Organic Geochemistry of the Paleoproterozoic 'Here's Your Chance' Pb/Zn/Ag Deposit

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The 'Here's Your Chance' (HYC) deposit is the largest sediment-hosted Pb/Zn/Ag deposit in Northern Australia. Organic matter (OM) associated with the deposit has been strongly affected by hydrothermal alteration, and possibly overprinted by non-indigenous hydrocarbons carried with the mineralising fluid. Novel organic geochemical techniques have been applied to highly mineralised samples to study the depositional environment of HYC and further investigate the effects of hydrothermal alteration on OM in ore deposits.

A fraction of OM that was occluded within the kerogen/mineral matrix (Bitumen II) was isolated after hydrofluoric acid digestion. Bitumen II contained *n*-alkanes up to C_{38} with $\delta^{13}C$ -32 to -34 ‰ and a predominance of even carbon numbers, attributed to the activity of sulfate-reducing and phototrophic sulfur bacteria during ore deposition. Combined with $\delta^{34}S$ measurements of elemental sulfur and kerogen, these data fit a genetic model in which sulfate was carried with the mineralising fluid and reduced to sulfide by bacterial sulfate reduction.

Micro-Scale Sealed Vessel pyrolysis (MSSVpy) was conducted on an unmineralised sample from the host Barney Creek Formation, to simulate the effects of hydrothermal alteration on HYC OM. The addition of lead and zinc sulfides had a significant effect on the alteration of OM, possibly due to retardation of organic isomerisation reactions on the sulfide metal surfaces. These novel organic geochemical techniques have demonstrated great potential in application to ore deposit studies.