Palaeoclimate record from groundwater of the Great Artesian Basin, Australia

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The Great Artesian Basin (GAB) is one of the largest artesian groundwater basins in the world, underlying more than one-fifth of the Australian continent. The water is stored in a multi-layered confined aquifer system. Earlier studies using different dating methods showed a wide range of water ages up to more than 400 000 years [1,2]. As the GAB aquifers constitute the major water source in this semi-arid to arid region their careful management is of great importance.

Study area of this project is the western margin of the GAB as part of the project "Allocating water and maintaining springs in the Great Artesian Basin" of the Australian National Water Commission. We aim to obtain a full record of palaeoclimate data over the last 30 kyr by analysing groundwater samples for dissolved noble gases and stable isotopes. Noble gas studies have proven to be a valuable tool for determining palaeotemperatures all over the world [3]. By examining the excess air component estimations of palaeohumidity can be made [4].

^{3}He, ^{4}He, Ne, Ar, Kr and Xe concentrations are measured using mass spectrometry. For dating mainly ^{14}C and ^{4}He, in some cases other radioisotopes, will be used. Radiogenic ^{4}He concentrations increase with distance along presumed flow lines. First results for noble gas temperatures of recent groundwaters correspond well to the mean annual air temperature in the study area (21.7°C).

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The rapid emplacement of the Val Fredda Complex, Adamello batholith, N. Italy

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Recent advances in U-Pb zircon geochronology have revealed the complexities of pluton construction, by multiple injections on 10-100 ka to Ma timescales [1, 2]. Using high precision U-Pb dating we are potentially able to determine timescales of magma generation, crystallization and emplacement within the crust. The potential exists to better understand magma forming processes with detailed high precision U-Pb dating and trace element analyses of zircon and titanite, combined with Hf isotope analysis of zircon.

The focus of this study is on the Val Fredda Complex (VFC) in the southern tip of the Adamello batholith, N. Italy. The VFC shows complex relationships among mafic melts that were injected into solidifying felsic magmas. Single zircon crystals, from the VFC, have been dated using CA-ID-TIMS, employing the ET2535 tracer solution for maximum precision and accuracy. The mafic units have apparent autocrystic zircons that indicate growth over a duration of 100 ka, with the majority of zircons crystallizing near the solidus, as indicated by ^{206}Pb/^{238}U zircon and titanite dates, both with permil uncertainties. Data from the VFC felsic units show more complex zircon populations, including xenocrystic, antecrystic and autocrystic zircons. Trace element ratios such as Y/Hf aide in our distinctions between autocrystic and antecrystic zircons. These felsic units have apparent autocrystic zircon growth over 100 to 200 ka, with zircons crystallizing near the solidus during the last 20 to 50 ka as indicated by titanite dates. Our data suggest that the oldest autocrystic zircon could be used to approximate the injection of the respective magma pulses into the host rock, whereas the youngest zircon and titanite could be used to approximate (final?) solidification. It appears that the five units from the VFC were injected into the crust between 42.58 Ma and 42.52 Ma and achieved the final solid state between 42.48 Ma and 42.42 Ma.

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