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Degradation of mercury (Hg) signals on incipient weathering calls attention to the use of Hg from outcrops as a volcanic paleoproxy

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Elevated mercury (Hg) contents and ratios of Hg to total organic carbon (Hg/TOC) in sedimentary rocks have been related to large igneous provinces (LIPs). Recently, it was reported that primary Hg and TOC contents of sedimentary rocks could be altered by *extreme* weathering [1]. Although *incipient* weathering has a limited effect on organic matter (OM) content [2], its effect on Hg contents and Hg/TOC ratios is unknown. In this study, we investigate the effects of incipient weathering on Hg contents and Hg/TOC ratios in black shales from the Upper Permian Ravnefjeld Formation in East Greenland (GRL) by comparing outcrop samples to stratigraphically equivalent drill core intervals from the same area. We added directly correlated Upper Permian shales (drill core) from the mid-Norwegian shelf (MNS) to further enhance the comparison. Using detailed geochemistry and principal component analysis (PCA), we characterize OM as the main host of Hg. We attribute the difference in Hg contents between pristine samples from GRL and MNS to different Hg inputs (authigenic vs. detrital) during shale deposition. Within the Greenland dataset, we show the vulnerability of Hg contents and Hg/TOC ratios to incipient weathering. Compared with chemically and visually pristine drill core samples, visually pristine outcrop shale samples have up to 77% lower Hg contents and up to 64% lower Hg/TOC ratios. Based on these results derived from fresh-appearing outcrops of organic-rich shale, we demonstrate that it is essential to use drill core rather than outcrop samples to avoid misrepresentation of Hg signals in sedimentary rocks. Drill core provides accurate Hg concentration data that can be used as a tracer for primary events in the paleo-record.

[1] Charbonnier, G. et al. (2020) G-cubed, 21(2).

[2] Peng, B. et al. (2004) Environmental Geology, 45(8), 1137 - 1147.

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