A 2006 Nature paper, however, added weight to the microbial interpretation. The paper described several different kinds of stromatolites in the Strelley Pool Chert, such as big domes, big cones, little cones, waves, and even shapes looking like giant egg cartons

The 3426–3350 Ma Strelley Pool Formation (SPF) is a silicified, dominantly sedimentary unit within the Pilbara Supergroup, Western Australia. It is found widely across the East Pilbara Terrane, and it forms a prominent marker horizon and separates the largely volcanic 3520–3427 Ma Warrawoona and 3350–3315 Ma Kelly groups. It has become one of the key formations for study by astrobiologists, following reports of some of the world's oldest stromatolites.

Abundant contextural and morphological evidence has been presented over the last decade in support of a biological role in SPF stromatolite formation. This evidence is reviewed here, and additional data are presented from recent fieldwork carried out across the ~25 km of SPF outcrops in the East Strelley greenstone belt of the East Pilbara Terrane. In addition to contextural and morphological evidence, a compelling claim for early life requires geochemical evidence for biological cycling

Weblink :

http://www.google.com.au/imgres?q=strelley+pool+chert+stromatolites&um=1&hl=en&sa=N&rlz=1R2NDKB_enAU523&biw=1236&bih=589&tbm=isch&tbnid=gYO_Vc0t3N4uJM:&imgrefurl=http://www.sciencedirect.com/science/article/pii/S0301926807001234&docid=-u7RmtuEKLnZSM&itg=1&imgurl=http://ars.els-cdn.com/content/image/1-s2.0-S0301926807001234-gr1.jpg&w=657&h=580&ei=oqUoUcCMEIiOmQW4xIC4Aw&zoom=1&iact=hc&vpx=147&vpy=98&dur=7738&hovh=211&hovw=239&tx=150&ty=86&sig=111058864168421919818&page=2&tbnh=139&tbnw=157&start=20&ndsp=27&ved=1t:429,i:190

Abstract

The 3.43 billion-year-old Strelley Pool Chert, Pilbara Craton, Western Australia, contains compelling evidence of Early Archaean life in the form of kilometre-sized remnants of an ancient stromatolitic carbonate platform. Reviewing and building on earlier studies, we examine the fossilized remains of the platform to seek ecosystem-scale insights to Earth's early biosphere, examining the evidence for biosedimentation, and the importance and effect of different environmental processes on biological activity.

Both vertical and lateral trends show that stromatolite abundance and diversity are greatest in the area interpreted as an isolated, partially restricted, peritidal marine carbonate platform, or reef, where there is virtually no trace of hydrothermal or terrigenous clastic input. In contrast, stromatolites are poorly developed or absent among hydrothermal, volcaniclastic or terrigenous clastic sedimentary facies, and are absent in deeper marine settings that are laterally equivalent to shallow marine stromatolitic facies. Hydrothermal veins, some of which were previously interpreted as vents that exhaled fluids from which the stromatolitic structures precipitated, are shown to postdate the stromatolites. On the platform, stromatolite facies associations varied between different palaeoenvironments, but some stromatolite types occurred across different palaeoenvironments, highlighting the combined influence of biological and environmental processes on stromatolite formation. The regional distribution of stromatolites in the palaeoenvironment suggests a biological response to variations in water depth, sediment influx and hydrothermal activity with stromatolite formation favoured by relatively ‘normal’ shallow marine environments with low clastic/chemical sedimentation rates and no direct input from high temperature hydrothermal systems. The lithology, structure and fabrics of the stromatolites, and their close association with abundant evaporite crystal pseudomorphs, indicate that evaporitic precipitation was probably the dominant non-biological process that contributed to stromatolite formation. The study supports a biological interpretation for the origin of the stromatolites, and reveals compelling evidence for the conditions that favoured biological activity on the early Earth and formation of macroscopic biosignatures that could be preserved for most of Earth's history.

3.43 billion-year-old stromatolite reef from the Pilbara Craton of Western Australia: Ecosystem-scale insights to early life on Earth

- Abigail C. Allwood[a, b],
- Malcolm R. Walter[a],
- Ian W. Burch[a, b],
- Balz S. Kamber[c]

- [a] Australian Centre for Astrobiology, Department of Earth & Planetary Sciences, Macquarie University, Herring Road, NSW 2109, Australia
- [b] NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91024, United States
- [c] Department of Earth Sciences, Laurentian University, 935 Ramsey Lake Road, Sudbury, Ont. P3E 2C6, Canada

http://www.sciencedirect.com/science/article/pii/S0301926807001234

Beschreibung fuer Karte

Fig. 1. Geological map of the Pilbara Craton, showing major structural elements and location of the North Pole Dome (Modified from Van Kranendonk et al., 2006). MCB = Mosquito Creek Basin, MB = Mallina Basin. Numbers represent areas containing Strelley Pool Chert outcrops examined in the present study. 1 = East Strelley Greenstone Belt, 2 = Panorama Greenstone Belt, 3 = Shaw Gorge area, 4 = Coongan Greenstone Belt, and 5 = McPhee Dome, surrounded by Kelly Greenstone Belt. Reprinted with permission, Geological Survey of Western Australia, Record 2007-11.

Trace elements record depositional history of an Early Archean stromatolitic carbonate platform

- Abigail C. Allwood[a, c],
- Balz S. Kamber[b],
- Malcolm R. Walter[c],
- Ian W. Burch[c],
- Isik Kanik[a]

- [a] Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA, 91109, USA
- [b] Department of Earth Sciences, Laurentian University, 935 Ramsey Lake Rd, Sudbury, ON, Canada P3E 2C6
- [c] Australian Centre for Astrobiology, School of Biotechnology and Biomolecular Sciences, University of New South Wales, Sydney, NSW 2052, Australia

Abstract

Rare earth elements and selected trace elements were measured in 48 samples of carbonate and chert from stromatolites and associated facies in the 3.45 billion year old Strelley Pool Formation, Pilbara Craton, Western Australia. The samples show coherent REE+Y patterns that vary systematically with sedimentary facies. Chert samples from bedded cherts beneath the Strelley Pool Formation and from the upper bedded chert members in the formation show REE+Y patterns consistent with originating by precipitation from hydrothermal and mixed marine-hydrothermal fluids. In contrast, carbonates and cherts from the stromatolitic reef member share the essential shale-normalized characteristics of other Archean marine precipitates (LREE depletion, positive La and Gd anomalies, absence of a negative Ce anomaly and a strongly superchondritic Y/Ho ratio). The close correspondence between REE+Y signatures and independent sedimentary facies interpretations is viewed as strong evidence for the primary nature of REE+Y patterns. They can thus be used as a proxy for the fluids from which sediments precipitated. Mixing hyperbolae can be constructed that reproduce the chemistry of cherts and carbonates by mixing of hydrothermal and marine fluid endmembers throughout the entire vertical succession from beneath the Strelley Pool Formation to the uppermost cherts. The mixing hyperbolae provide semi-quantitative confirmation that the trace element compositions across the suite of cherts represent different mixtures of ambient seawater and hydrothermal fluids.

Our results indicate that the Earth's oldest supracrustal carbonates and associated cherts record important aspects of the REE geochemistry of the waters in which they precipitated, and provide valuable information on possible habitats of some of Earth's earliest biota.

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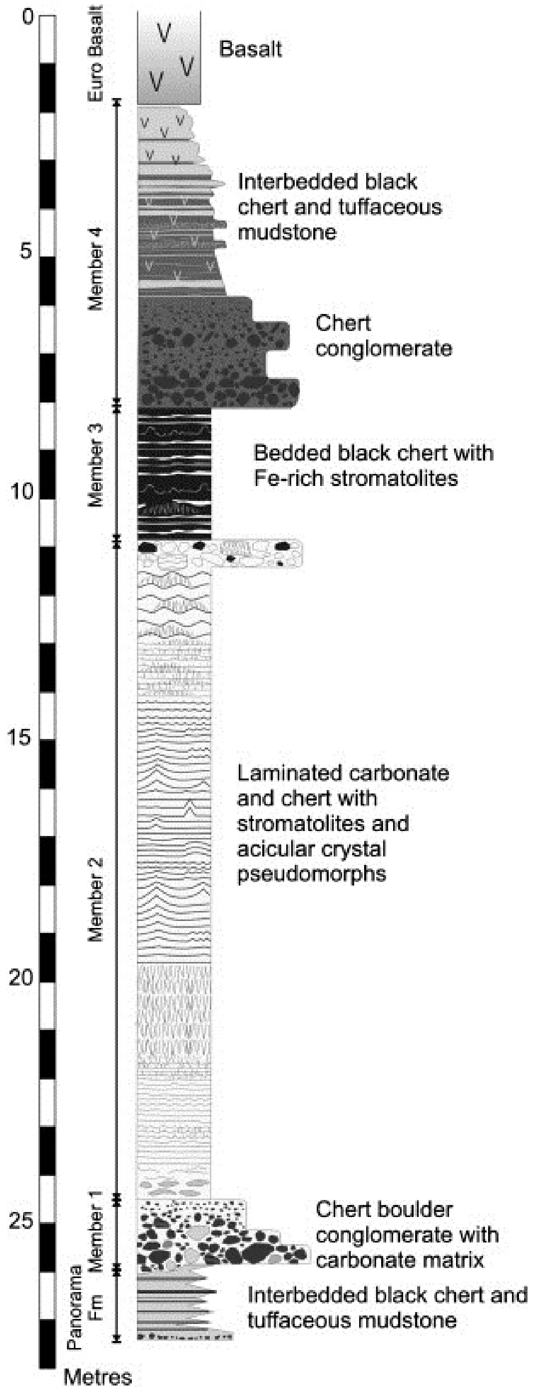

North Pole

An ironically named locality nearby is known as *North Pole* (21° 05' S. 119° 22' E.), no doubt for its heat. It is the location of rock formations considered to have evidence that puts the origin of life on earth back to 3,400–3,500 mya, due to stromatolites in particular rock sequences.[7][8][9][10][11][12][13][14][15][16] However this is disputed, and it is argued that stromatolites older than 3,200 mya are not the result of living organisms (the definition of stromatolites includes both living and abiotic causes), the small conical structures in the Strelley Pool formation (Warrawoona Group) being formed by evaporation and a dome structure from the North Pole chert (also Warrawoona Group) being formed by soft-sediment deformation.[17][18]

Multiple 3.47-Ga-old asteroid impact fallout units, Pilbara Craton, Western Australia ☆

- A.Y. Glikson[a], ,
- C. Allen[a],
- J. Vickers[b]

- [a] Research School of Earth Science, Australian National University, Canberra, ACT 0200, Australia
- [b] Department of Geology, Australian National University, Canberra, ACT 0200, Australia

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Abstract

A new microkrystite spherule-bearing diamictite is reported from below the impact spherule-bearing 3.47 Ga Antarctic Chert Member (ACM) at the base of the Apex Basalt, central Pilbara Craton, Western Australia and . The diamictite, defined as ACM-S2, consists of 0.6–0.8-m-thick spherule-bearing pebble to cobble-size chert–intraclast conglomerate separated from the main ACM-S3 by a ~200-m-thick dolerite and ~30-m-thick felsic hypabyssals. The microkrystite spherules are discriminated from angular to subangular detrital volcanic fragments by their high sphericities, inward-radiating fans of sericite pseudomorphs after K-feldspar, relic quench textures and Ni–Cr–Co relations. Scanning Electron Microscopy coupled with E-probe (EDS) and laser ICPMS analysis indicate high Ni and Cr in sericite-dominated spherules, suggesting mafic composition of source crust. Ni/Cr and Ni/Co ratios of

the spherules are higher than in associated Archaean tholeiitic basalts and high-Mg basalts, rendering possible contamination by high Ni/Cr and Ni/Co chondritic components. The presence of multiple bands and lenses of spherules within chert and scattered spherules in arenite bands within S3 may signify redeposition of a single impact fallout unit or, alternatively, multiple impacts. Controlling parameters include: (1) spherule atmospheric residence time; (2) precipitation rates of colloidal silica; (3) solidification rates of colloidal silica; (4) arenite and spherule redeposition rates, and (5) arrival of the tsunami. The presence of spherule-bearing chert fragments in S3 may hint at an older spherule-bearing chert (?S1). Only a minor proportion of spherules is broken and the near-perfect sphericities of chert-hosted spherules and arenite-hosted spherules constrain the extent of shallow water winnowing of the originally delicate glass spherules. It is suggested that the spherules were either protected by rapid burial or, alternatively, disturbance was limited to a short term high energy perturbation such as may have been affected by a deep-amplitude impact-triggered tsunami wave.

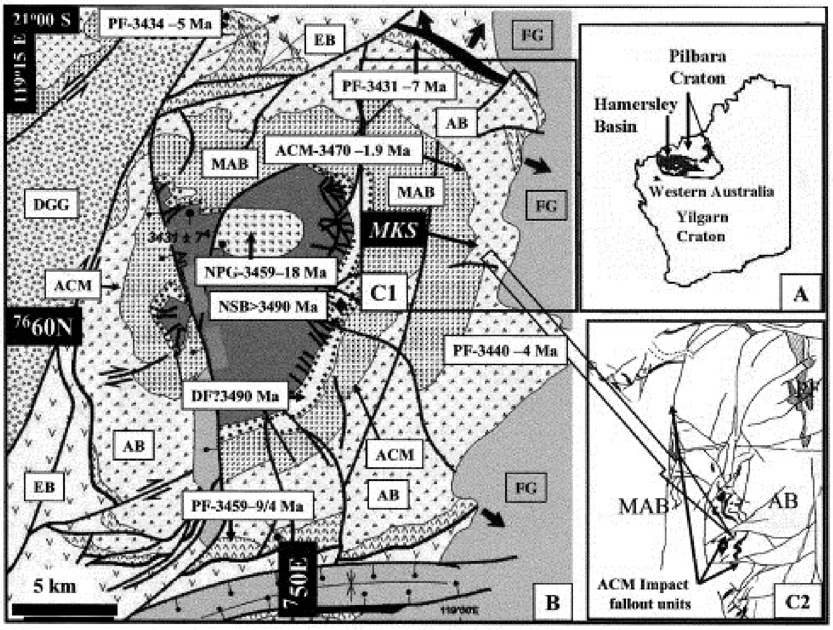

Fig. 1. Geological sketch map of the North Pole dome, central Pilbara, Western Australia (courtesy of M.J. Van Kranendonk, 2003). (A) Location of Pilbara Craton, northwestern Australia. (B) North Pole dome. Key: NPG, North Pole granitoid; NSB, North Star Basalt (basalts and komatiite); DF, Dresser Formation (arenite, barite, chert, stromatolites, mafic volcanics); MAB, Mount Ada Basalt (carbonated mafic volcanics); ACM, Antarctic Chert Member (chert, arenite, felsic volcanics); AB, Apex Basalt (pillowed basalt and komatiite, chert and arenite intercalations); Panorama Formation (felsic volcanics, arenite, stromatolites); EB, Euro Basalt (mafic volcanics);

DGG, De Grey Group (quartzite and conglomerate); FG, Fortescue Group (mafic volcanics). Ages are U–Pb zircon ages, except for a Pb–Pb age for the Dresser Formation. Stippled areas denote lithostratigraphic units with name abbreviation and ages marked in boxes; thick lines are faults; pinhead needles represent downfaulted blocks; short black arrows denote stratigraphic younging orientations; long black arrows are structural axes; C1 indicates area where microkrystite spherules were found; MKS (Microkrystite Spherules) is type locality of ACM impact fallout unit; C2 indicates ACM chert units (in black) within the lower Apex Basalt. Open arrow joins the ACM spherules type locality in C1 and C2.

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