

**Dispersion, fragmentation, abrasion, and organism
attachment of drift pumice from
the 2021 Fukutoku-Oka-no-Ba eruption in Japan**

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Appendix

Appendix 1 Estimation of transport speed of the drift pumice from the attached coral

We found the drift pumice with corals at KP06, FK05, FK06, FK08, AO01, KY03, HY02, IW02, YG02, AK03, and HO23 (Fig. 1 and Supplementary Table S3). Among them, Cape Erimo in Hokkaido Island (site HO23) was the northernmost site. In the following, the difference between the date when the 2021 FOB pumice was first found on Okinawa Island (17 October 2021 (65 days from the 2021 FOB eruption); Supplementary Table S1) and the date when the 2021 FOB pumice with coral was found in various locations is treated as the coral transport time. As for the distance, it is the estimated distance along the Kuroshio Current from Okinawa Island to the collection site.

The distance from Okinawa Island to Kii Peninsula, Wakayama Prefecture (KP06) is ~1000 km along the Pacific coast side, and the drift pumice took at least 247 days to travel that distance. The transport speed is estimated to be >0.05 m/s. The distance from Okinawa Island to Fukuoka Prefecture (FK05, FK06, and FK08) is ~1000 km along the Sea of Japan side, and the drift pumice took at least 255 days to travel that distance. The transport speed is estimated to be >0.05 m/s. The distance from Okinawa Island to Aomori Prefecture (AO01) is ~2400 km along the Pacific coast side, and the drift pumice took at least 281 days to travel that distance. The transport speed is estimated to be >0.10 m/s. The distance from Okinawa Island to Kyoto Prefecture (KY03) is ~1500 km along the Sea of Japan side, and the drift pumice took at least 285 days to travel that distance. The transport speed is estimated to be >0.06 m/s. The distance from Okinawa Island to Hyogo Prefecture (HY02) is ~1200 km along the Pacific coast side, and the drift pumice took at least 305 days to travel that distance. The transport speed is estimated to be >0.05 m/s. The distance from Okinawa Island to Ishikawa Prefecture (IW02) is ~1700 km along the Sea of Japan side, and the drift pumice took at least 306 days to travel that distance. The transport speed is estimated to be >0.06 m/s. The distance from Okinawa Island to Yamagata Prefecture (YG02) is ~2000 km along the Sea of Japan side, and the drift pumice took at least 329 days to travel that distance. The transport speed is estimated to be >0.07 m/s. The distance from Okinawa Island to Akita Prefecture (AK03) is ~2100 km along the Sea of Japan side, and the drift pumice took at least 329 days to travel that distance. The transport speed is estimated to be >0.07 m/s. The distance from Okinawa Island to Cape Erimo, Hokkaido Prefecture (HO23) is ~2500 km along the Pacific coast side, and the drift pumice took at least 351 days to travel that distance. The transport speed is estimated to be >0.08 m/s. Therefore, the maximum transport speed is >0.10 m/s.

Appendix 2 Mass estimation of drift pumice washed ashore in Southwest Islands

To calculate the weight of FOB drift pumice that washed ashore on the Southwest Islands from Amami-Oshima Island to Yonaguni Island at first appearance, we used coastline data (The Ministry of Land, Infrastructure, Transport and Tourism 2021) (Supplementary Table S7) and the weight per square meter values obtained in this study (Supplementary Table S2). To estimate the maximum weight of each island, we assumed that pumice drifted ashore uniformly along the coastline over a distance of 10 m from the shore. This depositional width is actually difficult to decide. In this paper, we consider that the most important assumption for calculating mass is that we assumed that drift pumice deposited uniformly along the shoreline. On the other hand, if the depositional width is halved or doubled, the total mass is still small (less than 2% of the original total mass). In fact, it did not drift to the whole shoreline, and a lot of it was deposited on the sandy beach. Although it is subjective from the field observation, we thought the depositional width on the sandy beach was wider than 5 m on average and narrower than 20 m. Therefore, it was assumed to be 10 m. For islands with data on the mass per square meter from more than one location, the maximum value was used (Supplementary Table S7). Because we did not have data on Okinoerabu Island in Kagoshima Prefecture, the mass per square meter of drift pumice on Yoron Island was used. For several islands with no data in Okinawa Prefecture, the mass per square meter of drift pumice on Okinawa Island was used. With these assumptions, we think that we can estimate the maximum mass of drift pumice deposition. We converted from mass to volume using the density ($0.5\text{--}0.7\text{ g/cm}^3$) of light-gray FOB pumice.

Reference:

The Ministry of Land, Infrastructure, Transport and Tourism (2021) Coastal statistics 2021 (The Ministry of Land, Infrastructure, Transport and Tourism). (Book title was translated by the authors) (in Japanese)