Pinpointing the sources of trans-Pacific dust

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Airborne dust from Asia travels across the Pacific passport-free, carrying pollution, building soil, and coloring sunsets thousands of miles from its source. Identifying that source is important for understanding atmospheric circulation, contaminant pathways, and climate. But collecting enough airborne dust to pinpoint its source is challenging. Now, a team of researchers has developed a way to match microscopic quartz grains to the desert they blew in from.

The team, led by Kana Nagashima of the Japan Research and Development Center for Global Change, used cathodeluminescence (CL) spectral analysis of tiny quartz grains to distinguish between two major Chinese dust sources: the Gobi and the Taklimakan Deserts. "The cathodoluminescence spectra of single quartz grains provide crystal-chemical features in quartz, such as impurities and imperfections," explains Nagashima. Those features, she says, vary with the conditions of quartz formation and later geological events such as metamorphism.

Compared to the Taklimakan desert, source rocks of the Gobi desert include a high percent of volcanic rock. To determine if that and other differences in source rocks are reflected in dust, Nagashima and colleagues analyzed 268 quartz grains from the Gobi and 311 grains from the Taklimakan. The grains, collected from loess, riverbeds, and sand dunes, ranged in size from 5 to 16 micrometers. That matches the clay to silt size typically blown across the Pacific Ocean.

Previous studies provided an overall average value for isotopes such as strontium and neodymium, says Nagashima. "Instead," she says, "our CL

spectra shed light on the heterogeneity in grains."

The results: statistically robust clustering of crystal-chemical characteristics that matched the percent of different rock types from each desert. This suggests a way that very small samples (a few tens of microscopic grains) can reveal big information about the pathways and effects of long-distance airborne dust.

More information: Kana Nagashima et al. Composition of Asian dust from cathodoluminescence spectral analysis of single quartz grains, *Geology* (2017). DOI: 10.1130/G39237.1

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