THE VICTORIAN GEOLOGIST

July 2012

THE GEOLOGICAL SOCIETY OF AUSTRALIA
Victoria Division

Next General Meeting

Thursday 26th July at 6:15 p.m.

Variable uplift from Quaternary deformation along the northern coast of East Timor, based on U-series age determinations of marine terraces

Nicole L. Cox
University of Ballarat

Fritz Loewe Theatre, School of Earth Sciences, University of Melbourne
Talks will be preceded by drinks from 5:30pm in the 4th floor tearoom, cost $2

The island of Timor is an emergent orogenic product of the arc-continent collision between the Banda Arc and the Australian continental margin. The accretionary wedge, composed of thrust sheets from both Australian and Banda Arc derived material, is estimated to have risen above sea-level 3.1 Ma ago with uplift rates as high as 3 mm/yr. Evidence suggests a decreased uplift rate of 1.5 mm/yr for the Pliocene-Quaternary, and possibly as low as 0.3-0.5 mm/yr for the last <1 Ma. A current evolutionary model for Timor associates these waning vertical displacement rates to post-collision lithospheric delamination and isostatic rebound, but is crustal shortening completely ruled out? Low seismic activity and regional GPS measurements raise questions about how strain is partitioned in the region. Marine terraces throughout the collision zone are an additional horizontal data set, used to quantifying rates of Quaternary uplift, which offers a piece to the evolutionary story.

Uplifted marine terraces are documented along ~180 km of the north coast of East Timor. The occurrence and number of marine terraces is not uniform along the coastline. Terraces never stretch over distances greater than 20 km; more commonly less than a few kilometers due to widening stream valleys, faults and slumps. Numbers vary between 2 to 25 sets, some with several subset terraces, and reaching altitudes anywhere between ~100 and 600 meters above sea-level. **CONTINUED ON NEXT PAGE...**

To potentially identify the neotectonic processes controlling these surface expressions we quantify uplift rates for 10 coastal locations along orogenic strike.

Uplift rates were obtained by measuring two variables. (1) Terrace altitudes by means of terrace profiles, built with high-resolution GPS field data and available aerial photos, topographic maps, and Landsat images. (2) U-series age analyses for coral samples from the lower terraces to determine terrace ages. Comparison of terrace altitudes with eustatic sea-level curves, in conjunction with U-series ages, shows variable vertical displacement rates between 0 and 1.8 mm/yr for the last 150 ka. Would a lithospheric mechanism, such as rebound, result in such variability over a 180 km distance?

The Illai-Buiomau region is particularly anomalous, where the peak surface uplift rate was measured at 1.8 mm/yr, with a mean uplift rate of 1-1.2 mm/yr over a <15 km distance. Terraces visually warp, increasing in altitude, between Laga and Illai; however, they become too dissected and intermittent to follow from Illai to Buiomau and Lautem, where the uplift rate drops down to 0.5 mm/yr. Quaternary uplift around this anomalous region of the coast is likely associated with active movement along a fault(s), possibly associated with "block-style" lithospheric rebound, or some would argue a retro-wedge thrust fault at depth. Whichever the case, the results in this study suggest that continued crustal shortening in the Timor region should not be factored out into the neotectonic evolution presently affecting the outer Banda arc.

The A.W. Howitt Lecture

Every winter the Geological Society of Australia (Victorian Division) and the Royal Society of Victoria hold an annual lecture at the Royal Society in honour of Alfred Howitt. Alfred Howitt is best known to the geological fraternity for his pioneering geological investigations of the Devonian of Gippsland. He also produced significant works on Eucalyptus of East Gippsland and famously led the recovery expedition for the Burke and Wills Expedition travelling twice to Coopers Creek. Howitt was also a keen observer of Aboriginal peoples and produced significant works on the social fabric of aboriginal life.

It was therefore appropriate that this years Howitt lecture was delivered by Guy Holdgate (Melbourne University) on the recent history of Port Phillip Bay. Guy drew together the threads from many different surveys of Port Phillip Bay and the sedimentary sequences encountered. Recent multibeam seismic imaging of the bay floor reveals meandering river channels and it is thought that the bay began drying out about 2800 years ago, reaching a minimum extent some 1000 years ago. This has some support in carbon dates of disconformity surfaces within the sedimentary sequences. This accords with aboriginal oral tradition that has the bay dry and as a hunting ground until a sudden flood event.

Guy postulates that this flood was an event rather than just post glacial sea level rise with the breach in the sand barrier releasing a flood of water into the bay, altering the landscapes of the area. The talk was well-attended with a packed house and prompted lots of questions from the audience.

GSAV Chair David Cantrill

Selwyn Symposium

'One day you'll be proud to tell your grand-kids that you were there when: "the Great East-Australian Geology Armwave of 2012: Tectonics, modern analogues/events, mineralisation" went down.
Selwyn Symposium: GAGA 2012, This September. Don't miss it!'

Full details for the day long event will be in next months Victorian Geologist so keep an eye out.

Science News

Story taken from ScienceDaily, June 28, 2012 (www.sciencedaily.com)

A 100 kilometre-wide crater has been found in Greenland, the result of a massive asteroid or comet impact a billion years before any other known collision on Earth. The spectacular craters on the Moon formed from impacts with asteroids and comets between 3 and 4 billion years ago. The early Earth, with its far greater gravitational mass, must have experienced even more collisions at this time -- but the evidence has been eroded away or covered by younger rocks. The previously oldest known crater on Earth formed 2 billion years ago and the chances of finding an even older impact were thought to be, literally, astronomically low.

Now, a team of scientists from Cardiff, the Geological Survey of Denmark and Greenland (GEUS) in Copenhagen, Lund University in Sweden and the Institute of Planetary Science in Moscow has upset these odds. Following a detailed programme of fieldwork, funded by GEUS and the Danish 'Carlsbergfondet' (Carlsberg Foundation), the team have discovered the remains of a giant 3 billion year old impact near the Maniitsoq region of West Greenland. "This single discovery means that we can study the effects of cratering on the Earth nearly a billion years further back in time than was possible before," according to Dr Iain McDonald of the School of Earth and Ocean Sciences, who was part of the team.

Finding the evidence was made all the harder because there is no obvious bowl-shaped crater left to find. Over the 3 billion years since the impact, the land has been eroded down to expose deeper crust 25 km below the original surface. All external parts of the impact structure have been removed, but the effects of the intense impact shock wave penetrated deep into the crust -- far deeper than at any other known crater -- and these remain visible. However, because the effects of impact at these depths have never been observed before it has taken nearly three years of painstaking work to assemble all the key evidence.

"The process was rather like a Sherlock Holmes story," said Dr McDonald. "We eliminated the impossible in terms of any conventional terrestrial processes, and were left with a giant impact as the only explanation for all of the facts." Only around 180 impact craters have ever been discovered on Earth and around 30% of them contain important natural resources of minerals or oil and gas. The largest and oldest known crater prior to this study, the 300 kilometre wide Vredefort crater in South Africa, is 2 billion years in age and heavily eroded. Dr McDonald added that "It has taken us nearly three years to convince our peers in the scientific community of this but the mining industry was far more receptive. A Canadian exploration company has been using the impact model to explore for deposits of nickel and platinum metals at Maniitsoq since the autumn of 2011."

GROUNDWATER ISSUES ASSOCIATED WITH COAL SEAM GAS DEVELOPMENT

A forum exploring groundwater issues associated with CSG development and ways that they can be managed.

Tuesday 21 August 2012

5.30pm meet and greet for 6pm start (refreshments provided)

Fritz Loewe Theatre, University of Melbourne, cnr Swanston and Elgin St, Carlton

Coal Seam Gas developments involve the drilling and installation of numerous wells and extraction of large volumes of groundwater. Please join us as we discuss various issues and risks to groundwater posed by CSG development and the preferred regulatory framework for management.

Panel Presenters:

John Ross - AGL

Deb Kerr – National Farmers Federation

Pierre Antipatis – Victorian Department of Primary Industries

Shaun Murray – Friends of the Earth

Each presenter will have 10 minutes to present their perspective on the issue. This will be followed by a Q&A session with the audience.

Come along, be informed and have your say.

Science News

Story taken from ScienceDaily, July 5, 2012 (www.sciencedaily.com)

Earth is shaken daily by strong earthquakes recorded by a number of seismic stations worldwide. Tectonic tremor, however, is a new type of seismic signal that seismologist started studying only within the last few years. Tremor is less hazardous than earthquakes and occurs at greater depth. The link between tremor and earthquakes may provide clues about the more destructive earthquakes that occur at shallower depths.

Geophysicists of Karlsruhe Institute of Technology (KIT) collected seismic data of tectonic tremor in California. These data are now being evaluated in order to better understand this new seismic phenomenon. About a decade ago, researchers discovered a previously unknown seismic signal, now referred to as tectonic tremor. Contrary to earthquakes, tectonic tremor causes relatively weak ground shaking. While tremor may last longer than earthquakes, it does not cause any direct danger. "Both earthquakes and tremor have the same cause. They result from the relative movement on fault surfaces, a result of the motion of the tectonic plates," explains seismologist Dr. Rebecca Harrington, who heads a research group at KIT. "While earthquakes at our research site in California typically occur at depths of up to 15 km below the surface, tectonic tremor signals are generated at depths ranging from approximately 15 to 35 km."

Tectonic tremor was first detected a decade ago in subduction zones in Japan and in the Pacific Northwest in North America. Since then, seismologists have discovered that tremor occurs in many other places, including the San Andreas fault in California. The San Andreas fault marks the boundary where the Pacific Plate and the North American plate drift past each other, generating many earthquakes in the process. KIT researchers have collected new seismic data recording tremor closer to where it occurs than the seismic stations currently installed near Cholame.

In mid-2010, KIT researchers, together with scientists of the University of California, Riverside, and the US Geological Survey, Pasadena, installed 13 seismic stations near Cholame, located approximately halfway between San Francisco and Los Angeles. Each seismic station was equipped with a broadband seismometer in a thermally insulated hole in the ground, a small computer, and a solar panel for power. Broadband seismometers are extremely sensitive to small ground motions, are therefore ideal for detecting tremor and small earthquakes. The data recorded over a period of 14 months are presently being analyzed at KIT.

Tectonic tremor signals have a unique character that differs from earthquakes, making them more difficult to detect using automated techniques. In order to address the detection problem, the KIT researchers first developed a new algorithm for the automatic isolation of tectonic tremor. Using their new technique, they found over 2600 tremor events that are now being studied in detail. "In addition to detecting tremor, we will determine their size or magnitude of the individual events. In order to do so, each of the tremor events must be precisely located," says Rebecca Harrington.

Additionally, KIT geophysicists compare the tremor and earthquake recordings in California with earthquake recordings at Mount St. Helens volcano, located in the Cascadia subduction zone, located to north of California, in the US state of Washington. A volcano eruption from 2004-2008 produced a series of earthquakes on newly formed faults, where the scientists of the US Geological Survey collect data that are also made available to Rebecca Harrington.

Student Funding Opportunities

Geological Society of Australia (Victoria Division) Student Research Scholarships

The GSAV are pleased to offer up to $10,000 per year in scholarships available to honours and postgraduate students for assistance with travel costs associated with conferences and field work.

The scholarship is valued at up to $500 for travel within Australia and $700 for travel outside of Australia. The number of and value of the scholarships awarded each year is made at the discretion of the GSA(Vic) committee.

Funding will not be granted retrospectively and applicants are asked to submit forms no later than 6 weeks prior to their trip to give the committee time to consider the application.

Students that receive this scholarship are required to submit a report for publication in the newsletter, "The Victorian Geologist", following their trip. A presentation may also be requested by the committee, which will consist of a short, 10-15 minute presentation prior to the monthly seminar.

Applications forms can be scanned and emailed to: secretary@vic.gsa.org.au

or mailed to:

Geology Research Scholarships Victoria
Geological Society of Australia (Victoria Division)
GPO Box 2355
Melbourne VIC 3001

More information including eligibility criteria can be found on the form and by contacting Barbara Wagstaff (wagstaff@unimelb.edu.au)

Something interesting to share? Want to see your name in print?

Don't be bashful, contribute to the GSA(V) monthly newsletter!

If there are any events, happenings, news, or views that would be of interest to the membership, please send your details and information to Matt Bliss at mbliss@student.unimelb.edu.au

We'd be glad to hear from you

FORTHCOMING SEMINARS AND EVENTS

to be presented at

GSA (Victoria Division) meetings

Note: unless otherwise indicated, all 2011 talks will be held in the Fritz Loewe Theatre, Earth Sciences Building, University of Melbourne.

August 30	TBA
September	Selwyn Symposium: GAGA 2012 The Great East-Australian Geology Armwave of 2012: Tectonics, modern analogues/events, mineralisation **more details in next months newsletter!**

Please join the GSAV in welcoming our new members

Laura Spelbrink
Robert Barratt

Visit the GSAV on www.vic.gsa.org.au or the GSA on www.gsa.org.au
• Renewing your GSA membership is easy - it can now be done online. •

CONSIDER CONTRIBUTING TO TAG!

It is member contributions which make TAG a member magazine – please keep the contributions coming and assist with informing all of the membership (not just your Division) about your activities.

Please send your news to: tag@gsa.org.au

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