Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG66-05 Room:101B Time:May 22 10:00-10:15

Comparison of stratigraphy of ferruginous sediments with meteorological events for 11 years in Satsuma Iwo-Jima Island.

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1. Introduction

Satsuma Iwo-Jima Island, which has rhyolite volcano Iwo-Dake, is located 38 km south of Kyushu Island, Japan. Nagahama Bay is small port located in the southwestern part of the island. In the bay, shallow-water hydrothermal activities were identified. Breakwaters constructed around the bay produce semi-enclosed environment to the bay. This provides in the bay to retain reddish brown seawater that contains high density of iron-oxyhydroxides (Ninomiya and Kiyokawa, 2009, Kiyokawa et al., in press, Ueshiba and Kiyokawa, in press). Breakwaters divide Fishermans port in the bay into two sites (designated as E-site and W-site) where iron-oxyhydroxide sediments have accumulated. In W-site, it is identified that iron-oxyhydroxide sediment of 1.5 m has been accumulated since dredging in 1998.

We obtained 13 core samples from the bay. The samples have information on iron-oxyhydroxide sedimentation history in the bay. In this study, we report results of analyses of the samples by FE-SEM, XRD and XRF, and comparison between stratigraphy of the samples and meteorological data from 2000 to 2011.

2. Stratigraphy

We collected 12 cores from W-site and 1 core from E-site of Nagahama Bay with 1-m-long core. The obtained cores showed Fe-rich mud, tuff and sandy mud beds. We identified three thick tuff beds (T1, T2 and T3) and thick sandy mud (SM) bed in ascending order. The tuff beds, 1˜9 cm in thickness, were white and pink color and the SM bed was gray color. From smear slide observation, sandy mud bed was essentially a mixture of rock fragments, volcanic glass, and fine reddish brown grains. The tuff beds were mainly composed of volcanic glass. Fe-rich mud consisted minor volcanic glass and mainly fine reddish brown grains. Based on the FE-SEM observation, this reddish brown grain was 100 nm spherical shape material that included Fe elements.

3. XRF and XRD

XRF showed that these sediments contained high density SiO2 of over 50wt%. Especially, tuff beds contained SiO2 of ˜90wt%. Fe-rich mud bed contained FeO of 9 to 25wt%; other beds have FeO of ˜7wt%. Sandy mud and Fe-rich mud beds above SM bed contained Al2O3 of over 5wt%.

XRD analysis indicated that Fe-rich mud and tuff beds contained Si-bearing minerals such as quartz, cristobalite and tridymite. On the other hand, sandy mud and Fe-rich mud beds above SM bed had both Si-bearing minerals and Al-bearing mineral such as albite.

4. Meteorological event

Using 11-years-long meteorological data (rainfall, wind speed and barometric pressure) recorded in Satsuma Iwo-Jima Island, we identified three heavy rainfall (over 100 mm/day) and strong typhoon events (maximum wind speed over 40m/s): Three heavy rainfall events occurred in June 2000 (189 mm/day), June 2001 (124.5 mm/day), and June 2002 (122 mm/day) and three strong wind events by typhoon at 2004 (40.3 m/s, 54.3 m/s and 44.6 m/s), 2005 (43.3 m/s), and 2007 (50.2 m/s).

5. Discussion

Three thick tuff beds were correlated to heavy rainfall events in 2000, 2001 and 2002. The volcano Iwo-Dake has activated since 1990 (Shinohara et al., 2002). Ash accumulations of a few millimeters were observed on Nagahama Bay. It is insufficient to explain the observed thickness of the tuff beds. Therefore, the thick tuff beds were driven by rainfall from unformed tuff-rich sediment around rhyolite Iwo-Dake.

SM bed could correspond to typhoon events in 2004 to 2005. The strong typhoons drove sediment with Al-bearing mineral to Nagahama Bay and form as sandy mud bed. Since breakwater construction in 2006 at entrance of Nagahama Bay, influence of typhoon to the inside of the bay decreased, resulting no accumulation of sandy mud bed by 2007 typhoon event.

6. Conclusion

1) Rainfall over 100mm/day supply ash material to the seafloor of Nagahama Bay from Iwo-Dake. 2) Strong typhoon mixed sediments near the seafloor of Nagahama Bay and various minerals such as Al and Si-bearing material (quartz, cristobalite, tridymite and albite) resediment together on this Bay.

Keywords: Iwo-Jima Island, hydrothermal water, ferric sediment, weather, Kikai caldera