

## Catalyst: Influence Annual Reporting Template

Supported international union membership:	<b>International Union for Quaternary Research (INQUA)</b>
New Zealand national delegate:	<b>Professor David J. Lowe</b>
Affiliated New Zealand organisation/national committee:	Group of New Zealand Quaternary researchers, most of whom are members of the <b>Australasian Quaternary Association (AQUA)</b> , which is affiliated with INQUA, and various other science associations/societies in New Zealand.
President/Chair of New Zealand organisation or national committee:	<b>Dr Lynda Petherick</b> (Victoria University of Wellington) is current Vice-President of AQUA (2018-2020).
Reporting year:	2019
Report due date:	6 December 2019
Estimate what proportion is engaged* with the International Union:  *Engaged is defined as active; such as, but not limited to; attending conferences/workshops; receiving newsletters; interacting with or part of the Executive Committee.	Most New Zealand-based Quaternarists are engaged with activities associated with INQUA either through (i) INQUA-based projects/focus groups (e.g. INTAV, SHAPE, SHeMax), or commissions (e.g. SACCOM, PALCOM), or (ii) through AQUA activities including the biennial conference (being held in Atherton QLD in 2020), or (iii) directly with the INQUA Congress that was held in Dublin in July 2019
Estimate of the number of participants of the New Zealand Research, Science, or Technology community of relevance to the International Union you as a delegate represent:	Approximately 60

I have discussed the potential content of this report with some leading New Zealand Quaternarists and/or leaders of several INQUA-funded projects/IFGs including A/Prof Peter Almond, Dr Andrew Rees, Dr Lynda Petherick, Prof Rewi Newnham, Prof Alan Hogg, Dr Marcus Vandergoes, A/Prof Helen Bostock (Australia), Dr Andrew (Drew) Lorrey, A/Prof Alan Palmer, and Dr Carol Smith.

*Citation:* Lowe, D.J. 2019. Quaternary research in New Zealand and relationship to the International Union for Quaternary Research (INQUA). *Annual Report for 'Catalyst Fund: Influence' for 2019*. School of Science, University of Waikato, Hamilton, 8 pp.

## 1. Catalyst: Influence assessment criteria

- *Please comment on how the supported union membership involves recognised global science and innovation leaders, the connection with whom could benefit New Zealand in a substantive manner.*

Many of the top Quaternary science specialists globally are members of the International Union for Quaternary Research (INQUA), and a number of New Zealand Quaternary scientists are in that category. Membership of INQUA provides access to this international knowledge base and the latest developments in the discipline, as described in my report for 2017 (Lowe, 2018a). The appendix of that report (Lowe, 2018b) provided examples of the international recognition of New Zealand Quaternary researchers and geological archives as globally important or unique, and of New Zealand participation and leadership in globally-significant research and in decision making at the international level through INQUA and through associated activities/outlets involving Quaternary research and its dissemination.

Most of New Zealand's Quaternary researchers have been involved with INQUA-led projects or research groups, referred to as international focus groups (IFGs), that have enabled them to tackle globally-relevant research questions in multiple disciplines encompassed by the Quaternary. A number of the New Zealand-based researchers lead, or have led, INQUA projects, as noted in the table below in section 3.

Key questions about climate change in the past over a range of scales are a main focus because understanding the causes and timing spatially and through time requires a global and multi-disciplinary approach, with a Southern Hemisphere perspective especially important because of the general paucity of data in much of the hemisphere in comparison with that from the Northern Hemisphere. Future models of changing climate are largely contingent upon robust paleoenvironmental data, dated at high precision, being obtained from a range of archives throughout New Zealand and surrounding marine sediments by Quaternary scientists (IPCC, 2018). Increasingly, high-resolution past-environmental data are needed as are improved chronologies, to enable questions of leads and lags in past climate systems to be answered at a range of scales (both regionally and globally). Discussion about defining and characterising the Anthropocene continues unabated (e.g. Schneider and Haberle, 2019).

INQUA's five broad commissions (Coastal and Marine Processes; Humans and the Biosphere; Palaeoclimates; Stratigraphy and Chronology; Terrestrial Processes, Deposits and History) provide seed funding to IFGs and projects annually (on a competitive basis) to enable new and especially collaborative research to be undertaken on important topics that may incorporate revised or new methodologies. Many early career researchers (ECRs) especially have benefitted from the funding provided by INQUA through support to attend and participate in meetings and conferences through travel grants. In addition, the New Zealand and Australian Quaternary research communities have forged a close relationship over the past decade under the umbrella of the Australasian Quaternary Association (AQUA), which is affiliated with INQUA. AQUA members have been very active with biennial conferences hosted in New Zealand and Australia, the publication of biannual newsletters, and financial and in-kind support for the INQUA-led IFGs and projects.

- *Please comment on how the International Union membership has advanced New Zealand's research, science and technology reputation over the last year and/or presented new opportunities for collaboration in research fields of strategic importance to New Zealand.*

For the year 1 January to 31 December 2019, the main Quaternary-focussed event was the full INQUA Congress held in Dublin 25-31 July. With 2359 delegates, this event was the largest congress in INQUA's history (a full report on the congress was provided by Lowe, 2019). The following points encompass some of the advances made involving New Zealand scientists at the congress.

**Prof David J. Lowe** (Waikato University, Hamilton) was the New Zealand representative on the International Council. David co-convoked an AQUA meeting as well as participating in all the council meetings (see Lowe, 2019). His deputy was **A/Prof Alan Palmer** (Massey University). David is additionally an advisory board member of the Stratigraphy and Chronology Commission (SACCOM) of INQUA.



Many of the New Zealand and Australian participants at the Dublin congress. Around 20 participants are from New Zealand and 40 or so from Australia. In front centre is A/Prof Helen Bostock, who was an invited plenary speaker at the congress. *Photo: T. Barrows*

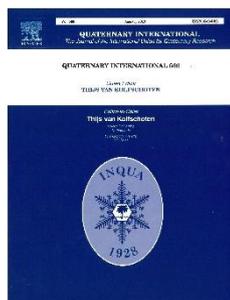
David was involved in co-convoking two sessions (60 papers in total) at the congress on behalf of the International Focus Group on Tephrochronology and Volcanism (INTAV) and the EXTRAS project (EXTending tephRAS as a global geoscientific research tool stratigraphically, spatially, analytically and temporally within the Quaternary) and in co-chairing a business meeting of INTAV. He also attended two meetings of editorial boards of Elsevier's journal *Quaternary Geochronology* and Wiley's *Journal of Quaternary Science (JQS)*. Fellow New Zealander **Prof Rewi Newham** (VUW, Wellington), a regional editor for *JQS*, also attended the editorial board meeting for *JQS*. INTAV is being reformed after 2019 into the Commission on Tephrochronology (COT) under the banner of the International Association for Volcanology and Chemistry of the Earth's Interior (IAVCEI), but it is planned that the commission will still retain linkages with INQUA, such as through the working groups of SACCOM.

Other New Zealand geoscientists were involved in leading or co-leading various INQUA-based projects and focus groups that ran sessions during the conference. Numerous papers were given within these sessions by New Zealand-based scientists from the universities and CRIs. The leadership roles included:

**Dr Andrew Lorrey** (NIWA, Auckland) – SHAPE project (Southern Hemisphere Assessment of PalaeoEnvironments)

**Dr Lynda Petherick** (VUW, Wellington) – SHeMax project (The Last Glacial Maximum in the Southern Hemisphere)

**Dr Helen Bostock** (University of Queensland, formerly NIWA, Wellington) – see photo above – was selected as one of only six plenary speakers. She gave an exceptional talk on past changes in the Southern Ocean to the entire congress.



A special issue of the INQUA-owned journal, *Quaternary International*, “**Quaternary International 500**”, was published especially for the conference to commemorate the 500<sup>th</sup> volume of the journal (van Kolfshoten, 2019). It provided a range of invited feature articles, including a New Zealand study by Loame et al. (2019), along with articles on the latest geological time scale for the Quaternary and its subdivision, and the origins of the Quaternary as a period in the Geological Time Scale (Cohen and Gibbard, 2019; Gibbard, 2019; Head, 2019).

The number of IFGs within INQUA is to be reduced after 2019, with each of the five commissions focussing on just one or two IFGs that will tackle big-scale projects somewhat along the lines of the INTIMATE initiative.

An important aspect of INQUA in recent years is the development of an early career researcher (ECR) group, and special sessions involving this group were featured at the Dublin Congress; a number of New Zealand ECRs were involved. Such researchers (including students) were by supported and mentored at the annual GNS Science “Quaternary Techniques Short Course” held at the National Isotope Centre at Gracefield (Lower Hutt) 9-10 May 2019 (speakers are listed at <https://www.gns.cri.nz/static/qtshortcourse/speakers.html>).

- *Please comment on what the New Zealand research sector, aligned with the International Union membership, can offer to international researchers, with a view to creating potential partnership, or cement New Zealand’s involvement, in the activity over the long-term.*

Very strong partnerships have been developed by New Zealand and Australian researchers through the IFGs and projects that are supported by INQUA. The advent of the Australasian INTIMATE project led to the more-or-less entire Quaternary communities of New Zealand and Australia becoming involved to develop new ideas and to publish benchmark papers and interpretations, along with a new template (the New Zealand Climate Event Stratigraphy) for interpreting climate change from c. 30,000 years ago through to c. 8000 years ago (e.g. Barrell et al., 2013; Reeves et al., 2013a, 2013b). That project morphed into the SHAPE project as noted above. Although centered on Australasia, the myriad of connections between New Zealand and Australian researchers and counterparts all around the world (including from South America and South Africa within SHAPE) means that international partnerships are strong and durable. For example, the INTAV executive (2015-2019) comprises representatives from New Zealand, Canada, UK, Japan, and Switzerland. Every four years the global Quaternary research community assembles for the full INQUA congress (held in Dublin in the Republic of Ireland July 2019), with New Zealand an important voice on the International Council and with numerous scientific sessions being convened by New Zealand and other scientists, i.e. the INQUA community provides one of the best examples of strongly connected and productive relationships in science that is tackling globally-relevant problems.

- Please comment on what has been planned for New Zealand to leverage off the opportunities identified in 1.2 or 1.3. If these are ongoing activities, please comment on the progress since last year's report.

The year 2019 was dominated by the full congress of INQUA that was held in Dublin in July. Thus, workshops and meetings were curtailed because most efforts of the New Zealand Quaternary research leaders were directed towards developing and convening symposia at the congress, as noted earlier. INQUA supported 300 ECRs to attend the congress (including some from New Zealand), as did AQUA (names not available).

Several Quaternary- or past climate-related sessions were at the fore at the recent Geoscience Society of New Zealand annual conference held at the University of Waikato in Hamilton (25-29 November, 2019), with Dr Nic Rawlence convening a session and leading with a keynote presentation "The ancient DNA revolution: how our understanding of the impacts of the Quaternary Ice Ages, and humans, on New Zealand's biodiversity is rapidly changing". Another session was "Lessons from Climates Past in Zealandia and Antarctica".

A number of national-extend Quaternary-centred projects continue at full-steam ahead, including (as one example) the *Lakes 380* project "Our lakes health – past, present, future" (<https://lakes380.com/>).

Next year, the AQUA community is meeting in Atherton (near Cairns), Queensland, for its biennial conference 20-24 July, 2020. The meeting will involve many New Zealand Quaternary researchers including ECRs.

The Commission on Tephrochronology (formerly INTAV) has submitted a symposium to the IAVCEI Congress being held in Rotorua in February, 2021.

## 2. Information relevant to the research community in the previous year

- Please list any New Zealander(s) participating in International Union work programmes and/or the Union council(s).

Person	RoleTitle
Dr Lynda Petherick (VUW)	Project lead of SHeMax (The Last Glacial Maximum in the Southern Hemisphere) in PALCOM (INQUA); co-convenor of SHeMax session at the INQUA Congress in Dublin, 2019; lead guest editor for special issue on SHeMax in <i>Quaternary Research</i> (open for submissions); Vice-president of AQUA executive (2018-19)
Dr Andrew Lorrey (NIWA Auckland)	Project lead of SHAPE (Southern Hemisphere Assessment of Palaeo Environments) in PALCOM until the end of 2019; co-convenor of SHAPE session at the INQUA Congress in Dublin, July 2019; New Zealand early career researcher representative on SACCOM (INQUA)
Professor Rewi Newnham (VUW)	Regional editor for the <i>Journal of Quaternary Science</i> ; member of advisory editorial board of <i>The Holocene</i>
Associate Professor Peter Almond (LU)	Member of AQUA executive (2016-18, 2019-20)
Dr Andrew Rees (VUW)	Member of the AQUA executive (2016-18, 2019-20)

Person	RoleTitle
A/Professor Helen Bostock (UoQ, formerly NIWA Wellgtn)	Plenary speaker at INQUA Congress, Dublin, July 2019
Dr Marcus Vandergoes (GNS Science)	Lead convenor of annual GNS Science “Quaternary Techniques Short Course”, Lower Hutt, May 2019
Prof Alan Hogg (UoW)	Member of editorial advisory board of <i>Quaternary Geochronology</i>
Assoc Prof Peter Almond (LU)	Member of AQUA executive (2016-18, 2019-20)
Dr Carol Smith (LU)	Co-editor of <i>Quaternary Australasia</i> (newsletter of AQUA)
Professor David Lowe (UoW)	Project lead of EXTRAS (EXTending tephRAS as a global geoscientific research tool stratigraphically, spatially, analytically and temporally within the Quaternary) in SACCOM (INQUA) through to end of 2019 (project finishes); formal advisor to SACCOM (INQUA) 2019-2023; NZ representative of RSNZ at INQUA Congress, Dublin, July 2019; past-president of INTAV 2015-2019; co-convenor of INTAV tephra session at INQUA Congress, Dublin, July 2019; member of advisory editorial boards of <i>Quaternary International</i> , <i>Journal of Quaternary Science</i> , <i>Quaternary</i> , <i>Quaternary Geochronology</i> ; co-guest editor special issue of <i>Journal of Quaternary Science</i> on tephra studies (Abbott et al., 2020; the volume comprises 27 papers and two editorials; to be published January 2020)

UoQ, University of Queensland; UoW, University of Waikato; LU, Lincoln University; VUW, Victoria University of Wellington

- Please list International Union activities over the last year of relevance to your research community and describe how these have been communicated.

Communication in all of these activities has been made via published papers in the international literature as well as via notices and reports in newsletters including *Quaternary Australasia* (newsletter of AQUA) (e.g. Mackenzie et al., 2019), *Quaternary Perspectives* (newsletter of INQUA), *IAVCEI News*, *Geoscience Society of New Zealand Newsletter*, multiple Facebook sites, and individual organisational (focus group or project) webmail services. David Lowe also reported to the New Zealand Quaternary community at least eight times in 2019 with brief updates or surveys on activities and issues via an email list (~60 names) of the main active Quaternary researchers in New Zealand. These emails were often copied to Australian INQUA representatives, initially Dr Jessica Reeves (Federation University Australia) and later Dr Scott Mooney (UNSW) (Scott represented Australia on the International Council during the INQUA Congress in Dublin in July 2019).

### 3. Additional comments

- Additional comments relevant to the International Union membership that you would like to share with the Society, MBIE, and/or the research community.

Professor Rewi Newnham (VUW) was elected a Fellow of the Royal Society of New Zealand in late 2019.

## 4. References

- Abbott, P.M., Jensen, B.J.L., Lowe, D.J., Suzuki, T., Veres, D. (editors) 2020. Crossing new frontiers: extending tephrochronology as a global geoscientific research tool. *Journal of Quaternary Science* (in press)
- Barrell, D.J.A., Almond, P.C., Vandergoes, M.J., Lowe, D.J., Newnham, R.M., NZ-INTIMATE members 2013. A composite pollen-based stratotype for inter-regional evaluation of climatic events in New Zealand over the past 30,000 years (NZ-INTIMATE project). *Quaternary Science Reviews* 74, 4-20.
- Cohen, K.M., Gibbard, P.L. 2019. Global chronostratigraphical correlation table for the last 2.7 million years, version 2019 QI-500. *Quaternary International* 500, 20-31.
- Gibbard, P.L. 2019. Giovanni Arduino – the man who invented the Quaternary. *Quaternary International* 500, 11-19.
- Head, M.J. 2019. Formal subdivision of the Quaternary System/Period: present status and future directions. *Quaternary International* 500, 32-51.
- IPCC 2018. Special report on global warming of 1.5° C. Intergovernmental Panel on Climate Change, Geneva.
- Loame, R.C., Villamor, P., Lowe, D.J., Milicich, S.D., Pittari, A., Barker, S.L.L., Rae, A., Gomez-Vasconcelos, M.G., Martinez-Martos, M., Ries, W.F. 2019. Using paleoseismology and tephrochronology to reconstruct fault rupturing and hydrothermal activity since c. 40 ka in Taupo Rift, New Zealand. *Quaternary International* 500, 52-70
- Lowe, D.J. 2018a. Quaternary research in New Zealand and relationship to the International Union for Quaternary Research (INQUA). Annual Report for 'Catalyst Fund: Influence' for 2017 (with Appendix A). School of Science, University of Waikato, Hamilton, 24 pp.
- Lowe, D.J. 2018b. Quaternary science in New Zealand: report to the Catalyst Fund. *Quaternary Australasia* 35 (1), 10-14, with Appendix A "Summary of Quaternary-related research in New Zealand and relationship to International Union for Quaternary Research (INQUA) (17 pp.) at <http://aqua.org.au/wp-content/uploads/2018/06/Quaternary-NZ-issues-summary-2018.pdf>
- Lowe, D.J. 2019. Report on international union meeting attendance: INQUA Dublin 25-31 July, 2019. *Report for Catalyst Fund: Influence*. School of Science, University of Waikato, Hamilton, 10 pp.
- Mackenzie, L., Moss, P., Mooney, P. 2019. A Quaternarist's guide to attending INQUA. *Quaternary Australasia* 36, 27-28.
- Reeves, J.M., Barrows, T.T., Cohen, T.J., Kiem, A.S., Bostock, H.C., Fitsimmons, K.E., Jansen, J.D., Kemp, J., Kraus, C., Petherick, L., Phipps, S.J., OZ-INTIMATE Members 2013a. Climate variability over the last 35,000 years recorded in marine and terrestrial archives in the Australian region: an OZ-INTIMATE compilation. *Quaternary Science Reviews* 74, 21-34.
- Reeves, J.M., Alloway, B.V., Barrows, T.T. (editors) 2013b. Linking Southern Hemisphere records and past circulation patterns: The AUS-INTIMATE Project. *Quaternary Science Reviews* 74, 1-279.
- Schneider, L., Haberle, S. 2019. Global markers of the Anthropocene – workshop report. *Quaternary Australasia* 36, 29-32.
- Van Kolschoten, T. 2019. Quaternary International 500 – a milestone to be celebrated. *Quaternary International* 500, 2-4.

## 5. Signature:

Delegate:  (Prof David J. Lowe)

Date submitted to the Society: 5 December 2019

Please return this form to the Royal Society Te Apārangi by email using the email address [International.Unions@royalsociety.org.nz](mailto:International.Unions@royalsociety.org.nz). For transparency reasons, we would appreciate if the report is additionally cc'ed to the President/Chair of the affiliated New Zealand organisation/national committee.

Note that all or parts of this report may be made assessable to the public on the Royal Society Te Apārangi Catalyst: Influence website and through a Catalyst: Influence newsletter.