Past and modern weathering conditions in the Murrumbidgee basin (Australia)

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Continental weathering plays a substantial role in the long-term carbon system and perhaps also over much shorter timescales, but its controls at large scale are still debated. In recent years, lithium isotopes have become a useful tool for tracing chemical weathering conditions. This study aims to assess modern & past weathering conditions in response to climate fluctuations over the last 100,000 years in the Murrumbidgee River catchment (south-eastern Australia). To evaluate the palaeo weathering environment and how the weathering signal is transferred from source to sink, we investigated sediments from the modern Murrumbidgee River comprehensively. Lithium isotope ratios were measured on the <2μm fraction of modern sediments collected from river banks. Data from these sediments give insight on the potential effect of lithology and assess whether δ^7Li evolves during transport. With this understanding, we then evaluate the weathering regime of four palaeochannel deposits, with deposition ages ranging from 13ka to 105ka.

Results from monolithologic catchments of active river channels indicate that there is no lithological control on lithium isotope fractionation. This strongly suggests that changes in sediment source/river pathways are not responsible for past δ^7Li variations. Sediments from small tributaries show a wide range of δ^7Li (from -4.58‰ to +0.96‰). In comparison, the main Murrumbidgee river and its major tributaries, display a narrower range of δ^7Li values from -1.56‰ to -0.10‰. The large range of δ^7Li values in the small watersheds may be attributed to local variabilities driven by water availability, catchment size and soil thickness. In contrast, larger tributaries integrate an average behaviour of Li isotopes over a larger area and we observe no evolution of the sediment δ^7Li with distance. We will use lithium isotopes from four palaeochannel deposits to infer past weathering conditions in relation to climate change/variability over the last 100,000 years.