A fluid inclusion inventory for U, Cu and Pb-Zn deposits in the Proterozoic McArthur, South Nicholson and Mount Isa basins (Northern Territory and Queensland, Australia)

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The objective of this work is to summarize the available microthermometric data on fluid inclusions from a world-class metallogenic province hosting U, Cu and Pb-Zn deposits: the Paleoproterozoic to Mesoproterozoic McArthur Basin, Northern Territory, Australia. This basin shows exceptional preservation and has remained unmetamorphosed and relatively undeformed since ~1.5 Ga. To date, about twenty publications have been devoted to fluid inclusions in the McArthur basin. To the North, unconformity-related U deposits show ~150°C, 25-35 wt% Na-Ca-Cl brines with molar Cl/Br ratios of ~140 indicative of an evaporated-seawater origin. Those brines are continuously diluted by a hotter (150-200°C) low-salinity fluid. To the South, U and Cu deposits around the Westmoreland conglomerate and its underlying basement show ~250°C brines chemically similar to those from unconformity-related U deposits, also showing widespread dilution. There is no fluid inclusion data available for the giant McArthur River Pb-Zn deposit yet, but the similar Century deposit in the nearby undeformed part of the Mount Isa basin shows also an involvement of 120-150°C basinal brines and low-salinity fluids. Similar brines and low-salinity fluids have also been described along regional sandstones and faults, altered volcanics, and other Cu and Pb-Zn deposits within the basin. Collectively, the compiled data attest for large-scale lateral and vertical migrations of basinal fluids at the time of ore-deposit formation. However, it remains to be determined if one or several basinal brine reservoirs have been involved and what was the origin and importance of low-salinity fluids. Further work is planned to establish the metal and halogen content of the fluid inclusions in the different deposits by Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) analysis and to refine the geochronological data on economic and alteration minerals to better constrain the origin and nature of the ore-forming fluids and the timing of fluid flow. Ultimately it will be established whether the different deposits have formed from a single basin-scale diagenetic-hydrothermal systems or from distinct systems in space and time.