

Figure F1. Location of giant piston cores in the Japan Trench offshore North Honshu, Expedition 386. Red triangle = Towada volcano with proximal outcrop of the To-Cu tephra (red square). Yellow squares = distal subaerial outcrop of the To-Cu tephra. To-Cu tephra locations and isopachs after Ishimura and Hiramine (2020). Map based on GeoMapApp.

Figure F2. Composite of the ~230 cm thick stratigraphic section study at Site M0090, Holes M0090B and M0090D. Because of the different penetration depths of Holes M0090B and M0090D (Strasser et al., 2023b), identical stratigraphic intervals have different section numbers. Samples were taken from the lower interval in Hole M0090B and the higher interval in Hole M0090D (brown shading). These intervals are separated by a ~50 cm thick sample gap. The lower interval, which is rich in silt and fine sand, was correlated (blue dashes) using X-ray core tomography (XCT) (Strasser et al., 2023a) and XRF (Lin et al., 2024). The To-Cu ash is estimated to occur at 386-M0090B-1H-15, 30 cm, approximately corresponding to 386-M0090D-1H-16, 83 cm, where the To-Cu ash was recently identified by Satoguchi et al. (2024).

Figure F3. Major element oxides of glass shard compositions, Site M0090, compared to the glasses of the distal To-Cu sites (Ishimura and Hiramine, 2020) and the Japan arc (Kimura et al., 2015). All glass composition normalized to 100% sum of oxides. A. K_2O vs. SiO_2 with division into K-series after Le Maitre (1989). B. K_2O vs. CaO . C. CaO vs. FeO^* . D. K_2O vs. TiO_2 after Aoki and Machida (2006).

Figure F4. CaO wt%. A. Site M0090 glasses. B. Distal To-Cu glasses (Ishimura and Hiramine, 2020) compared to glasses produced during early and later explosive eruptions of the Towada volcano (Ishimura, 2024).

Figure F5. Depth distribution of low-K and K-rich glasses, Site M0090. A. Layers of silt and very fine sand in clayey sediment; B. CaO of low-K and K-rich glasses. C. Average number of low-K and K-rich glasses identified in each sample by electron microprobe analyses. Note abundance reversal in the stratigraphically higher interval where low-K glasses are rarer than K-rich glasses. D. Weight percentage of coarse fraction $>27 \mu m$ in individual samples. E. MS from Strasser et al. (2025a; 2025b). The To-Cu ash bed previously identified by Satoguchi et al. (2024) is indicated. Pumice particles $>125 \mu m$ have K-rich compositions (~3 wt% K_2O) (see Table T2 for glass shards denoted with a P).