

records needed to define it. The results will appear in an upcoming issue of EoS alongside report of progress from OZ-INTIMATE.

The Australian group held a meeting at the Australian Institute of Nuclear Science and Engineering (AINSE), Lucas Heights, on 16-17 December 2009. The meeting was organised and co-chaired by Jessica Reeves and Tim Cohen, with support from AINSE. A full meeting report is at [www.aqua.org.au/AQUA/attachments/OZ_workshop2009](http://www.aqua.org.au/AQUA/attachments/OZ_workshop2009_report.pdf)

[report.pdf](http://www.aqua.org.au/AQUA/attachments/OZ_workshop2009_report.pdf). Prior to the meeting, a strategy of dividing Australia up into climate regions had been adopted, and at the meeting, selected early career researchers presented syntheses of available records for those regions. Paleoclimate modelling was also addressed alongside the climatic/geographic themes. The outcome of the meeting was the selection of co-ordinators and key continuous and fragmentary records on which regional climate event stratigraphies could be constructed. See www.aqua.org.au/AQUA/attachments/Key%20records.rtf.



Participants in the Oz-INTIMATE meeting at AINSE, December 2009.

It was also agreed that calibration protocols for dating methods used in each of the records would be established. Two of the milestones agreed upon were:

1) a poster with the key records from each of the regions and oral papers of 4 regional summaries (tropical, temperate, interior, Southern Ocean/Antarctic) to be presented in an OZ-INTIMATE workshop at the Australasian Quaternary Association (AQUA) meeting on North Stradbroke Island, July 11-15, 2010 (www.aqua.org.au/AQUA/aqua_conf.html), and

2) a workshop in December 2010 focussing on a continental scale synthesis involving identification of leads, lags and north versus south responses.

Upcoming meetings in NZ will be a workshop in late July after the AQUA conference finalising the EoS article on the NZ and Australian CES's, and one in February 2011, in preparation for the INQUA Bern Congress. Three INTIMATE sessions are envisioned for the Bern Congress, an AUS-INTIMATE session, a North Atlantic-INTIMATE session, and an INTIMATE IFG session. Proposals are being prepared at present.

Project 0907: INTREPID - Enhancing tephrochronology as a global research tool through improved fingerprinting and correlation techniques and uncertainty modelling

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'Active Tephra in Kyushu' – International Field Conference on Tephrochronology, Volcanism and Human Activity, Kirishima City, Kagoshima Prefecture, Japan, 9-17 May, 2010. Report by David J. Lowe and Kat A. Holt.

Introduction: In May, 2010, the inter-congress meeting of the INQUA International focus group on tephrochronology and volcanism (INTAV) was held in Kirishima City, southern Kyushu, Japan. INTAV was formed in 2007 at the International Union for Quaternary Research (INQUA) congress held in Cairns. It replaced SCOTAV (Sub-commission on tephrochronology and volcanism), COT (Commission on tephrochronology), and earlier tephra-related research groups dating back to the 1960s. Previous meetings of the group in the past two decades were held in the Yukon Territory, Canada (2005), France (1998), New Zealand (1994), and USA (1990). The venue for the 2010 meeting was the main hall of the Kokobu Civic Centre in Kirishima City, which was very generously provided free of charge by the Kirishima authorities in return partly for the delivery of two public lectures, one by David Lowe ("Connecting with our past: using tephras and archaeology to date the Polynesian settlement of Aotearoa/New Zealand") and the other by Hiroshi Machida ("Widespread tephras originating from Kagoshima occurring in northeast Asia and adjacent seas"), on Sunday 9 May. Participants were treated to a personal welcome by the Mayor of Kirishima City, Shuji Maeda, followed by what appeared to be a very special (and delicious) banquet. However, this spread turned out to be standard lunch and dinner fare provided by the centre's cafeteria and was enjoyed by participants throughout the meeting.

Mayor Maeda graciously invited the entire conference group to his personal residence for another spectacular and generous banquet on Monday evening which included the use of dining 'rooms' in caves cut into the c. 30 cal ka Ito ignimbrite. Traditional Kagoshima fare (all labelled in English) was put on, accompanied by the local alcohol 'sho-chu', which is made from fermented sweet potato. Commentary in Japanese by Shuji Maeda, including emphasis on the importance of his ancestry and family history, was fluently translated by Ayumi Yamamoto, an employee of Kirishima City's PR office. Ayumi earlier had

translated, with meticulous preparation, David's public lecture into Japanese.



Members of the 'Active Tephra' organising committee with Chairman Takaaki Fukuoka front right. *Photo: David Lowe.*

Participation: A total of 76 participants from 11 countries attended the INTAV-J conference, the largest number of participants ever for such a meeting (previously the record attendance was 64 at the triple-discipline meeting held in 1994 in North Island, New Zealand). Around 25 participants were students. Financial support obtained by the organising committee, especially from the INQUA-based INTREPID project (INQUA-0907) and from PAGES, enabled 12 'young scientists' to attend the conference. Further support, financial or 'in kind', was generously provided by the Tokyo Geographical Society, Paleo Labo Co., West Japan Engineering Consultants (West JEC), Asahi Co., Japan Association for Quaternary Research (JAQUA), and Kirishima City.

The conference organising committee was chaired by Takaaki Fukuoka (Rissho University) with great support from Vice-chairman Hiroshi Moriwaki, Secretary Takehiko Suzuki (Tokyo Metropolitan University, TMU), Kaori Aoki (Rissho University), Ryusuke Imura (Kagoshima University), Shinji Nagaoka (Nagasaki University), senior advisor Hiroshi Machida (TMU), and David Lowe (Waikato University, current secretary of INTAV).

The INTAV-led project INTREPID, "Enhancing tephrochronology as a global research tool", was launched at the conference and a number of papers presented were related to objectives within this project (see INTAV website).

A unique feature of the meeting was that two participants, Siwan Davies (Swansea University, current president of INTAV) and Rhian Meara (University of Edinburgh), were able to converse with each other entirely in Welsh! **Papers and trips:** Around 50 oral papers, including six invited keynote talks, were presented over three days alongside nearly 40 poster papers. Two one-day intra-conference field trips were organised for all 76 participants, and 37 participants later embarked on a three-day post-conference field trip across the island of Kyushu. Very warm and sunny spring weather was enjoyed on all the trips. However, a serious problem, an outbreak of foot-and-mouth disease, first reported on 20 April, in the Miyazaki Prefecture, which adjoins Kagoshima Prefecture, meant that a planned field trip to the outstanding Kirishima volcanic system (the centrepiece of Japan's first national park) had to be cancelled. In the event, and as a precaution, not a single participant from the conference set foot in Miyazaki

Prefecture, even remaining in the bus at an expressway viewpoint.

Almost without exception, the oral papers, especially those by students, were well prepared and presented to a very high standard (remarked on by many). Posters also received good attention. One of the highlights of the oral sessions was a special session, which drew local TV and newspaper coverage, on the recent Icelandic eruption from *Eyafjöll* volcano. Takehiko Suzuki as a representative of the organising committee was interviewed at length on the eruption, the role and importance of tephra studies, and the INTAV-J meeting. The special session comprised talks by Chris Hayward and Thor Thordarson (both University of Edinburgh) together with one by Siwan Davies (Swansea University). Together these three speakers presented and discussed some of the first results produced from this 'world stopping' eruption event. It became very clear during the course of the meeting that this series of eruptions will provide an excellent opportunity to enhance knowledge on cryptotephra from Icelandic volcanoes, which are being increasingly utilised for time control in the Northern Hemisphere ice-core as well as marine and terrestrial records. An INTAV-sponsored research project on the eruptives is being planned.



Fig. 2. Small mid-afternoon eruption of Showa crater on Sakurajima, 12 May. *Photo: David Lowe.*

Another feature was the series of high-quality 40-minute keynote addresses, all delivered with enthusiasm and expertise: Nick Pearce (UK) spoke on LA-ICPMS applications in tephrochronology; Duane Froese (Canada) spoke about Yukon-Alaskan Quaternary permafrost studies linked by tephras; Siwan Davies (UK) discussed research on tephras in Greenland ice cores; Mitsuhiro Nakagawa (Japan) outlined the petrology and eruption processes of Shikotsu and Aira calderas; Simon Blockley (UK) described tephra age modelling including Bayesian-based studies; and Takeshi Nakagawa (Japan/UK) reported the latest geochronological and analytical work on the exceptional Lake Suigetsu varve sequence.

Active tephra! Sukurajima volcano provided a (deliberately chosen) stunning backdrop for a tephrochronology meeting. The volcano has been in a state of ongoing activity since 1955, with approximately 8670 eruptions since then, and well over 500 eruptions already in 2010. Several small vulcanian eruptions occurred during the meeting, with the first on Tuesday afternoon, exactly as the meeting broke for coffee. City streets were replete with dustings of ash from previous events. Kagoshima resi-

dents noted wryly to some conference participants that an umbrella had three, not two, uses in southern Kyushu: to protect from rain, sunshine, and ash-fall!

Intra-conference field trips: These were prepared and led very capably by Hiroshi Moriwaki, Tetsuo Kobayashi, Ryusuke Imura, H. Hirakoba, N. Iwashita, T. Takeyama, and K. Nishizono. A field trip guide, in full colour, comprised a series of 10 thematic articles about Kyushu's climate, geology, soils, etc and then summarized information about the various stops (Moriwaki and Lowe, 2010). The first day of the intra-conference field trips (re-organised to replace the cancelled Kirishima volcano trip) began

with a visit to the Uenohara Jomon-no-mori archaeological centre, where remains of a c. 9,500 year-old Jomon-period village had been preserved under layers of ash from repeated eruptions from Sakurajima and other volcanoes. The group then travelled southwards towards Sakurajima itself. Sakurajima is a post-caldera stratovolcano, c. 26,000 years old, and has produced large plinian eruptions over its lifetime as well as much vulcanian and stromblian activity. It was formerly an island in Kagoshima Bay (hence the *jima* appellation), but during the Taisho eruption of 1914, lava flows from the eastern craters of the volcano linked the western flank of the volcano to Osumi Peninsula.

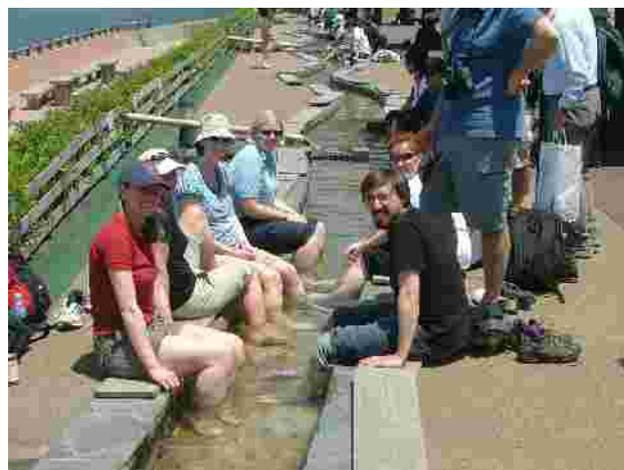


Participants of the 'Active Tephra in Kyushu' conference. Sakurajima volcano (background) erupted later that day. *Photo:* Koji Okumura.

While visiting the volcanic fan of Jigokugawara on the eastern flank of the volcano, participants were lucky enough to witness two small vulcanian eruptions from Showa Crater by a remarkable coincidence of good luck and management (this stop being the closest point to the active crater of the revised field trip). The two eruptions provided a real treat and really made the conference for many. After dragging the contingent of volcano-watchers back into the waiting buses, the trip proceeded to the western side of the volcano to the observatory to view more 20th century lava flows and other features. Another small vulcanian eruption took place whilst many in the group tucked into sweet-potato-flavoured ice creams.

The second intra-conference field trip took participants into the hills behind the town of Takatoge. The group first visited an exposure of tephra and soil layers overlying the c. 30 cal ka Ito ignimbrite. Most of these layers were derived from Sakurajima, and participants were quick to attack the section with newly purchased archaeological cutters (actually mini-gardening hoes). The group then visited the spectacular Tenjindan archaeological site, another Jomon era site which was recently discovered during construction of a new roadway. Various archaeological artifacts dating to beyond c. 26,000 years have been unearthed at this site, including pottery, china, stone tools, ovens, cooking pits, hunting traps, and the remains of dwellings. One of the oldest tephras from Sakurajima, Sz-Tko (c. 26 cal ka), provided a critical datum for constraining the timing of human settlement in the southern Kyushu region following the catastrophic Ito ignimbrite eruption at c. 30 cal ka, and numerous archaeological

remains have been found between the Ito ignimbrite and Sz-Tko tephra.



Six UK participants (seated) enjoying foot baths near Sakurajima. *Photo:* David Lowe.

After leaving Tenjindan, participants proceeded to the coast at Fumoto to see a spectacular exposure, c. 20–30 m high, of the deposits of the Aira tephra formation. This formation was produced by a huge, voluminous eruption (>450 km³) from Aira caldera at approximately 30 cal ka. The formation consists of a basal plinian fall (Osumi pumice fall) overlain by an intraplinian flow (Tarumizu ignimbrite) from the first phase of the eruption, followed by a post-plinian flow (Tsumaya ignimbrite) during phase two,

overlain by a huge thickness of massive Ito ignimbrite deposited during the climactic phase of the eruption.



Six UK participants (seated) enjoying foot baths near Sakurajima. *Photo: David Lowe.*



Part view of the Tenjindan archaeological site. Prominent yellow bed behind people is K-Ah tephra c. 7.3 cal ka. *Photo: David Lowe.*

Conference closing: The meeting was closed with another spectacular banquet, held this time at the Satsuma Brewery. Food, beer and sho-chu were consumed in vast quantities, topped off by an impressively powerful Taiko drumming performance by all-female drummers. The date and location of the next INTAV meeting will be decided at next year's INQUA congress in Bern, where an INTAV-led session "Enhancing tephrochronology and its application" is being convened by Siwan Davies and David Lowe.

Post-conference field trip: This three-day trip was prepared and ably led by Shinji Nagaoka, Yasui Miyabuchi, and Mitsuru Okuno, and a field trip guide was provided (Nagaoka et al., 2010). The trip traversed some spectacular landscapes and included visits (including via a ferry crossing) to the dramatic and rather ominous-looking Unzen volcano, including the new, steep-sided lava dome named Heisei-shinzan, as a feature of day 1. Deposits from the 1990-1995 Unzen eruption series included lava domes, block-and-ash flow deposits, and pyroclastic flow (density current) deposits. Tragically, a pyroclastic flow deposited on 3 June, 1991, killed 43 people including Maurice and Katia Krafft (French volcanologists) and

Harry Glicken (33), a young American volcanologist then undertaking post-doctoral studies at TMU. Older tephra, lahar deposits, and debris flows were also visited.



Michael Turner examines Aso fall deposits, Aso-A (top) to Aso-D in a tunnel at Nago village, ~15 km east of Aso caldera. *Photo: David Lowe.*

Coastal section of c. 30 cal ka Aira tephra formation: Omumi pumice fall (base of cliffs), Tatumizu ignimbrite (bedded unit above base), and thick, massive Ito ignimbrite. *Photo: David Lowe.*

Day 2 featured the extremely impressive, 20- to 25-km-wide, Aso caldera and associated deposits and volcanoes. Aso caldera was formed by four large eruptions (Aso-1 to Aso-4 from c. 270 to 90 ka, respectively). Within Aso caldera, the summit crater of the basaltic-andesite to basaltic stratovolcano of Nakadake (1506 m asl) is currently emitting volcanic gas (mainly SO₂) and participants all noted the effect (stinging in the eyes, etc) of such gases as they traversed the active crater area. The crater lake of Nakadake is described as hyperacidic (pH = 0.4). A ropeway, road, boardwalks, and stalls, and the arrival of a Harley Davidson motorbike group (complete with a dog in a back-pack), all added to a slightly bizarre but immensely enjoyable, memorable, and instructive atmosphere amidst the landscape of ash deposits, blocks, and bombs. About 1 million tourists visit Nakadake volcano each year. Aso caldera had large numbers of flooded paddy fields on its extensive floor. After leaving Aso, participants viewed Aso-derived eruptives including fall and flow deposits beautifully exposed in three dimensions in an old tunnel accessed via a wonderful walk through languid, hilly countryside.

On Day 3 the featured volcanoes were Kuji and Yufi-Tsurumi and their products. At many stops on the three-day excursion, two very widespread tephra were frequently evident, namely the 7.3 cal ka K-Ah (Kikai-Akahoya) tephra and the c. 30 cal ka AT (Aira-Tn) tephra. The trip concluded at Beppu in time for participants to catch trains or planes or to stay overnight in the famous geothermal spa town.

Conclusion: Planning for the "Active Tephra in Kyushu" conference began in late 2007. The resultant meeting and associated field trips were extremely successful and worthwhile. As one participant remarked, "tephrochronology has never been so strong". The rise of emerging young tephrochronologists was especially prominent and augers well for future research and leadership in the discipline. The organising committee is to be congratu-

lated for a great effort that made the meeting professional, educational, inspirational, and friendly, and the genuine and generous hospitality of the hosts was greatly appreciated by all participants. Papers arising from the meeting are to be published in a special issue of *Quaternary International* that will also commemorate the career and contributions made by Emeritus Professor Hiroshi Machida of Japan. Support for the meeting from INQUA, including from executive member Koji Okumura (Hiroshima University), and from Brad Pillans (Australian National University), president of INQUA's Stratigraphy and Chronology Commission, was appreciated by the organisers and participants.

Acknowledgements: Kat Holt's attendance as a young scientist was supported by funding from the "Active Tephra" committee. David Lowe's attendance, as part of a wider research project and lecture tour, was supported by an invitation fellowship from the Japan Society for the Promotion of Science. The fellowship was organised by host researcher and colleague Hiroshi Moriwaki (Kagoshima University). Both KAH and DJL are very grateful for the support they were given.

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Project 0911: Decoding the Last Interglacial in the Western Mediterranean

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INQUA Project 0911 was proposed as an International tool to collect all the available data regarding to western Mediterranean climate (both terrestrial and marine) and its evolution during the Last Interglacial.

Last Interglacial coastal deposits have been widely studied around western Mediterranean countries, and many divergences have arisen about many items such as the number of highstands, height reached by sea level, or presence of warm equatorial fauna. Faunal content, sedimentary facies, number of highstands, etc. differ from one country to another. However, we must not forget that in the present Mediterranean coasts different settings behave in different ways. The responses to climatic signals are indeed different around the Western Mediterranean; these differences are observed today and must be interpreted or decoded from the Last Interglacial deposits.

Project 0911 has organized an International Workshop that will be held in Cagliari, Sardinia from 25th to 29th October 2010. This workshop aims to gather all the available information both from coastal and terrestrial settings, and to develop a common evolution model for the Last Interglacial in Western Mediterranean.

Special attention must be paid to long term karstic and lacustrine records, where the climatic signals are better

preserved and can help us in the interpretation of how climate influences the coastal evolution during last Interglacial times, or which were the land-sea interactions during the Last Interglacial. The analyses of coastal settings, including littoral caves, from sites located all around this basin, can give the necessary information to state the number and height of highstands that occurred during this interglacial.

Organizing Committee: The Workshop is organized by Salvatore Carbonis and Luciano Lecca (Università di Cagliari, Italy), Teresa Bardaji (Leader of P.0911, Universidad de Alcalá, Spain) and Ana Cabero (Universidad Nacional de Educación a Distancia, UNED, Spain).

An Italian-Spanish committee will act as Scientific-Organizing Committee, and it is composed by Fabrizio Antonioli (ENEA, Italy), Javier Lario (UNED, Spain), José Luis Goy (Universidad de Salamanca, Spain), Paolo Orrù (Università di Cagliari, Italy), Andrea Vacca (Università di Cagliari, Italy) and Cari Zazo (Museo Nal. CC. Naturales, CSIC, Spain).

See Forthcoming conferences, below.

Project 1004: Abrupt Climate changes and Environmental Responses (ACER)

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The ACER International Focus Group initiative has been built on global data syntheses of vegetation and fire regimes for the last glacial (MIS 4, 3 and 2: 73.5-14.7 ka) made under the QUEST Group on Abrupt Climate Change (<http://researchpages.net/QUESTD-O/>) and published in a special issue of *Quaternary Science Reviews* on "Abrupt climate changes and vegetation response" (2010). This group aims to understand the timing, frequency and amplitude of the rapid climate variability, the abrupt CO₂ and CH₄ changes recorded in ice cores and the feedback mechanisms involved. ACER is an initiative under the Commission PALCOMM on Palaeoclimatology.

Since the identification of the millennial-scale climate variability in ice and marine archives, Dansgaard-Oeschger cycles and Heinrich events, a number of questions remains open such as the regional expression of this variability, the oceanic and atmospheric mechanisms involved and the interaction with other forcings (e.g. ice volume, greenhouse gas and insolation changes). So far, modelling this millennial-scale variability and, in particular the D-O warming, is difficult in part because of the lack of well-documented paleoenvironmental reconstructions of surface and deep-ocean conditions, vegetation, fire regime, wetland extent and biogeochemical cycles over the last glacial.

Understanding the causes of abrupt climate changes is important in the context of being prepared for "climate surprises" in the future. However, evaluation of proposed mechanisms for abrupt climate changes necessitates developing a global view. It also necessitates understanding leads and lags between the different components of the earth system. Thus ACER requires the involvement of scientists from different biogeographic regions and with expertise on all the different Earth's reservoirs (land, ocean, ice). Thus, this is a timely project involving researchers from different countries and in which the international aspect is crucial.