Episodic sub-seafloor hydrothermal activity determined by uranium-series disequilibrium in barite, eastern Manus backarc basin, Papua New Guinea

S. M. JOHNS[1]*, R. G. DITCHBURN[2], B. J. BARRY[2] AND C. J. YEATS[1]

[1]CSIRO Earth Science and Resource Engineering, ARRC, Kensington, WA 6151, Australia (*correspondence: johns_shannon@hotmail.com)

[2]Cosmogenic Isotope and Radiochemistry Laboratory, GNS Science, Lower Hutt 5010, New Zealand

The geochronology of sub-seafloor hydrothermal activity from several mineralized, active and inactive vent fields at Suzette and Pual Ridge, eastern Manus backarc basin, Bismarck Sea, Papua New Guinea, was established using the $^{228}Th/^{228}Ra$, $^{228}Ra/^{226}Ra$ and $^{226}Ra/Ba$ uranium-series disequilibrium methods for barite-rich samples. The hydrothermal mounds and chimney structures of Suzette and Pual Ridge are located on dacitic-rhyodacitic volcanic domes and ridges. Precipitation of hydrothermal barite was controlled by decreases in temperature and mixing of hydrothermal fluids with oxidized seawater. Repeated fluctuations in hydrothermal fluid temperature and chemistry resulted in complex sequences of barite and sulfide minerals lining vugs and conduits, whereas rapid cooling following fracture events led to precipitation of only barite and some Fe-oxide coatings on barite crystals. Within the hydrothermal mound structures, wide age ranges of barite from drill cores (380-5990 yrs BP) represent pulses of hydrothermal fluids through the altered volcanic and mineralized rocks; with younger ages (34-220 yrs BP) indicating more recent barite-precipitating fluid circulation accessing fractures, veins and vugs. Barite from chimney samples is, on average, younger (23-1680 yrs BP) than drill cores, with the majority precipitated between 23 and 41 years before present; reflecting the structural stability (standing life) of the chimneys, and possible influences from varying hydrothermal fluid chemistry or reactivation of vent fields. Three generalized age groups, representing major episodes of barite-precipitating hydrothermal fluid circulation, are resolved from Suzette (19-45, 810-1900 and 3740-4710 yrs BP, including 1σ errors); with the most recent ages recorded from both Suzette and Pual Ridge. Fast-spreading rates within the Manus basin, an abundance of faults and variable magmatic inputs are major factors controlling the frequency and longevity of these episodes of hydrothermal activity.