# Facies associations and the largest Neoproterozoic carbon-isotopic anomalies

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Carbon isotope ($\delta^{13}C$) excursions of >10‰ recorded in Neoproterozoic aged carbonate-bearing sediments are increasingly used as a monitor for changes in the Earth's biosphere through time. The basis for their utility as tracers of global-scale variability in the Earth's carbon cycle relies on the assumption that marine carbonates have precipitated in equilibrium with an isotopically homogeneous oceanic carbon pool that changes through time in response to the Earth's exogenic cycle. We present paired stratigraphic and isotopic ($\delta^{13}C$ and $\delta^{18}O$) data from key sections in the Amadeus Basin in central Australia (Bitter Springs Formation) and the Flinders Ranges in South Australia (Trezona and Etina Formations) to show that a systematic relationship exists between major lithofacies transitions and the isotopic variability that defines major features of the Neoproterozoic $\delta^{13}C$ record in all cases. The $\delta^{13}C$ inflection points that bracket intervals of highly enriched (+6‰) or depleted (-8‰) $\delta^{13}C$ values occur precicely along major facies transitions, which in turn record the rising or lowering of relative base level. Local variations in lithofacies are predicted to be insesnitive to changes in the glocal seawater $\delta^{13}C$ as no currently understood mechanism exists able to link these parameters. As such, the isotopic variability recorded here may be better interpreted within the context of the basins in which they accumulated where influences such as hydrologic isolation and diagenesis might impart a first-order influence on the $\delta^{13}C$ values recorded.