Geochronology and isotope geochemistry of syntectonic sinter deposits in active fault zones, central Australia

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Earthquake-producing intraplate faults occur in the relatively stable Australian continent and create surface fault ruptures in south–central Australia. We investigate silica and carbonate deposits that occur as widespread fracture filling and breccia vein systems in the Great Artesian Basin (GAB), central Australia. Our field studies in northern South Australia confirm that pre-existing regional fault systems were reactivated neotectonically and controlled the formation of late Quaternary carbonate vein and breccia deposits in local releasing bends of a sinistral strike-slip system. Calcite veins and breccias formed as hydro-fractures due to CO_2-rich fluid overpressure, a process commonly observed in seismically active geothermal systems worldwide [1]. Our observations of chalcedonic silica deposits in various locations in the GAB also evidence intense fracturing, veining and faulting. Such features are similar to GAB opal vein deposits that show repeated episodes of fluid injection and hydraulic extension fracture development in association with normal and reverse faulting in the host rock [2]. To constrain the timing of faulting events and determine the source and evolution of fluids mobilised during faulting episodes, we carried out geochronological, isotopic and trace element investigations of carbonate and silica deposits. $\delta^{13}C$ values (-2 to -7‰) of sampled carbonate veins are similar to mantle-like $\delta^{13}C$ signatures of CO_2 accumulations that occur abundantly in central Australian sedimentary basins [3]. In addition, recent He isotope studies of volatiles from artesian waters confirm the presence of mantle-derived fluid reservoirs in central-eastern Australian basins [4]. Preliminary results of U-series dating of carbonate veins indicate the discharge of pressurised CO_2 took place intermittently from 142 ± 2.9 ka to 1.2 ± 0.02 ka, in association with mantle degassing in response to active tectonics. Further geochronological and geochemical studies of carbonate and silica vein deposit are currently underway.

[1]] Uysal *et al* (2009), *Chemical Geology* **265**, 442-454
[2] Pecover, S.R. (2007), *Rocks & Minerals*, **82**, 103-115
[3] Boreham, C.**J**., *et al* (2001), *APPEA Jour.* **2001**, 523-547
[4] Italiano. *et al* (in press), *Chemical Geology*.