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Evaluating the provenance of Permian-Triassic and Palaeocene-Eocene ash beds by high precision U-Pb and Lu-Hf isotopic analyses of zircons: linking local sedimentary records to global events

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Zircons are a powerful tool in geochronology and isotope geochemistry, as their affinity for U and Hf in the crystal structure and the low initial Pb and Lu allow for precise and accurate dating by U-Pb ID-TIMS and precise and accurate determination of initial Hf isotopic composition by solution MC-ICP-MS analysis. The U-Pb analyses provide accurate chronostratigraphic controls on the sedimentary successions and absolute age frames for the biotic evolution across geological boundaries. Moreover, the analyses of Lu-Hf by solution MC-ICP-MS after Hf-purification column chemistry provide a powerful and robust fingerprinting tool to test the provenance of individual ash beds. Here we focus on ash beds from Permian-Triassic and Palaeocene successions in Svalbard and from the Palaeocene-Eocene Thermal Maximum (PETM) in Fur, Denmark. Used in combination with whole rock geochemistry from the ash layers and the available geochemical and isotopic data from potential source volcanoes, these data are used to evaluate the provenance of the Permian-Triassic and Palaeocene ashes preserved in Svalbard and PETM ashes in Denmark. If explosive eruptions from volcanic centres such as the Siberian Traps and the North Atlantic Igneous Province (NAIP) can be traced to distal basins as ash layers, they provide robust tests of hypotheses of global synchronicity of environmental changes and biotic crises. In addition, the potential correlation of ash layers with source volcanoes will aid in constraining the extent of explosive volcanism in the respective volcanic centres. The new integrated data sets will also contribute to establish new reference sections for the study of these boundary events when combined with stable isotope data and biostratigraphy.