

Jinata Hot Spring as an Analogue to Early Proterozoic Oceans

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Understanding the biological dynamics of past environments relying solely on geological records is a difficult task. However, some contemporary environments may be analogous to past environments, and give hints to early ecosystem dynamics. In particular, iron rich hot springs represent a unique chance for researchers to investigate microbial metabolisms and biogeochemical processes that may be similar to the early Earth prior to the great oxygenation event.

Located in Shikine Island 160 km from Tokyo, Japan, Jinata Hot Spring is proposed as a Proterozoic analogue environment. Jinata Hot Spring has low oxygen, high temperature, reducing conditions, together with high dissolved Fe²⁺ (~60-200 μ M) concentrations. Additionally, it harbors a chemical gradient through its flow towards the ocean, mixing with oxidizing, neutral pH, saline water as well as undergoing gas exchange with the atmosphere. In only a few meters, Jinata hot spring provides a small-scale timeline of redox dynamics. Due to its closeness to the ocean, Jinata hot spring is influenced by tidal variations that make it an even more dynamic environment. However, the degree of tidal influences in its wide variations in pH, temperature and major elements content are unknown.

Here we report tidal dynamics of water chemistry at Jinata hot spring during a high amplitude tidal event. We discuss nutrient availability and redox dynamics of Jinata Hot Spring in relationship to microbial community structure and metabolism. It was found that tide has a marked effect on the chemical parameters of spring water. Biologic community structure during tidal event is also reported.

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