The Neogene-Quaternary Newer Volcanic Province (NVP) of southeastern Australia is a well-preserved intraplate basaltic lava field containing >400 eruptive centres. The NVP initiated at ~4.5 Ma and continued to recent times, with the youngest volcanism dated at ~4,300 years. Given the protracted and recent history of volcanism, the NVP is considered an active volcanic province; however limited radiometric age information limits volcanic hazard assessment. The objective of the current study is to compile a precise and accurate chronology of NVP volcanism to establish eruption duration, episodicity and frequency. Although numerous K-Ar ages exist for older NVP basalts, age constraints on Holocene to Late Pleistocene volcanoes are limited to several ^{14}C, ^{36}Cl and ^{21}Ne results (~4 - 60 ka). Given the uncertainties in these methods and variable erosion of the lava flows, these results may underestimate the true age of volcanism. In recent years, the $^{40}Ar/^{39}Ar$ dating method has been applied to Quaternary basalts using whole rock samples. However, the precision of these analyses is limited by low K contents and low radiogenic $^{40}Ar^{*}$ yields. To test alternatives and improve precision levels, we have undertaken $^{40}Ar/^{39}Ar$ laser step-heating analyses of feldspar megacrysts entrained by Late Pleistocene NVP volcanoes. Anorthoclase and sanidine megacrysts (4 – 10 wt.% potassium) were selected from three Late Pleistocene volcanoes, Red Rock, Lake Bullen Merri and Mount Franklin. Laser $^{40}Ar/^{39}Ar$ analyses of crushed fragments yielded reproducible ages ranging from 111 ± 6 ka to 119 ± 20 ka (2 sigma). The concordance of the results suggests that excess $^{40}Ar^{*}$ contamination is minimal, although further analyses are warranted. These results suggest that, at least in some cases, crushed feldspar megacrysts may provide high precision ages for Quaternary volcanoes.

FROM THE TROPICS TO ANTARCTICA: INTEGRATING PALAEOCLIMATE ARCHIVES WITH CLIMATE SYSTEM MODELS

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The integration of proxy data with climate system models can provide new insights into the nature of the climate system. The proxy data can be used to constrain and evaluate the models, while the models provide a dynamical framework within which to understand the changes recorded by the proxies.
This presentation will use changes in the Southern Hemisphere climate to demonstrate the potential of data-model integration. A low-resolution climate system model is used to simulate the evolution of the global climate over the Holocene. The model simulations are then integrated with multiproxy records, and the resulting synthesis is used to study the role of natural forcings in driving climate variability and change.
In the tropics, the model simulates an increase in both the frequency and magnitude of El Niño events. The simulated trends are consistent with those recorded by fossil corals from multiple sites in the tropical Pacific Ocean. The data-model synthesis suggests that, on millennial timescales, changes in El Niño variability over the Holocene represent a response to orbital forcing. On shorter timescales, however, there is strong decadal-scale variability, accompanied by rapid switches between modes. This behaviour appears to be stochastic in nature, with considerable implications for our ability to simulate future changes in El Niño.
At high latitudes, the model simulates a minimum in Antarctic sea ice extent at around 5.5 ka BP, consistent with the record from both ice cores and marine sediments. The increasing sea ice cover during the late Holocene is associated with an increase in the rate of Antarctic Bottom Water formation, which causes a gradual cooling of the deep ocean. As with the tropics, the data-model synthesis indicates that changes on millennial timescales are driven by orbital forcing, but that stochastic internal variability dominates on shorter timescales.

AUSTRALASIAN CLIMATE VARIABILITY AND CHANGE DURING THE PAST TWO MILLENNIA: TOWARDS DATA-MODEL INTEGRATION

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Climate modelling plays a fundamental role in the study of the past two millennia. Models simulate the processes that occur within the climate system, and therefore provide a dynamical framework within which to understand past changes. By integrating climate model simulations with proxy data, it is possible not only to evaluate and constrain the models, but also to generate new insights into the nature of the climate system.
This poster will present results from climate modelling work conducted on behalf of the PAGES Aus2k Working Group. A climate system model is used to simulate the evolution of the global climate over the past 2,000 years. Different combinations of natural and anthropogenic forcings are applied, including changes in the Earth's orbital parameters, solar irradiance, volcanic emissions and greenhouse gas concentrations.
The model simulations are compared with high-resolution proxy data for the Australasian region. The comparison considers changes in both the mean state of the climate and the dominant modes of climate variability, particularly El Niño-Southern Oscillation. The model simulations are also used to assess the relative roles of different forcings in driving past climate variability and change, as well as to explore the physical mechanisms involved.

U-PB DATING OF FLOWSTONES: CHALLENGES, AGE MODELS AND SUCCESS STORIES

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Speleothems are well established archives of palaeoclimate information and their value is enhanced by their inherent suitability to U-series dating. U-Th dating provides both accurate and precise ages, but not beyond 500ka. U-Pb dating has seen major advances in recent years and the possibilities of this technique are both numerous and exciting. While much work has focused on dating stalagmites, in many archaeological and palaeontological settings, flowstones are useful targets as they can provide age constraints for the material associated with them. In many cases bulk U concentrations in flowstones are typically too low (<0.05 μg/g) to provide useful ages, however, and some form of pre-screening using, for example, laser ablation ICPMS traverses, is needed in order to select potentially datable layers with U concentrations 1 μg/g. Very small amounts of radiogenic Pb accumulated in young samples and a dominance of common Pb, even in Pb poor material, further complicates dating. In an effort to avoid problems associated with variable common Pb components, several sub-samples are normally taken from close proximity to each other along a single growth layer. Current age estimate errors are at best around 1% but sometimes approaching 10%. In relatively thin flowstone layers of under 10cm there are sometimes several U-rich layers suitable for dating but, in such cases, the resulting ages are often within error of each other. Efforts to constrain within-sample age variations are therefore focused on imaging and counting the micron-scale layers visible under UV microscopy. A flowstone sample specific chronology can be generated if these layers are assumed to be annual. Trace element profiles and thin secction petrography assist in identifying hiatuses. Flowstones from two of the sandstone cliff cave sites of Pinnacle Points on the southern coast of South Africa are U-Pb dated to ~1 Ma. Both samples display remarkable visible layering and were invesigated in detail using the approach outlined above.

PALEOHYDROLOGY OF THE SALAR DE ATACAMA (CHILE) IN THE LAST 70 KY FROM RIVER TERRACES AND HALITE CAVE MORPHOLOGY AND DEPOSITS

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The Salar de Atacama is one of the most arid places in the world with mean annual rainfall below 25 mm. In the past decades many palaeoclimate studies (pollen, lake sediments, palaeowetlands, fluvial records, salt, archaeology, etc.) have shown the Late Quaternary to be composed of an alternation of hyperarid and wet periods. Differences in the type of proxy used and in location (latitude, altitude and local conditions) make comparison among these records difficult. A study on river terraces along