Abstracts of Session 5 of the 1st International Biopetrological Congress (Shijiazhuang, China, Sept. 22-25, 2023): Biological and microbial structures in clastic rocks including MISS

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Microbially induced sedimentary structures (MISS) within Precambrian siliciclastic sedimentary rocks

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Abstract

Microbially induced sedimentary structures (MISS) are formed by means of interactions between microbes (e.g. bacteria and algae) via their cohesive extracellular polymeric substances and ambient siliciclastic and/or carbonate grains. Morphologically, MISS represents the architecture of microbial mats that widely occur in Proterozoic sedimentary rocks. Direct evidence for microbial life has been mostly documented from chert owing to permineralization and preservation prior to decay. In contrast, convincing microbial evidence has been difficult to trace in siliciclastic and carbonate sedimentary rocks as microbial bodies are rarely preserved and easily degraded therein. This is particularly true in Precambrian sedimentary rocks where widespread metamorphism and deformation tend to erase microbial evidence. Nevertheless, MISS can leave indirect mineralogical and geochemical evidence showing previous microbial activities, which is hardly achieved in purely physical or chemical processes without the involvement of microbes. As a result, MISS have been extensively and intensively investigated in siliciclastic and carbonate rocks as proxies to trace indirect evidence for microbial life, which have aided in our understanding of microbial roles that contributed to the formation of MISS and corresponding proxy structures in sedimentary rocks. MISS have been frequently documented from Paleo- to Neoproterozoic siliciclastic successions worldwide, which include microbially induced sand cracks/crack-fills, alternating dark and light laminae, oriented siliciclastic

and carbonate grains, gas domes, pyrite concentrated laminae, micrite laminae, alpha-petees, triradiate cracks, wrinkle structures, millimeter ripples, levelled ripple marks, organic carbonaceous laminae, microsequences, multidirectional linear ridges, erosional remnants and pockets and others. Despite similar geometry and dimension, these MISS can be effectively distinguished from abiogenic sedimentary structures by means of indirect mineralogical and geochemical evidence as an indication of microbial activities.

Analyzing Paleoclimatic Events Based on Astronomical Cyclones--A Case of the Northern Huizhou Depression in the Pearl River Estuary Basin

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Abstract

The cyclostratigraphy of Milankovitch theory provides new ideas and methods to establish a high-precision chronostratigraphic scale. The northern margin of the South China Sea is the largest Miocene sea basin in the world, and the use of astronomical cyclostratigraphy theory to establish a chronostratigraphic scale for the Miocene strata in this area is of great significance for its stratigraphic delineation and comparison. The natural gamma logging data from some depths of important wells in the center of the Huilu Low Bump in the northern part of the South China Sea are analyzed using the spectral analysis and filtering techniques of Matlab software, and its astronomical age scale is constructed. The results show that the power spectrum of the GR data sequence shows peak frequencies of ~68.8m, ~16.99m, ~7.81m, and ~3.74m, where the sedimentary cyclotron of ~68.8m and ~16.99m thicknesses corresponds to the long eccentricity cycle signals of 405kyr and 100kyr, and the sedimentary cyclotron of ~7.81m thickness corresponds to the 46kyr and 22kyr slope period signals, and the thickness of the sedimentary gyres shows a good linear relationship with the corresponding ages. By converting the depth domain into the time domain through astronomical tuning, the duration of the Hanjiang Formation in the Pearl River Estuary Basin is calculated to be 9.192 Ma, and the geological age of the entire Hanjiang Formation is roughly determined to be 9.192-16.5 Ma based on the established

astronomical age scale, and it is hypothesized that there was a cooling event during the period of 14-15 Ma, which is due to the decrease in the eccentricity of the Earth's interior. After the cooling event, the world warmed up rapidly and the climate reached the optimum period in the Middle Miocene.

Keyword: paleoclimate analysis; cooling event; Milankovitch cycle; Matlab; spectrum analysis