

Simple method of Identifying Sources of Supply of Beach Sand by Chemical Analysis of Sand Grains

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1. Where did this sand come from?

“Tiny particles were discovered in the capsule!”
The world swung from joy to despair over a few grains of sand carried from the Itokawa Asteroid by the Hayabusa spacecraft. The question, “where did this sand come from?” is an important challenge for the Coast Division.

Beach sand is maintained by a balance between sand washed away by the action of waves and wind and newly supplied sand. At locations where insufficient sand is supplied, coastline erosion occurs, exposing the hinterland to danger, so identifying the sources of sand is indispensable for coastline management.

The Coast Division is working cooperatively with Tokyo City University to develop methods of identifying the supply sources of sand. This report introduces research carried out along Kujukurihama Beach.

2. How is the source of supply of sand identified?

There are cases where coastal sand consists of a variety of different minerals, permitting researchers to hypothesize the sources of its supply by examining its mineral constituents under a microscope. But identifying minerals requires experience, and identifying minerals in more than 100 grains in a single sample is a labor-intensive task. One method of more easily identifying the constituents of sand is to use fluorescent X ray analysis to perform whole-rock analysis which quantifies the 10 major elements and 9 trace elements found in all sand.

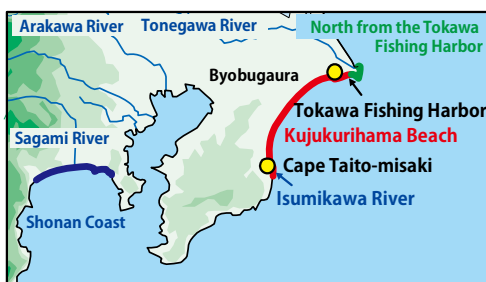


Figure 1. Coast where Whole-rock Analysis of Sand was Performed

3. Differences of sand supply sources revealed by chemical analysis

The results of analysis of sand and rock sampled from Kujukurihama Beach, the nearby coastline, inflowing rivers, and sea cliffs (Fig. 1) confirm that the quantities of Nb in the minerals (Nb/TiO_2) are completely different on the coastline north of the Tokawa Fishing Port and on Kujukurihama Beach, with Byobugaura as the northern boundary (Fig. 2).

Most of the Nb/TiO_2 on Kujukurihama Beach is almost equal to that at Byobugaura, and there are also points with low Nb/TiO_2 on Chojagahama Beach at the mouth of the Isumikawa River, suggesting that sand is also supplied from south of Cape Taito-misaki.

According to the results of analysis of other elements, origins vary according to minerals, and pyroxene on Kujukurihama Beach for example, originated in the same Kanto Loam as that on the Shonan Coast.

This reveals that it is possible to clarify differences in the origins of sand on coastlines by examining their chemical composition. In the future, more sand samples will be obtained from the hinterland and inflowing rivers, bringing us closer to finding the origins of the sand on Kujukurihama Beach.

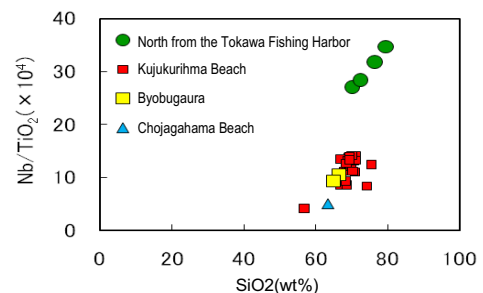


Figure 2. Example of the Results of Whole-rock Analysis of Coastline Sand

[Source]
A. Ishii, H. Hagiya, K. Watanabe (2010): Study of the origin of beach sediment based on the chemical composition of beach sand on the Kujukuri Coast, Annual Journal of Civil Engineering in the Ocean, JSCE, Vol. 26, 1125-1130