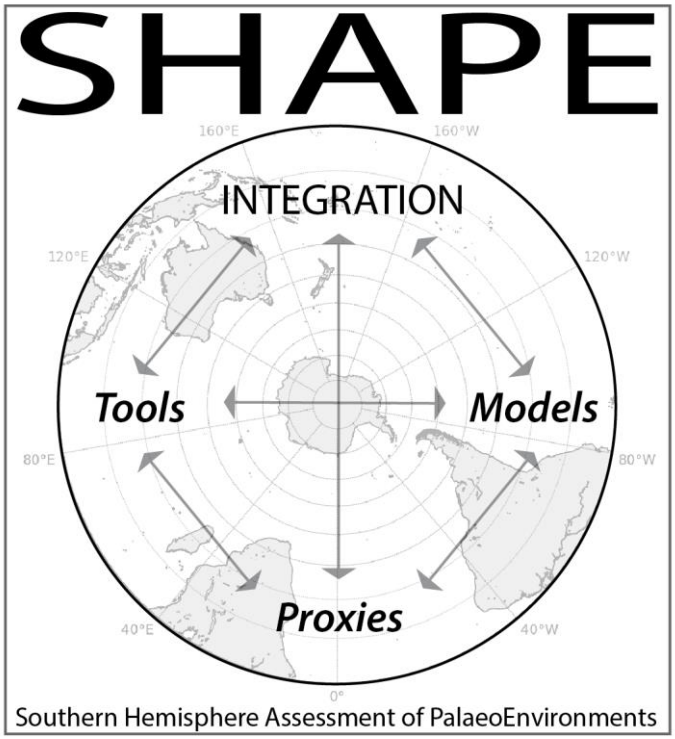
Summary of Inaugural SHAPE meeting

16-17th September 2013

GNS Science, Lower Hutt, New Zealand



Participants: Steven Phipps (UNSW), Andrew Lorrey (NIWA), Helen Bostock (NIWA), Jessica Reeves (University of Ballarat), Peter Almond (Lincoln University), Marcus Vandergoes (GNS), Paul Williams (Auckland), Joel Pedro (University of Washington), Claire Krause (ANU), Heidi Roop (VUW, GNS), Matt Ryan (VUW, GNS), Giuseppe Cortese (GNS), Gavin Dunbar (VUW), Kat Holt (Massey), Xun Li (GNS), Ian Fuller (Massey), Troy Baisden (GNS), Duanne White (University of Canberra), Tim Cohen (University of Wollongong), Craig Woodward (University of Queensland), Chris Hollis (GNS Science), Andrew Rees (VUW), Liz Keller (GNS), Joe Prebble (GNS), Liz Kennedy (GNS), Helen Neil (NIWA).

Introduction by Drew Lorrey and Steven Phipps

The main aim of SHAPE is to continue the momentum that was started with Australasian-INTIMATE (Integration of Ice, Marine and Terrestrial) – with the recent publication of the Quaternary Science Reviews Special Issue, but to broaden the scope and compare with records from the rest of the Southern Hemisphere. Thus there will be some of the same people who were involved with Aus-INTIMATE, but a wider collaboration network is needed for this project, especially for South Africa and South America. One of the other objectives of INTIMATE, and we hope to continue with SHAPE, is to foster the growth of early career scientists and encourage them to lead some of the initiatives.

The original INTIMATE timeframe was from 8-30 ka, one of the first aims for SHAPE is to expand and provide good, high resolution climate records from 0-60 ka – thus sitting within the timeframe that is possible to date with radiocarbon. There is a special interest in the rapid climate change events

during MIS3, and also improving our understanding of the Holocene. Another goal of SHAPE is to compare the proxy data to the paleo-climate model outputs such as the PMIP3 (Paleoclimate Modelling Intercomparison Project). By comparing the proxy data with the models we hope to understand some of the processes and drivers of past climate.

SHAPE sits under the INQUA International Focus Group CELL 50K (Calibrating Environmental Leads and Lags over the last 50 ka). The aim is to eventually compare climate changes between the two hemispheres. SHAPE is a recognised INQUA-PALCOMM project and as a result gets a small amount of money each year to help support early career researchers to attend the workshops and meetings.

The first SHAPE meeting took the format of presenting the state-of-play for sub-regions of the Southern Hemisphere, including some new work and records on the first day, followed by a discussion of what we would like to achieve and future collaborative projects and deliverables on the second day.

Summary of talks

The talks on the first day highlighted a wide range of work is occurring across a range of environments, using different proxies and models. It is also encouraging to see some talented and motivated early career researchers who attended this workshop. Jessica Reeves started the talks with an overview of the Oz-INTIMATE group and lessons learnt during that project. She outlined the previous attempts to develop climate compilations for the Australian Region – starting with CLIMANZ (I, II, III and IV) which started in 1981 and continued until 1996. But very little was ever published except for a couple of articles in Quaternary Australasia. In 2004 Oz-INTIMATE had its first meeting at ANSTO, which developed a poster that was presented at the INQUA conference in Cairns in 2007. However, there were many problems with chronology, and the large range of climate regions across Australia, very few continuous records, proxies with ambiguous interpretations, local influences rather than regional climate and hard to quantify the data. Thus in many ways the development of a climate event stratigraphy for the Australian continent was considered too hard. The initial group was also top heavy, with mostly older researchers that were too busy.

In 2009 the Past Climates meeting was held in Wellington, at which many new Quaternary records from around New Zealand were presented, including all the work mapping and dating the moraines in the Southern Alps by George Denton and his team in collaboration with GNS. Several Early Career Researchers from Australia were invited to come over and given the task of reinvigorating the Australian community.

Between 2009 and 2011 AINSE funded several meetings to bring the Australian Quaternary researchers together to progress the Oz-INTIMATE effort. Participation in these meetings was by invite only and primarily Early Career Researchers. Early on it was decided that rather than trying to understand Australia as a whole, the only way to progress was to split the continent into the 4 main climate regions – tropics, temperate, arid interior, Southern Ocean. A different team worked on each region and compiled most of the records, including those that were not continuous. Then used the best records to pull together a poster which was presented at INQUA in Bern. A synthesis of each region and a paper bringing all the regions together were published along with 12 other papers in the QSR special issue.

The biggest lessons learned from Oz-INTIMATE were firstly to go back to the original records and really interrogate them for what they mean, and use the spatial variability to your advantage – don't exclude records if they don't fit in with the other records, and secondly to involve the early career researchers, who ended up driving and writing the papers. SHAPE needs to continue to identify the next generation of researchers and involve them in research deliverables (such as leading key papers).

Long, high resolution marine pollen records linking onshore and offshore climates

Matt Ryan presented his PhD work looking at pollen from long marine sediment cores from the west coast of the South Island of New Zealand. These records compare very closely with the onshore records, but go back much further in time and allow a direct comparison with changes in the ocean. He has used the close comparison of the pollen records and the better dating of the marine records, using the d18O foraminifera, to provide a better chronology for both records beyond the range of radiocarbon. The marine core provides a more regional picture than the onshore records at Galway Tarn and Okarito Pakihi and there are also some taphonomic issues. Other main points include that the pollen seems to follow Northern Hemisphere insolation, there was beech present during MIS6 and evidence of a warmer early to mid Holocene than present. The Kawakawa tephra (KKT) is also present in the core – to provide a tie point.

The Bipolar see saw – evidence from ice cores and models

Joel Pedro presented some work he is undertaking for his postdoc at the University of Washington looking at and timing of millennial scale climate variations during the last glacial period and deglaciation in ice cores. Using methane as a common global signal, the ice cores can be put on the same age model and the leads and lags compared between the AIM (Antarctic isotope maxima) events and the Heinrich/Dansgaard-Oeschger events in NGRIP. There is an antiphase relationship between the arctic and antarctic. Start of ACR lines up with Bolling Allerod, with peak warming in the north corresponding to maximum cooling in the south (within the error of 200 years). This suggests a clear bipolar seesaw – evident on millennial timescales. CO2 also increases at the same time, (again within the 200 year error (Pedro et al., 2012; Parrenin et al., 2013)). AIM events in the glacial are very similar to the ACR/BA with a maximum cooling in Antarctica at peak warm intervals in Greenland, usually, but not always preceded by a Heinrich Event. What are the mechanisms for this? Is it caused by the ocean resulting from the freshwater flux during Heinrich events? Or through the atmosphere due to the expansion of sea ice in the north Atlantic, which shifts the ITCZ south and strengthens the westerlies (Lee et al., 2011). The stronger westerlies increased upwelling of CDW in the Southern Ocean, which may explain how CO2 has the same phasing.

First full transient model runs for the deglaciation using CCSM3 (He et al., 2013). These put fresh water into the North Atlantic, then turn it off. The Atlantic Meridional Overturning Circulation (AMOC) immediately responds, increasing temperatures in the north. However, there is a cooling trend which begins south of 30-40˚S. The sea ice also increases around Antarctica at the start of the ACR. The model suggests that there is a reduction in poleward heat transport at 45˚ N and S, which happens within a decade, while precipitation changes in the tropics, indicating that the ITCZ shifts north. Also evidence of a negative SAM and a northerly shift in the westerlies. Thus, according to the models, we would only expect to see the ACR or AIM events in the records south of the STF.

Demise of the Australian megafauna – was climate stable between 40-60 ka?

Tim Cohen presented work that has just been submitted as a paper about the variability of the Australian climate between 40-60 ka, a time period that saw the demise of the megafauna around 55 to 40 ka. What caused the extinction of the megafauna? This has been a highly debated topic over the years with many competing theories suggesting that humans, or the use of fire, or changes in predation caused it. But most of these theories start with the premise that climate was stable across this interval (Johnson 2005).

The research team have been dating the shorelines around Lake Eyre to determine past lake levels. At present 9 out of 10 years Lake Eyre is completely dry, but in very wet years it fills. Theory is that when Lake Eyre is full Australia is wet, as the rivers that flow into Lake Eyre drains such a large area of the continent. The team have been revisiting the high elevation shorelines, originally discovered by GK Gilbert (1885) and re-dating and accurately surveying the geomorphic features. They have got 39 OSL ages and 17 radiocarbon ages from beach foresets that are 20-25 m above the recent lake fill levels. This would be equivalent to a volume of 200-300 km^3 of water, a large lake, supporting a complex ecosystem. The ages suggest that the last time that Lake Eyre was this full was around 48 ka. This is supported by evidence from Lake Frome nearby and similar to the time when Genyornis went extinct in this region (the large megafauna emu). Fluvial records also suggest significant changes in the hydrological cycle at this time. This also fits with a change in the abundance of C3 and C4 plants reported by Giff Miller. Suggesting that the change in the hydrology changed the ecosystem.

Reassessing the LGM records in Australia

Craig Woodward reported in on an ongoing large ARC project that is examining climate across Australia during the Last Glacial Maximum. In the past there has been a lot of problems dating and interpreting the LGM records in Australia. This has produced a mismatch between reconstructions of climate from different environments. Also large gaps spatially and a lack of quantitative proxies. The focus of Craig's collaboration is centred on east Australia, working within a range of different environments and different proxies while attempting to develop quantitative calibrations for chironomids using modern samples from lakes. Craig and colleagues are also examining and monitoring modern periglacial deposits, re-dating fluvial, lakes and lunettes. They hope to present improved dates and data in the future.

Circulation in the SW Pacific during MIS 5E

Giuseppe Cortese presented some marine sediment core work that was recently accepted for publication in paleoceanography. They looked at the sea surface temperature (SST) in the South West Pacific during the last interglacial, MIS 5E, as a potential analogue for what future warmer conditions might look like. The paper uses ~16 cores from around the region, with SST determined from foraminferal assemblages, based on the calibration from 1223 southern hemisphere core tops, then using a Random Forest approach. This gives the SST with a 1.5˚C error. MIS5E SST appears to be slightly warmer than modern at low latitudes and along the east coast of Australia, and also warmer on the Campbell Plateau, but slightly colder than present in the Tasman Front coming in to the north of New Zealand. This compares with the modern observations and models, which show the wind stress curl has increased since 1950 with increasing amount of water transported south as part of

the East Australian Current (EAC) to Tasmania. Models of modern conditions suggest that the flow of the EAC across the Tasman Sea, along the Tasman Front, will be reduced. However, models for MIS5E don't agree in this region.

Composite speleothem records from the South Island of New Zealand and glacial advances

The keynote talk was given by Paul Williams, who has been a stalwart of the New Zealand Quaternary community and involved right since the start of the INTIMATE in 2004. Over the years Paul has developed a $\delta^{18}O$ and $\delta^{13}C$ speleothem composite record for the last 130 kyr for the west coast of the South Island of New Zealand. There is good age control with a 178 U/Th dates. There are a few gaps in the record. He has compared the speleothem record with marine records from the west coast, as this is the source region of the precipitation, as well as with the pollen and glacial morphology onshore and integrated summer insolation. The records agree pretty well and suggest that MIS4 had the largest late Quaternary glacial advances in Te Anau.

Dating of stalagmites from Aurora Cave near Te Anau in Fiordland, a cave that sits half way up a glacial valley with the stalagmites only growing when the glacier retreats, suggest that there were glacial advances between 48-50 ka, 38-42 ka, 18-32ka. This compares well with the cosmogenic dates from the moraines in the valley which suggest that the glaciers during the LGM (~32-18Ka) were at their maximum thickness in New Zealand around 30 ka. This early LGM in NZ may be due to cold and wet conditions, and the glacier shrunk in size as conditions got drier up until the end of the global LGM ~19 ka.

Peter Almond summarised the latest glacial history of New Zealand over the last 0-60 ka. For the last glacial there is a relatively coherent story between the east and west coasts of the South Island: Pre KKT advance 26 ka, 22 ka advance, 20 ka advance, 17 ka collapse of glaciers.

But what about older glaciations? Evidence from Te Anau cave presented by Paul Williams exists for a few older glacial advances, but not a lot of published dates between 30-60 ka. We need to get out and find these previous advances – especially if MIS4 is so large – there should be evidence in the landforms.

Duanne White has been dating the boulders on moraines and sediment cores from lakes and fluvial sequences around the East Antarctic Margin and found evidence for lots of ice free areas during most of MIS3. The ice sheets expanded into the LGM, but looks like a progradation rather than a thickening of the ice (Mackintosh et al., 2013). But in some places the ice sheet did not prograde out on to the continental shelf at the LGM and had retreated back by 12 ka. However, not a lot of data from the Wilkes and Aurora basins at the moment.

Generally evidence suggests that the MIS3 was warm, but dry, LGM was cold and dry and early to mid Holocene experienced a period of warmer climate and then cooling into the late Holocene. However need to improve chronology and find pre-LGM records, as well as some good marine SST records from just offshore, as this will affect the extent of the ice sheets during the glaciations.

Changes in the monsoon and hydrological cycle in the tropics

Claire Krause presented a 40 ka high resolution stalagmite record from Mimpi Cave in Southern Sulawesi. The record is well dated with 36 U/Th dates. The $\delta^{18}O$ record shows that the deglaciatoin

kicks off only around 15 ka, with a major change in the hydrological cycle in the region. There are rapid stepwise changes in the record at 11-10 ka and 8-7 ka, coincident with the rapid flooding of the Sahul and Sunda Shelves. When the $\delta^{18}O$ records are corrected for ice volume and the high frequency variability filtered out, the records of past changes in the monsoon appear to compare very well with summer insolation, with wet anomalies lining up with a maxima in summer insolation. The premise is that precessional cycles are driving the low frequency variability in the Indo-australian monsoon. When precessional change is removed from that record, the millennial variability appears greatest at the edge of the monsoon region and lowest in the centre of the region. The d13C record aligns closely to the global methane record seen in ice cores. It appears as if warming occurs at 18 ka, even though major changes in the hydrological cycle don't occur until 15 ka.

It is possible that Heinrich events are recorded in this record – but questions exist as to whether this is this feasible. Claire used the CSIRO Mk3L model coupled with a GCM to simulate a Heinrich Event with a 1 Sv of freshwater input over 100 years in the North Atlantic and then turn it off to see what happens. The models show wetting and drying anomalies over the tropics, caused by the atmospheric connection across central America. When the model is also forced with southern insolation the freshwater influence continues much longer than when it is forced with northern insolation.

Paleo-hydrology of the South Island from potentially annually resolved Lake Ohau records

Gavin Dunbar talked about a new lake record from Lake Ohau which is one of the Mackenzie Basin lakes in the South Island of New Zealand. Seismic sections show a large sediment wedge at the bottom of the lake that has accumulated since 17.7 ka, the age of the moraine at the end of the lake (Putnam et al., 2013).

Most of the rainfall to this region is spill over from the Southern Alps. The current Ohau discharge correlates very closely with the South Island rainfall, so the workers supsect that that the Ohau lake sediment record will represent a rainfall record for this region as only a small area of the catchment is glaciated (although this would have changed over time). The lake sits in a zone that is very sensitive to the westerly winds, which are currently changing, so the Lake Ohau core could provide a longer, pre instrumental (>50 yr) record of westerly winds and SAM.

A 6m core was recovered from the end of the lake to avoid sedimentary gravity flows. The core is dated using ^{137}Cs, ^{210}Pb, first occurrence of exotic pine pollen and ^{14}C on a couple of macro fossils. Counting the laminations in between suggests that they are annual varves, confirmed by 3 independent counts. They are currently monitoring the lake at both the inflow and the outflow with moorings measuring the temperature structure n the water column, turbidity, and velocity of currents and there are sediment traps to understand the modern sediment input into the lake. In the summer, the lake is strongly stratified, while in winter it is isothermal. Most of the discharge, precipitation and coarse sediment is deposited during the summer. Thicker layers appear to correlate with flood events. The Ohau team is assessing limnological processes that may affect the sediment deposition at the core site. They aim to get funding for drilling a longer core at this site to get high resolution records of the deglacial period.

Evidence for shifts in the Subtropical Front south of New Zealand

Helen Bostock showed a transect of marine sediment cores from south of New Zealand that cross the Subtropical Front (STF). First of all they had to work out where the modern STF sits in this region as the previous literature didn't agree. Using the hydrographic data from 3 voyages and satellite SST data a PhD student mapped out the location of the STF. The complex topography appears to control the position of the STF in this region (Smith et al., 2013). Foraminifera assemblage data is used to estimate SST for the cores and suggests that despite the bathymetric control on the modern STF, the STF did not sit south of New Zealand during the last glacial. This agrees with some of the onshore data which suggests that the glaciers in Fiordland reached the coast during the LGM, and this would have been unlikely if there was warm water just offshore. The SST increase in the northern most core occurs during the LGM and then subsequently after the LGM in the cores further south – indicating the migration of the STF south during the deglacial. The STF is found at its most southerly position during the early Holocene. Still waiting for radiocarbon dates for the cores to confirm the chronology which is currently only constrained by the δ^{18}O curves.

Poster presentations

Several posters were also presented. Ian Fuller presented work from Massey University colleagues that outlined a compilation of ages of Holocene fluvial activity across both the north and south islands of New Zealand. They linked the changes in the pattern seen in their records to changes in regional circulation patterns (Regional Climate Regime Classification). There was a compilation of ancient kauri tree ring data by Drew Lorrey, which provides a complementary high resolution proxy alongside lower resolution records during MIS3. The kauri chronologies are 'floating' in time, anchored by high precision radiocarbon ages. There was some more detail on the Lake Ohau sediment core presented by Heidi Roop, who will focus on the most recent end of the sediment record for her PhD project. Andrew Rees presented work on chironomids from lakes in Tasmania, which will be a useful connection between Australia and New Zealand and larger hemispheric scale atmospheric circulation.

Discussion

Day 2 was spent discussing the SHAPE proposal, the timeline for undertaking work, and what collaborative deliverables could be achieved to support the aims of SHAPE. SHAPE runs from now until the next INQUA congress in 2015 in Nagoya, Japan. We hope that if we can show some progress towards our objectives at the upcoming INQUA congress that PALCOMM will continue support for the project for a second phase until the next congress in 2019. This will allow some of the more ambitious compilations (hemispheric-scale) and collaborations (listed below) to be completed.

Questions in the SHAPE proposal

1) What changes occurred to the Southern Hemisphere westerly wind field (position and strength at the surface and upper level) during the Late Quaternary including the last glacial-interglacial transition (LGIT)?

2) What climate drivers promoted major changes in the SH circulation (atmospheric and oceanic) during the Quaternary?

3) How did the SH oceanic traits (including fronts, upwelling, currents, nutrients, productivity and sea ice extent) change during the late Quaternary and what were the consequences for the atmosphere, biosphere and cryosphere?

4) How are changes in SH circulation connected to climate variability and change in the NH?

5) What changes occurred in the SH tropical monsoon and how do those changes compare?

These are very high level, big picture questions, so initially the discussion focussed on what collaborative work could be undertaken to address these questions. There is also the requirement from CELL 50K to produce high resolution records that can be compared with the Northern Hemisphere records to look at leads and lags and the comparison with paleoclimate models. The models have been run for specific time slices, some of which are transient, while others are just for a specific time slice.

Model runs currently available for comparison

- 0-2ka (transient) – but really covered by PAGES2K and quite different records required
- 0-8 ka (transient possibly back to 21 ka) there are major change in NZ around 7ka, and 9.5 ka – so perhaps better to extend back further than 8 ka. Changes in Antarctica at 8.2 ka and well dated with methane in the ice cores. Perhaps look at a few key intervals of this using the transient models – such as the ACR.
- 6 ka timeslice (already underway for the Australian/NZ region)
- 21 ka timeslice (already done for New Zealand – Lorrey et al., 2012)
- 32 ka timeslice

PICT – Past Interpretation of Climate Tool

Drew Lorrey demonstrated a new tool called PICT (pict.niwa.co.nz). An example, using glacier equilibrium line altitudes, was recently published in a Climate Dynamics paper (Lorrey et al., 2013).

This is an online tool allows the submission and synoptic interpretations to be made from different kinds of proxy data and climate archives. It is currently set up for analysing discreet time periods, but will be augmented in the near future to work with continuous time series. It is possible to input the data as quantitative or qualitative assessements of past climate (below, normal below, normal, normal above, above). Users can also specify the time of year that the proxy response represents, annual or seasonal, and also specify dating controls.

PICT uses a virtual climate station network (VCSN), a gridded product with 5 x 5 km resolution, and runs currently for rain fall and temperature for NZ, but 13 different fields will eventually be available. Currently it is only active for proxies in the terrestrial domain, but can be expanded to the oceans using gridded reanalysis data.

Once users input their proxy interpretations or reconstructions, PICT derives analog years and selects corresponding information from reanalysis data to generate ensemble maps (modern synoptic configurations) that show realistic configurations of atmospheric and oceanic conditions that can help to explain why the site (and proxy) responded the way it did. The more data and spatial coverage included for a time slice will increase confidence in the spatial output of the reconstuctions, as outliers (presumably from a few proxies) won't play as big a role in the ensemble mean. PICT is set up to generate figures with captions that are rendered ready for publication. It does assume a modern analogue exists to explain the anomalies relative to the mean climate state and the proxy data are responding to an atmospheric circulation change. At present, PICTcan realistically be applied to the Holocene, when sea level and climate were more similar to modern conditions. In the future, proxies over longer time scales will need to consider the relative changes in the contribution from insolation and GHG forcings, in addition to circulation changes, to explain local conditions.

Dating techniques and standards

- Tephrochronology – 10 more eruptions > 30 ka, but need better dating on these before they can be used to provide a chronology for older sequences. Could be very useful for the north island, but unlikely to have reached the south island of New Zealand. May be possible to use sulphur and sulphur isotopes to see evidence of eruptions in south island speleothems.
- Radiocarbon dating - INTCAL 13 is currently being compiled and they are asking for funding to make it open access. However, until it is out we will continue to use INTCAL09, reporting a 2 sigma error. For marine cores we will continue to use Marine09, with 2 sigma. However, need to look at reservoir ages and if they change over time. For example we can use tephra dates/comparison with pollen/speleothem in the marine cores to look at changes in the reservoir variations around New Zealand.
- $\delta^{18}O$ forams – a paper by Thompson et al, looks at the errors from the Lisiecki and Raymo (2004) curve. Standard is to wiggle match using Analyseries. Probably best if this is used with other forms of dating for the 30-60 ka records.
- Ice cores - Greenland ice core records NGRIP – then tie using the sulphur records and methane. New WAIS – can layer count as well. Roosevelt ice core – possibly as far as 50 kyr. Highly resolved, but coastal...
- Speleothems – standard is to use John Hellstrom's Monte Carlo method.
- Bayesian age modelling – Bacon, Oxcal – P sequence, becoming more common.

- OSL – A protocol was written by Kat Fitzsimmons during the INTIMATE. Hasn't worked previously in New Zealand, but may be worth trying on sand dunes. Loess too fined grained probably to work.
- Magneto-stratigraphy – possible to look for magnetic anomalies across time periods like the Laschamp – could be very useful for the 30-60 ka time period.
- Cosmogenic – need to use the updated production rates for New Zealand. New rates for South America and Antarctica are very similar to New Zealand. Australia needs to have a new production rate checked. Use of Chronos software. Probably first thing to do is to go back and recalculate the ages from all the old ^{10}Be data available. Might be good to try to measure ^{10}Be spike in sediment cores.
- Varves – layer counting, but use in conjunction with other dating methods such as – ^{14}C, ^{137}Cs, ^{210}Pb – need multiple operator counts. Varve database outlines the methods you need to follow and documents how to report to be considered a high fidelity record.
- Tree rings – there are standard protocols, but harder to do more than just internal replication on older materials as there may not be many trees of same age in same area. Potential for high precision dating using Bayesian techniques and wiggle matching results to long calibration curves.
- Loess – dating of molluscs using radiocarbon seems to be showing great potential. Also using amino acid dating on the molluscs and on egg shells. However, only a few locations where the carbonate is still present.

Several offers of dating to support the SHAPE project came from Rafter Laboratory at GNS and John Dodson (ANSTO). There are also AINSE grants – GNS, VUW, Auckland, Massey, most Australian universities subscribe – Jessica Reeves currently sits on the Archaeology and Geoscience panel. Stephanie Kermode doing a project at ANSTO and looking for a cosmogenic project to learn how to do cosmogenic dating.

SHAPE dating wish list:

- Be spike – in the marine cores to look at reservoir ages, or lake cores.
- Tephra – dates around older tephras >30 ka
- Holocene – re-date some stuff for the Australia region
- Australia – Western Vic Tephra chronology potential.

Final list of anticipated project deliverables*[1] (with named lead and support people)

1) Compilation of records from 30-60 ka – Tim Cohen (Aus)/Drew Lorrey (NZ - tree rings)/Matt Ryan(pollen)/Paul W (speleo)/Joel (ice) – if too large then keep Aus (separate into regions) and NZ separate.
2) ENSO changes through time – Drew Lorrey using Kauri tree ring records
3) ACR compilation of models and records – Joel Pedro (lead/models), marine records - Helen Bostock and marine colleagues, onshore records – Paul Williams, Marcus Vandergoes/Andrew Rees
4) Monsoon speleo compilation – Claire Krause

[1] *indicate main deliverables set out in the SHAPE project proposal.

5) *Westerlies across LGIT – Michael Shaun-Fletcher, with help from Andrew Rees and others
6) KKT timeslice from 24-26 ka for NZ – Peter Almond /David Barrell
7) 28-32ka timeslice – will be covered partly by Paul Williams speleothem paper to be submitted soon – need to recalculate the Te Anau cosmogenic dates with the new production rates, and talk to Nick Gollege and Andrew Mackintosh about models for glacier advance at this time? Is is sufficiently different from LGM?
8) Holocene data – Craig Woodward (Aus)/Use of Pict – help from Drew
9) Holocene model comparison – Steve Phipps
10) *Tephrochronology across the SHAPE timescale – Kat Holt with help from David Lowe using tephra older than 30 ka...
11) ^{14}C reservoir ages in the surface waters in the SW Pacific – Helen Bostock/Helen Neil/Matt Ryan/Marcus Vandergoes/Paul Williams/Peter Almond/Lionel Carter
12) Temperature gradients across oceans – 21 ka, Tim Barrows? Implications for surface circulation? Is there enough data and good enough age control to do other timeslices? Possibly early Holocene?
13) $*\delta^{13}C$ deglacial minimum – Helen Bostock/Tim Barrows/Helen Neil/Gavin Dunbar

Additional contributions

If your name isn't mentioned and you would really like to contribute to the deliverables listed above, then please get in touch with the lead person listed, as many of these projects will need some extra help.

Mailing lists for each geographical region and main working groups will be put together – please get in touch with us if you want to be included in one of these mailing lists. A central repository will also be set up in Google Docs to pull all the data together by June 2014. Links to international databases will be provided. Metadata will also be provided for all records included in SHAPE compilations, with an explanation of what the data might mean/represent and issues with dating. People doing the compilations are encouraged to include the people who have provided the data to be part of the work / deliverables to ensure consistent interpretations of the proxies have been made. Climate modelling metadata will allow SHAPE contributors to see what comparisons are possible, and the full data suite can also be accessed in a netcdf format. If graphical outputs are also required, collaborators should direct enquiries to Steven Phipps, Maisa Rojas or Duncan Ackerley.

Next SHAPE workshop

We will have a Virtual Conference (VC) held online sometime between February and March in which will overview progress in record compilations for the SHAPE timescale and also any progress on the paper deliverables listed above.

Next SHAPE meeting

The next meeting of SHAPE will coincide with the biannual AQUA conference in Mildura, Australia – "Back to the Core!" 29th June – 4th July - Mark in your diaries. We hope to have some funding to get

SHAPE early career researchers to the meeting to present results and continue to develop compilations and records. The expectation is that regional syntheses of proxies used in the papers above will be presented in poster format and 'frozen' at about that time as well (to allow the papers to proceed ahead of INQUA congress in 2015).

30th Anniversary of AQUA and same location as the first AQUA conference was held. Coincidently also 40 years since Jim Bowler first ran over Mungo Man. We expect it will be much larger than typical AQUA conference as will include archaeologists as well.

Other conferences

Also INQUA ECR meeting in December 2013 in Wollongong… get your applications in soon.

(The GSNZ November 2013 – SHAPE session will have some representation, but could be post-poned (as a result of this meeting occurring too soon after the Aus-INTIMATE special issue.)