

Supplementary Information for Mixing states and composition of fine aerosol particles in the 2023 Canadian wildfire plumes detected in southern Greenland

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Figure S1. Spatial distributions of various aerosol types modelled by an aerosol model over Canada, USA, and
 15 Greenland during the sampling period. The box in the top right corner of each panel shows an enlarged model product
 over southern Greenland. The aerosol model products were developed by Meteorological Research Institute and
 Kyushu University and was supplied by the P-Tree System of the Japan Aerospace Exploration Agency (JAXA)
 (https://www.eorc.jaxa.jp/ptree/aerosol_model/index.htm)

Supplementary text 1. Vanadium-bearing particles

20 Vanadium (V)-bearing particles were occasionally observed (Fig. S2). In addition to the aerosol classifications shown in Fig. 1, we identified particles containing detectable amounts of vanadium (V) as V-bearing particles. They were present at relatively high concentrations during the background periods, on July 7, July 11–12, and July 30–31 (Fig. S2d). These V-bearing particles were primarily mixed with sea salt (52 %) and sulfate (28 %) and were categorized accordingly. Atmospheric V commonly originates from anthropogenic sources such as heavy oil emissions from ships (Abou-Ghanem et al., 2024) and

25 coal combustion (Schlesinger et al., 2017). They can be sourced from local ship emissions or long-range transport.

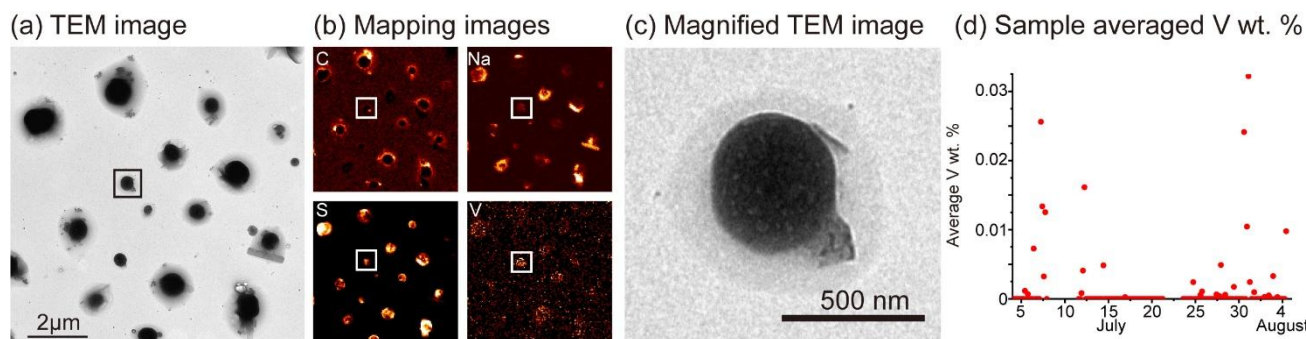


Figure S2. Representative images of V-bearing particles (a–c) and the sample-average V weight percentages during the sampling period(d). (a) Transmission electron microscopy (TEM) image of the sample with a high V weight percentage on July 31 2:00. (b) Elemental mapping images of C, Na, S, and V for the area shown in (a). (c) A magnified image of a

30 **V-bearing particle shown in (a) and (b).**

References

- Abou-Ghanem, M., Murphy, D. M., Schill, G. P., Lawler, M. J., and Froyd, K. D.: Measurement report: Vanadium-containing ship exhaust particles detected in and above the marine boundary layer in the remote atmosphere, *Atmospheric Chemistry and Physics*, 24, 8263-8275, 10.5194/acp-24-8263-2024, 2024.
- 35 Schlesinger, W. H., Klein, E. M., and Vengosh, A.: Global biogeochemical cycle of vanadium, *Proceedings of the National Academy of Sciences of the United States of America*, 114, E11092-E11100, 10.1073/pnas.1715500114, 2017.