Glass Data Description

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1 Glass Data Description

We have collected data on the chemical composition of float glass samples. These data are available to the research community for use in research or instruction activities, with the following acknowledgment: "This database was created by S. Park, A. Carriquiry, and D. Peate, from Iowa State University and University of Iowa, 2018. A description of the data can be found in Park and Carriquiry, Annals of Applied Statistics, 2019." The complete citation is the following: Park, S., Carriquiry, A. Learning algorithms to evaluate forensic glass evidence. *Annals of Applied Statistics.* 13.2 (2019): 1068-1102.

These data were collected as part of an effort to construct a dataset to be put in the public domain. The dataset includes 31 panes of float glass manufactured by Company A and 17 panes manufactured by Company B, both located in the United States. The Company A panes are labeled AA, AB, ... , AAR, and the Company B panes are labeled BA, BB, ... ,BR. The panes from Company A were produced within 3 weeks (Jan. 3 - Jan. 24, 2017) and the panes from Company B were produced within 2 weeks (Dec. 5 - Dec. 16, 2016). To understand variability within a ribbon of glass, two glass panes were collected on almost all days in each company, one from the left side and one from the right side of the ribbon. In folder 'CompanyA', there are 31 Excel files each one containing measurements of 18 elemental concentrations on a pane from Company A. The folder entitled 'CompanyB' includes 17 Excel files corresponding to the 17 panes provided by Company B. Twenty four fragments were randomly sampled from each glass pane. Five replicate measurements were obtained for 21 of the 24 fragments in each pane; for the remaining three fragments in each pane, we obtained 20 replicate measurements. Therefore, each complete Excel file includes 165 rows of measurements for 18 elements. In some panes, there may be a fragment with fewer than five replicate measurements. The unit for all measurements is parts per million (ppm).

Analytical procedures to carry out the measurements followed the protocols recommended by ENFSI [Willis et al., 2015] and ASTM [ASTM-E2927-13, 2013]. Each forensic glass sample was broken into four quadrants, and then six

fragments from each quadrant were selected, making a total of 24 fragments per sample. Fragments from two samples were embedded in a 1" diameter epoxy mount, avoiding external glass surfaces, and the mount was polished flat. Each mount was carbon-coated and then given a quick wipe, which removed the coating from the glass but not the epoxy. This provided a visual contrast between the glass and epoxy, which made it easier to navigate around the mount to set points for analysis. Trace elements in forensic glass fragments were measured by LA-ICP-MS at the University of Iowa using a 213 nm NewWave laser ablation unit. Analyses were made using He carrier gas and an 80 μm spot, ablating at 10 Hz for 50 s, following a 30 s baseline measurement, with a fluence of 14 J.cm-2. A 45 s washout period was used between each analysis spot. Ablation products were analyzed with a Thermo X-series II quadrupole ICP-MS instrument. Tuning was done using the NIST612 glass, and the FGS-2 forensic glass standard was used to check that CeO/Ce was < 1%. Data were processed with the Iolite software [Paton et al., 2011], using FGS-2 as the calibration standard (using values from Latkoczy et al. [2005]) and 29Si as the internal standard (assuming a value of 72 wt% SiO2 as recommended by Willis et al. [2015] and ASTM [ASTM-E2927-13, 2013]). NIST1831 and DGS-1 were analyzed as quality control standards during each analytical session. One glass sample was analyzed per analytical session that lasted about 9 hours.

References

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