A Temporal Record of Plio-Pleistocene Volcanism of the Kurile-Kamchatka Arc From Odp Site 881, Northwest Pacific

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The Pleistocene is a period known for global cooling, glacial cycles, and increased volcanic activity, which suggests the possibility of a causal link between climate and volcanism. Tephra fallout beds preserved in marine sediments provide long-term and temporally highly-resolved records of explosive arc volcanism that allow tests of such links. We re-evaluated the tephra fallout record from Site 881in the northwestern Pacific Ocean that was recovered by the Ocean Drilling Program (ODP), a predecessor of the International Ocean Discovery Program (IODP). Site 881 is located 560 km to the east of the nearest volcanic sources of the Kurile-Kamchatka arcs. Plio-Pleistocene sediments from 0 to 4 Ma were drilled with APC coring with 100% recovery. New section half image logger (SHIL) images of the archive halves, shipboard visual core descriptions (VCD) and pass-through magnetic susceptibility tracks were used to identify a total of n=146 tephra beds. Tephra bed ages were calculated using a timescale based on shipboard paleomagnetic data. The minimum Volcanic Explosivity Indexes (VEI) were calculated assuming an elliptical dispersal area whereby the maximum dispersal axis is taken as the minimum distance between site and source after correction for plate convergence. At Site 881 the tephra bed frequency increases from 7 to 52 beds per Myr at the Plio-Pleistocene transition (PPT, at 2.59 Ma) and thus after the intensification of the Northern Hemisphere glaciation (iNHG) at 2.73 Ma. The range of the minimum VEI also increases from approximately VEI=6 in the Pliocene to approaching VEI=7 in the Pleistocene. Peak eruptions verging on VEI=7 and an increased tephra bed frequency occur at 2.5 Ma (about 100 kyr after the PPT) and at 1.1 Ma during the Mid-Pleistocene Transition (MPT). The VEI is also high between 0.41 to 0.15 Ma in the late Pleistocene. However, we also observed two volcanic hiatuses from 2.0 to 1.8 Ma, and from 0.68 to 0.51 Ma, respectively, where the ice cycles evolve without apparent influence on or by volcanism. Overall, the Site 881 tephra profile is consistent with the hypothesis that climate change precedes and drives an increase in Pleistocene volcanic frequency and magnitude.