Does Climate Modulate Explosive Arc Volcanism? Re-Examining Pliocene-Pleistocene Distribution of Fallout Ashes at ODP Site 887, Northeast Pacific Ocean

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Time series of Pliocene-Pleistocene marine fallout ash beds provide evidence that the pacing of Pliocene-Pleistocene explosive arc volcanism may be influenced by the ice cycles [1,2]. We tested this hypothesis through a re-investigation of Pliocene-Pleistocene marine fallout ash beds recovered at Site 887 during the ODP Leg 145 in the northeast Pacific. The site is an ideal target, being located outside the eastern Aleutian-Alaska arc, which was partially covered by the Cordilleran ice sheet during glacial periods. Using new high-quality SHIL (section-half image logger) images of the core sections and paleomagnetic age model [3], we counted a total of 29 and 33 primary fallout ash beds in Holes 887A and 887C, respectively, within the last 5 million years. Ash bed thicknesses and existing glass shard data suggest that the ash originated from large-magnitude explosive eruptions of Aleutian-Alaska arc volcanoes (> 600 km distance) with minimum volcanic explosivity indexes (VEI) of ~5.3 to 6.8. Overall, the ash bed frequency increases by a factor of ~3 at the Pliocene-Pleistocene boundary. In addition, the ash bed frequency shows a marked short-term increase right after the intensification at the Northern Hemisphere glaciation (iNHG, 2.73

Ma) and just before the Pliocene-Pleistocene boundary (~2.58 Ma). This short-term increase coincides with abrupt increases in the mass accumulation rate of the ice-rafted debris (IRD) [4], and of the magnetic susceptibility, and is followed by a more gradual increase in the number of graded turbidite deposits rich in IRD. The data are consistent with a perceptible volcanic response to the rapid major warm-to-glacial climate shift at the Pliocene-Pleistocene transition. The documented large-magnitude eruptions, however, are too rare for investigating correlations with Milankovitch orbital pacing of the ice cycles. Possibly, such links can be investigated with a record of the more frequent smaller eruptions with VEI<5 that should be preserved in a more proximal volcanic record.