How Many Explosive Eruptions are Missing from the Geologic Record? Analysis of the Quaternary Record of Large Magnitude Explosive Eruptions in Japan.

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Explosive eruptions of the Japanese islands, which are included in The Large Magnitude Explosive Eruptions database of Volcano Global Risk Identification and Analysis (VOGRIPA) project, are analyzed to understand the preservation potential of eruptions with time. The Large Magnitude Explosive Eruptions database is a part of the VOGRIPA project and contains information about the age of eruptions, pyroclastic ejecta volume, VEI (Volcanic Explosivity Index), magnitude and data source of volcanic records. The database attempts to include all known explosive eruptions to 1.8 Ma and VEI magnitude 4 or greater. The database contains 696 explosive eruptions. Half of the eruptions in the database occurred within the last 65 ka. 77% of the total eruptions occurred since 200 ka; the oldest eruption in the database is 2.25 Ma. In addition, percentages by eruption magnitude are: VEI 4 (40%), VEI 5 (42%), VEI 6 (13%) and VEI 7 (5%). Because it is reasonable to assume that smaller eruptions occur more frequently, fewer VEI 4 eruptions than VEI 5 eruptions indicates that small eruptions are missing in this database. Survivor functions of smaller VEI eruptions show steeper decreases and suggest smaller eruptions are more rarely preserved. Therefore the discrepancy in smaller eruptions is attributed to erosion of units. These preservation trends are modeled by functions and detrended. The result suggests 97% of VEI 4 events are missing from the record after 100 ka, whereas 40% for VEI 5 to 7 are missing after this time period. The change of preserved eruptions with time shows two major trends. The likelihood of an eruption preserved in the last 10 to 100 ka follows exponential trend, suggesting that many young deposits are rapidly eroded and go unidentified in the geologic record. Older deposits have a gentler trend, indicating that once the deposit is initially preserved it is more likely to be identified in the geologic record than suggested by simple exponential decay. The relationship between VEI and logarithmic scale recurrence rate shows recurrence rate decays by a factor of about 8.6 for each successive VEI category. These results indicate that eruption probabilities based on long term recurrence rate must account for the potential for even large eruptions to be missing from the geologic record.