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Understanding volcanism at the PETM: Abundant volcanic ash layers in the Central Tertiary Basin of Spitsbergen, Svalbard

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During the early Tertiary, Svalbard developed a fold-thrust belt on its western margin with an associated foreland basin in the central-south of what is now Spitsbergen. This Central Tertiary Basin (CTB) is a syn-orogenic sedimentary basin in a strike-slip regime. The CTB contains the $\sim$1900 m thick Van Mijenfjorden group, a dominantly sandstone-shale succession that was deposited in a North-South extending basin. Sediments in this group display evidence of major transgressive-regressive cycles related to local tectonics and eustatic sea level change. This basin is ideal for study as it has been extensively cored for coal prospecting, allowing a suite of sedimentary logs across the basin to be considered. Prominent marker beds in this sedimentary sequence are 1-30 cm thick bentonites, formed from the chemical weathering of volcanic tuff deposits. In this study, we focus on 8 sedimentary logs across the CTB, spanning the Palaeocene to lower Eocene in age. Bentonites are common in the Palaeocene cores (Basilika and Grumantbyen formations), while rarer but still occasionally present in the Eocene Frysjaodden formation. The cores had between 3-12 observable bentonite layers that showed large variations in preservation and subsequent reworking. Roots and other finer organic material were common, especially when the bentonites were found next to coal seams. Geochemical affinities between ash layers were investigated to identify basin-wide depositional events, with the aim of elucidating the provenance of these ashes. This sedimentary sequence is of broader interest as it covers the Palaeocene-Eocene thermal maximum (PETM), an extreme global warming event driven by large releases to the atmosphere of CO_2 and/or CH_4, evidenced by a negative carbon isotope excursion in both the ocean and atmosphere. Potential sources include volcanism and associated gas release from intruded sediments, CH_4 hydrate dissociation, and/or the oxidation of organic matter. These formations are poorly dated, so an objective of further study is to provide a wider range of dated units through the formations. We also plan to assess whether the ash deposition had a local effect on proximal ecosystems, such as fertilisation or toxicity, and/or were contemporaneous with identifiable isotope excursions through the formations.