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Grain-Size Distribution of Source Areas of Asian Dust (Yellow Sand) in China

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Abstract

The source regions of Asian Dusts (Yellow Sands) in the western part of China are investigated, and the soil samples are collected samples for approximately 15 days during the spring of 2005. Particle sizes of sediments are analyzed and compared with each other. These grain-size analyses from the source areas can be compared Particle sizes between loess deposits and desert sands in western part of China and desert areas show distinctive differences. Loess deposits are predominantly composed of fine sands and silts. The distinction between the final characteristics of Asian Dust particles arrived in Korea and characteristics during transportation can be recognized comparison with the Asian Dust particles collected where the dust particles settled down. The characteristics of Asian Dust particle sizes can provide the basic information regarding the transportation history from the source region.

1. Introduction

There are much public interests regarding the characteristics of Asian Dust in desert areas and loess deposits. However, few published papers are available so far. The purpose of this study is to introduce the particle size distribution patterns of Asian dust which is collected at the western part of China on the spring of 2002.

2. Materials and methods

Top 1cm of soil deposits in the source areas is carefully collected using by plastic spoon, and stored in the plastic bag. The soil samples are moved to the laboratory for analysis and the left samples are preserved at the refrigerator.

Approximately 10g of soil samples are put in the beaker, and about 30% hydrogen peroxide are poured into the soil samples of beaker and boiled at 110 ℃ for the complete evaporation in order to get rid of organic materials in the soil sediments. After the organic matters are completely removed, 0.1 N hydrochloric acids are added in order to get rid of calcium carbonate. Then, the chemical treated samples are washed with distilled water several times to remove the chemicals such as the hydrogen peroxide and hydrochloric acid.

Samples are wet sieved with 4 ø sieve in order to divide between coarser than sands and finer than sands (i. e., silts and clays). Coarser sediments less than 4 ø are put in the beaker and dried in the oven, then weighted. Completely dried sediments less than 4 ø are

dry-sieved using by 0.5 ø sieves and weighted in each 0.5 ø scale. These weighted sample data are calculated and draw by the relative abundance (%). On the other hand, finer grain size greater than 4 ø is wet-sieved and collected into the 1 ℓ mass cylinder through a funnel. In the 1 ℓ mass cylinder, fine grained sediments are well mixed with distilled water at 500 ㎖. The fine sediments in the mass cylinder are extracted exactly 50 ㎖ with 50 ㎖ pipette, then are added 0.1% calgon solution. Then, the 50 ㎖ samples are put the into the ultrasonic cleaner and auto shaker in order to mix and spread well the particles. Particle size analysis was done with Sedigraph 5100D. The results of grain-size analysis are statistically calculated using basically Folk's method (1968) and Yi's method (2007). In these statistically methods, mean particle size, sorting, skewness and kurtosis are identified.

3. Results and discussion

The extensive areas of the source region soils are investigated in this study. The result provides informations regarding the characteristics of soils in the source of Asian Dust. The distribution patterns of particle sizes of soils from this study can be used for the basic information of Asian Dust characteristics. The study of particle analysis of the source region soils is very rare so far. The data from this study can be used for the Asian Dust workers.

The grain sizes of Lanzhou loess are composed of 5 weight % of sands, 72 weight % of silts and 23 weight % of clay. This is a typical grain size patterns of loess. Among silts, the most dominant grain size is the size ranging from 0.0442 mm (4.5φ) to 0.0156 mm (6φ) and their weight % are 38 %. These particles ranging from 0.0442 mm (4.5φ) to 0.0156 mm (6φ) are coincided with the particle size of Asian Dusts transported and arrived at the Korean Peninsula and Japanese Islands. Therefore, these particle ranges can be the source materials of Asian Dusts. Jiangyun loess also shows similar grain sizes with Lanzhou loess. The similar particle ranges are found in the Jiangyun loess. One sample ranges from 10 weight % of sands, 73 weight % of silts and 17 weight % of clays, while the other ranges from 10 weight % of sands, 73 weight % of silts and 25 weight % of clays. In the Jiangyun loess, grain sizes ranging from 0.0442 mm (4.5φ) to 0.0156 mm (6.0φ) are the most dominant particles and are composed of approximately 38-46% of the whole samples.

While, the Shapotou Desert areas are mainly composed of sands and characterized by coarse particle sizes which are big enough to be able to observe by the naked eyes and the sorting of samples are poor. with poor sorting. The grain sizes of Shapotou Desert areas consist of 99.98 weight % of sands, 0.02 weight % of silts with no clays. The dominant particle sizes range from 0.1768 mm (2.5φ) to 0.0884 mm (3.5φ) among sand.

The sediments from Minquin area are composed of 60 - 75 weight % of sands, 20 - 30 weight % of silts and 5-8% of clays. (5-8%). The most dominant particle sizes range from 0.125 mm (3.0φ) to 0.044 mm (4.5φ) which is composed of very fine sands and coarse silts. It is found from another soil samples in which medium sands and fine sands are also major primary particle sizes. The size of these particles ranges from 0.5 mm (1.0φ) to 0.177 mm (2.5φ).

4. Conclusions

1. Sediments from one of the source regions of Asian Dusts are analyzed. Particularly, loess and desert sediments from the western part of China are analyzed.
2. Loess deposits are predominantly composed of fine sands and silts. Desert areas including the Shapotou Desert are composed of sand dunes, and sands are the dominant particle sizes.
3. The different grain sizes are found from one region to the other. In the special case, the difference in grain sizes are found in the same areas. For example,

the Jiangyun plain is clearly distinguished by different grain sizes with the mixture of clays and sands.

References

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