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# Hydrothermal oceanic environment and iron sedimentation in Satsuma Iwo-Jima Island, Kagoshima, Japan

Tomoaki Nagata[1*], Shoichi Kiyokawa[1], Ryo Sakamoto[1], Mami Takehara[1], Minoru Ikehara[2], Kazumasa Oguri[3], Shusaku Goto[4], Takashi Ito[5], Kosei E. Yamaguchi[6]

[1]Kyushu Univ., [2]Kochi Univ., [3]JAMSTEC, [4]GSJ, AIST, [5]Ibaraki Univ., [6]Toho Univ., JAMSTEC, NASA Astrobiol.

Introduction
Satsuma-Iwojima is small volcanic island, located 38km south of Satsuma Peninsula, 6km wide and 3km long. This island is located on the northwestern rim of the Kikai caldera (23km wide and 16km long). It contains active rhyolitic Iwo-dake and old basaltic Inamura-dake. Many hot springs identified along the shore of Iwo-dake. Brown to creamy white waters, which formed mixing with hot water and seawater, identified along coast of the Iwo-dake. It formed from dissolved Fe2+ ion in acidic hot spring to red colored ferrihydrite (Fe3+) (Shikaura, 2001).
Especially, half cleidoic environment of the Nagahama Bay preserved high rate sedimentation iron oxide and reddish color ocean. In this study, to understand the iron sedimentation in Nagahama Bay, we did 1) Sediment core samples (core sketch, CT scan, 3D analysis), 2) Sediment trap (using 1m cylindrical containers), 3) Long term temperature analysis of hydrothermal ocean floor using fixed-point thermometer.
Results and Discussion
1. Core sample: Core samples are 1m long. Stratigraphy, about 5cm from the top layer is unformed iron rich deposit, below layer is weakly consolidated iron rich orange color mud, the organic-rich black mud and volcanic ash layers (6 pieces, maximum thickness 6.5cm). The cross stratification and ferruginous fine-grained sediment layers could be confirmed by CT scan and 3D analysis. Layer of fine-grained volcanic ash have the feature of fining-upward. The bottom part has distinctive layers of pink ash which was felled in 1997 (base on report in Mishima Village). Therefore, the average of deposition rate of these core samples is 8cm/year.
2. Sediment trap: The unformed iron deposit piled up 7.5cm during 82days (2009/07/12?2009/10/03). Approximate deposition rate of red ferrihydrite is 2.8cm/month (33.3cm/year).
3. Long term temperature: The temperature of seawater in the Nagahama bay shows similar fluctuations to air temperature in measurement period, and indicated the lowest value in February. The temperature of hot spring in the chimney mount shows high value at low tide (about 46 deg), low value at high tide (about 40 deg). Moreover, the temperature shift according to the tide changed most, and the maximum at the spring tide. Sea water temperature changed from 27 deg (September) to 17 deg (February) with seasonal change, but hot spring temperature remained constant regardless of the seasonal change.
Conclusion
The 1m long core samples of Nagahama Bay have records during 12 years and show average deposition rate is 8cm/year. There are 6 ash layer in middle to lower part, and the cross stratification well preserved. Therefore, ash layers were affected by wave and water current. Fine-grained iron deposit layer without ash became deposited during quite term.
To compare with temperature shift of hot spring and tide, we could confirm that temperature is low at high tide, high at low tide, and temperature shift change maximum at the spring tide, minimum at the neap tide. In other ward, the amount of discharge of hot spring and the amount of seawater inflow vary inversely. If hot spring contains many iron oxide, spring tide and lower tide

might be best condition for thick sedimentation. The iron sedimentation, however, did not deposit, because high-speed inflow at these time (Ninomiya and Kiyokawa, 2009).
Moreover, sediment trap shows deposition rate of unformed iron deposit not affected by the stir is 2.8cm/month (33.3cm/year), and to compare with this result and deposition rate from core sample is 8cm/year. At least, about 3/4 iron hydroxide formed the Nagahama bay might be flowed out to the open sea during tidal effect.
From the above, in the Nagahama Bay, the fine-grained iron deposit (iron hydroxide) is provided and deposited at neap tide because neap tide is relatively quiet and has enough supply of hot spring. Most of them become the stratification through influence of stir by typhoons and heavy rain.

Keywords: Satsuma Iwo-Jima Island, Volcano, Hydrothermal activity