Early Archaean Collapse Basins, a Habitat for early bacterial Life.

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For a better definition of the sedimentary environment in which early life may have flourished during the early Archaean, understanding of the basin geometry in terms of shape, depth, and fill is a prerequisite.

The basin fill is the easiest to approach, namely from the well exposed, low-grade metamorphic 3.4 - 3.5 Ga rock successions in the greenstone belts of the east Pilbara (Coppin Gap Greenstone Belt and North Pole Dome) in West Australia and of the Barberton Greenstone Belt (Buck Ridge volcano-sedimentary complex) in South Africa. They consist of mafic to ultramafic volcanic rocks, largely pillow basalts, with distinct intercalations of intermediate to felsic intrusive and volcanic rocks and of silicious sediments.

The, partly volcaniclastic, silicious sediments of the Buck Ridge and North Pole volcano-sedimentary complexes form a regressive-transgressive sequence. They were deposited close to base level, and experienced occasional emersion. Both North Pole Chert and the chert of the Kittys Gap volcano-sedimentary complex in the Coppin Gap Greenstone Belt preserve the flat-and-channel architecture of a shallow tidal environment.

Thickness and facies distribution appear to be genetically linked to systems, i.e. arrays, of syn-depositionally active, extensional faults. Structures at the rear, front and bottoms of these fault arrays, and the fault vergence from the basin margin towards the centre characterize the basins as due to surficial crustal collapse. Observations in the Pilbara craton point to a non-linear plan view and persistence for the basin-defining fault patterns over up to 50 Ma, during which several of these fault arrays became superposed. The faults linked high-crustal level felsic intrusions within the overall mafic rock suite via porphyry pipes, black chert veins and inferred hydrothermal circulations with the overlying felsic lavas, and more importantly, with the cherty sediments. Where such veins surfaced, high-energy breccias, and in the case of the North Pole Chert huge barite growths, are juxtaposed with the otherwise generally low-energy sediments. Such localities are interpreted as sites of hydrothermal vents. Within this large-scale geological context, many environments on the micro-scale were habitable for life, such as hydrothermal vents and their vicinities, volcanic rock surfaces, sub-

surface sediments and sediment surfaces.

These early collapse basins, hosting this bacterial life, are only partially comparable to Earthly analogues. A resemblance with Venus' coronae and the chaos terranes on Mars is suggested.

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