Geophysical Research Abstracts, Vol. 8, 05567, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05567

A felsic volcanic caldera setting and new age for Earth's oldest fossils in the 3.525 Ga Dresser Formation, Warrawoona Group, Pilbara Craton, Australia

M. Van Kranendonk (1), P. Philippot (2), K. Lepot (2), S. Bodorkos (1), F. Pirajno (1)

(1) Geological Survey of Western Australia, 100 Plain St., East Perth, Western Australia, 6004, Australia, (2) Laboratoire Géobiosphère Actuelle et Primitive, Institut de Physique du Globe de Paris, Case 89, 4 place Jussieu, 75252 Paris Cedex 05, France (martin.vankranendonk@doir.wa.gov.au / Fax: +618-9222-3633

Detailed stratigraphic and petrographic data is presented from surface outcrops and newly acquired drillcore intersections of the chert-barite unit at the base of the Dresser Formation. Results indicate a highly dynamic environment with deposition alternating between periods of quiet water carbonate sedimentation and periods of coarse clastic deposition associated with felsic volcanism, growth faulting and hydrothermal fluid circulation. Felsic volcanoclastic sandstone yielded a single population of igneous zircons with a U-Pb date of 3525 $\pm$ 2 Ma that is interpreted to be a depositional age, making this the oldest dated supracrustal rock in Australia.

Deposition commenced with precipitation of deep, quiet water marine carbonates above a thin basal conglomerate deposited on underlying pillow basalts, and continued to shallow water conditions, accompanied by stromatolite growth. Carbonate sedimentation was interrupted by periods of felsic volcanism and multiple pulses of hydrothermal precipitation of alternating silica-pyrite and silica-barite-sphalerite. Sandstone and diamictite beds with clasts of barite, pyrite-replaced stromatolite and felsic volcanic rocks indicate periods of uplift and erosion during felsic eruptive events. These were followed by renewed carbonate sedimentation during periods of subsidence. Textural observations indicate that pyrite laminates largely formed through replacement of sedimentary carbonate during hydrothermal events, although some pyrite laminates may represent direct seafloor precipitates. Thin carbonaceous films on surfaces of carbonate beds (probable biofilms) were preferential sites for pyrite precipitation during

hydrothermal alteration. The nearly complete replacement of stromatolitic laminates by pyrite may thus be used to infer a high concentration of organic material in these rocks and to provide further support for their biogenic origin. Barite crystallised in the very shallow subsurface (mm-dm) beneath pyritic laminates, and in deeper subsurface veins. Hydrothermal alteration of footwall basalts is zoned upwards from propylitic to argillic and advanced argillic, and includes widespread hydrothermal kaolinite: epithermal textures include bladed calcite and hydrothermal aragonite with colloform banding. These data indicate a high-sulphidation system with steam-heated acid-sulphate weathering under shallow water to subaerial conditions that accounts for the widespread occurrence of barite.

The interpreted geological setting is a submarine felsic volcanic caldera, with episodic emergence during periods of volcanism and hydrothermal circulation, followed by subsidence once volcanism and hydrothermal circulation had ceased. Hydrothermal circulation switched between pulses of higher temperature silica-pyrite alteration and lower-temperature silica-barite-sphalerite alteration. This alternation suggests mixing of higher-temperature magmatic water with cooler surface waters drawn down along syn-volcanic growth faults.