U-Pb (CA-TIMS) zircon geochronology of the late permian of Australia: Constraining the time scale between two major extinctions

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The Bowen and Sydney Basins make up a ca. 600 km long, NNW-trending series of basins in eastern Australia, filled with terrestrial sediments of late Paleozoic to early Mesozoic age. The basins are also important sedimentary archives of evolutionary events in eastern Gondwana during times that are characterized by two major extinctions (end Middle Permian and Permian-Triassic extinctions).

We present new U-Pb (CA-TIMS) zircon ages for several tuffs interbedded within the sediments, with the purpose of creating a time scale of the Upper Permian as recorded in eastern Australia that allows correlations with different parts of the world. Currently, these correlations mostly depend on carbon-isotope records as well as biostratigraphy and lithostratigraphy that are deemed unsuitable for constructing high-resolution chronostratigraphic framework in absence of robust and precise radio-isotopic ages. The existing SHRIMP U-Pb ages [1] on zircon have been shown to be compromised by inaccuracy and low precision when compared to what is achievable with the CA-TIMS method.

Initial analyses constrain a tuff bed within the Moranbah coal measures to an age of ca 255 Ma and a tuff within the topmost Bandanna Fm. to ca. 252 Ma (both with permil level pecision). The presence of additional volcanic layers throughout the Late Permian promises the construction of a chronostratigraphic framework for this terrestrial sedimentary record that allows correlation with terrestrial records from elsewhere as well as with the marine record. The study is aimed at integrating calibrated records from different parts of the world in order to establish the timing and mode of extinction events and recovery. Also, precise ages on the tectonic development of the Sydney and Bowen Basins will contribute significantly to the refinement of Gondwanan paleogeography and the assembly of Pangea [2], and accompanying large-scale paleoenvironmental and paleobiological shifts at that time [3].

[1] Roberts (1996) *Aust. J. Earth Sci.* **43**, 401–421.
[2] Klootwijk (2009) *Aust. J. Earth Sci.* **56**, 273–308.
[3] Veevers (2006) *Gondwana Res.* **9**, 231–260.

Riverine mercury contamination after the 2008 coal ash spill at the Kingston Fossil Plant, TN

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More than half of coal combustion products (CCPs) generated by power facilities in the U.S. is disposed in landfills and holding ponds. The hazards of mercury (Hg) and other toxic elements associated with CCPs is unknown, particularly if the wastes are accidently released to the environment. Leaching of Hg from the ash and methylation in river sediments could negatively impact aquatic ecosystems. In this project we investigated the impacts stemming from the accidental release of coal ash occuring in December 2008 at the TVA Kingston Fossil Plant in Harriman, TN. At this facility 4.1 million cubic meters of coal ash slurry was accidently released to the adjacent Emory and Clinch Rivers, the largest coal ash spill in U.S. history. Our field sampling in areas near this spill site demonstrated that the ash material was enriched in Hg (~0.15 mg/kg) relative to background sediment levels in the Emory (<0.08 mg/kg). Our sampling during the year after the spill demonstrated that total Hg in surface waters were less than the EPA water quality guidelines. However, in sediments near the spill, total Hg in the sediments were 0.11±0.03 mg/kg, greater than Hg levels in the Emory River upstream of the spill (0.06±0.03 mg/kg). Further downstream in the Clinch River sediments, average Hg content was greater (0.86±0.36 mg/kg), probably due to historical contamination from the Y-12 facility at Oak Ridge, TN. MeHg concentrations in the river sediments varied spatially and temporally and were generally unrelated to total Hg content. The percentage of total Hg as MeHg was largest at locations in the Emory River near the coal ash spill site and lowest in the historically contaminated Clinch River, indicating that conditions in the Emory River were more amenable to MeHg production. In the Emory, we also observe other water and sediment parameters (e.g. organic carbon, sulfide, sulfate) that suggest conditions favorable for mercury methylation by anaerobic bacteria. Our results highlight the need to consider the bioavailablity of the mercury to methylating bacteria and the potential for MeHg production when evaluating the hazards of CCPs with respect to mercury.