

C₁₆ AND C₁₈ PREDOMINANCE IN N-ALKYL-CYCLOHEXANES: A POSSIBLE EVIDENCE FOR ACIDOPHILIC THERMOPHILIC BACTERIA CONTRIBUTION TO THE MESOPROTEROZOIC BLACK SHALES

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The prokaryotic ecosystem may have predominated in Mesoproterozoic oceans. This idea is supported by the biomarker evidence from Barney Creek Formation (1.64Ga) of the McArthur Group in northern Australia (Brocks et al., 2005), Hongshuizhuang and Xiamaling Formation (1.45–1.3Ga) in North China Craton (Wang, 2010), and Atar Formation (1.1 Ga) in Taoudeni Basin, Mauritania (Blumenberg et al., 2012). However, the microbial compositions of the prokaryote-predominated ecosystems are less revealed. Here, we report a new research on the Hongshuizhuang and Xiamaling Formation in which the acidophilic thermophilic bacteria may have contributed to the organic matters.

The biomarker assembly suggests that organic-rich Hongshuizhuang and the Xiamaling shales were deposited in a cyanobacteria-predominated ecosystem (Wang, 2010). In these black shales, we detected a series of n-alkyl cyclohexanes which is characterized by an distribution with C₁₆ and C₁₈ even-number-carbon as predominant components. We infer that this anomalously enhanced abundance of C₁₆ and C₁₈ n-alkyl-cyclohexane probably derived from a unique microbial source. To our knowledge, just the acidophilic thermophilic bacteria (such as *Bacillus acidocaldarius*) can synthesize principal components of 11-cyclohexylundecanoic (C₁₇) and 13-cyclohexyltridecanoic (C₁₉) acid (De Rosa et al., 1971; Oshima and Arica, 1975) that could be the precursors of C₁₆ and C₁₈ n-alkyl-cyclohexane. We suggest that C₁₆ and C₁₈ n-alkyl-cyclohexane were the diagenesis product of 11-cyclohexylundecanoic and 13-cyclohexyltridecanoic acid, respectively, generated by decarboxylation under clay mineral catalysis. This means that these black shales may have deposited in the restricted epicontinental sea environment with low pH condition and hydrothermal effect. Considering that these shales are silica-rich and volcanic tuff-rich, we suggest that the tectonic setting for the formation of these sediments could be an arc-back basin. Perhaps this will be an important biomarker evidence for the reconstruction of the tectonic setting of the north margin of North China Craton during the period of 1.45–1.3Ga.

References

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