** variations in a region. Land-based **seismic profiles** can also define structures typical of impact craters.

Sometimes we find **meteoritic material** around the structure. We may observe **overturning of beds** of rock around the edge of the structure.
There may be **breccia** (broken-up material as a deposit of more-or-less consolidated rock) around or in the crater.
Rocks of a suitable nature may contain **shatter cones**. These are rocks fractured in a special way due to shock effects. They are similar to the curved fractures caused in glass if hit by a small object: the apex of the cone points to the direction of impact.
Another shock effect is the production of sets of parallel planes (planar deformation features or "**PDFs**") in quartz, a common mineral found in crustal rocks which is normally clear of fractures or planar zones.

Various melts can be produced in an impact. These range from dark veins of melt, called **pseudotachylite**, to other glassy melt rocks like **suevite**, other **impactites**, and even the droplets of glass which have been flung high into and above the Earth's atmosphere and fall to the ground as **tektites**. The melts are all of Earth rocks melted by the high energy produced in an crater-forming event, but they may incorporate an identifiable **meteoritic component**.

Shock can also convert graphite grains in the crustal rocks into **diamonds**. These can range in size from very small to of dimensions of commercial interest. They can have shapes which reflect their graphite origin, unlike those brought up in diamond pipes in the normal way, so we can identify a shock event, but we cannot rule out shock caused by violent volcanic activity.

Ten of the impact structures in Australia are listed below: in many cases we are seeing only the roots of the crater where the Earth rocks have been damaged, perhaps thousands of metres below the true crater floor, since over time the surface layers have been removed by erosion. An example of a "simple" and a "complex" crater type are noted.

IMPACT SITE	DIAMETER OF CRATER	AGE
Wolfe Creek *(a **simple** crater)*	880 metres	340 000 years
Henbury (group of craters)	largest 180 metres	4 200 years
Veevers	70 metres	less than 4 000 years
Dalgaranga	24 metres	less than 3 000 years
Yalallie	13 kilometres	more than 65 million years
Shoemaker *(a **complex** crater)*	30 kilometres	around 1 600 million years
Goat Paddock	5 kilometres	around 55 million years
Connolly Basin	9 kilometres	
Piccanniny	7 kilometres	less than 360 million years
Spider Structure	13 kilometres	more than 700 million yrs

Calculations of cratering rates show that there is a likelihood of 6.5 cratering events every ten million years of a size greater than 32 kilometres. There is a 1 : 30 000 chance of a large impact in the next century, so we may yet see something really catastrophic on the news!

If you want to find out more about Impact Craters come and see me in the Museum: I have visited four of them on field trips and have more information. You can also buy copies of Alex's booklets, "Australia's Meteorite Craters" and "Tektites".
Don't forget you can ask Alex personally, on the Friends' Christmas Function WA Museum visit at the end of this month, if you have any queries!!

WHAT ELSE IS ON??

CLEAR OUT YOUR CUPBOARDS THIS WEEK AND HELP SUPPORT EAST TIMOR

UWA RECYCLED GOODS SALE

to raise funds for East Timorese students to attend UWA

SATURDAY 20 NOVEMBER

on the Oak Lawn (next to the Guild) 10 am-4 pm

If you have a vehicle, please deliver donated goods to the Oak Lawn on Friday 19 November after 9 am or leave them with me in the Museum any time this week. No clothes or bedding please.

Teachers! I am re-running the **"Teaching the Dynamic Earth" free Teachers PD Day** on Monday November 29th: contact me for details.

I am also participating in the STAWA one-day conference on Friday 26th November with a presentation:

"Earth Sciences Resources, from information to "hands-on" ideas, where to find them and how to use them"
Jenny Bevan, Curator of the Earth Science Museum at UWA.

Earth Science is a useful "science sampler" subject which can be related to familiar aspects of everyday life. It can be readily tailored for various age groups and incorporate inexpensive hands-on activities. Other sciences such as chemistry and biology can gain new relevance when linked with real-life Earth Science examples and perspectives. ***The introduction of the new Curriculum Council "Earth and Environmental Sciences" program for senior high school, (www.curriculum.wa.edu.au/pages/pcreview/stagetwo/COS.html) is sure to stimulate increased interest in the planet we live on and the dynamic processes which shape its surface.***

Ideas for hands-on activities and subject summaries, as well as course materials and free PD workshops, are available from a variety of sources: it is a question of knowing where to look! This workshop will summarise a number of directions to investigate, including downloadable workbooks on websites, videos with related course materials, and materials for practical activities, some of which will be on display.

Get a start by visiting the Museum website today on www.earthmuseum.segs.wa.edu.au

Interested in public talks on various topics? Go to the UWA website for a list of exciting events, many of which are free, including music recitals and Art Gallery Floortalks:

http://events.uwa.edu.au/

IS THIS YOUR *LAST* NEWSLETTER?

I am revising the list of "Friends" members.
Your name will remain on the list if:

You have **done a roster** within the last two years
You have **helped the Museum in any way** the last two years
You have **given a donation** to the Museum in the last two years
You are a **Life Member**

or if you **let me know** that you wish to stay on the list because you are planning to help the Museum next year.

It is expensive in both time and money to produce and post these newsletters and we cannot afford to continue to send them to lapsed members.
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NB If you are unsure whether you will qualify to remain on the list and want to make sure you do, **let me know anyway**, either by ringing me on 6488 2681 or email to jbevan@segs.uwa.edu.au

MUSEUM ROSTER:

Contact Allan Hart 9360 5157 (business hours) or you can email him on: `allan.hart@abs.gov.au` **to let him know which date(s) you would like.**

Sunday roster for Summer 2004

Nov 7	Bill Fitzgerald/Ron Ashlin	Dec 12	Stephen Lipple
Nov 14	Danuta Stansall	Dec 19	Leo Goldflam
Nov 21	Pat O'Shea	Dec 26	closed
Nov 28	Allan Hart	Jan 2	closed
Dec 5	Kirsten Dahl		

Notice we have no-one for January: PLEASE contact Allan if you can volunteer. He is back on November 17th, then away from December 18th until January 2nd. It is important to do your roster as promised so that visitors are not disappointed, so makesure you **DON'T FORGET!!!!**

New members who haven't done a roster yet: it is EASY and PLEASANT! I will guide you through what needs to be done, either beforehand or on the day if I am free. The book will be open at the **instructions page** so just READ THAT if you have forgotten anything, and the Security guys are there to help too. If all else fails, **ring me on my home number (button marked "HOME" on the phone)** or on my mobile: 0423 948 393.

NB I have put a small CD player next to the desk and a couple of CDs: if you are keen to play some nice music during your stint you can bring your own CDs: probably a good idea to have it not too loud and preferably not "heavy metal"!

Thanks so much, all of you, who have helped by being on the roster! Even if you don't get many visitors, it is important to be open when we promise we will be open, and who knows, your visitor may spead the word to others (and even be the reason why a student does Earth Science at U.W.A.!). Thanks also to those who organised their own "swaps".

NB.If you are unable to be a "Friend" by doing a roster, please don't forget that the alternative is to give a donation towards newsletter expenses etc.: $15 is suggested. Thanks very much to those who have donated so far in 2004!! Please make cheques payable to: "**School of Earth & Geographical Sciences**" and I can then direct it into the Museum's donation fund.