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Construction and environmental implications of a tuff cone erupted under cold-based ice: Harrow Peaks, northern Victoria Land, Antarctica

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Antarctica is host to the largest glaciovolcanic field in the world, active for the last 30 million years, at least, and coincident with the inception and widespread development of the Antarctic Ice Sheet. Yet it is also very remote, difficult and costly to access, and investigations require government funding and an extensive logistical infrastructure in order to undertake any fieldwork. It is therefore not a regular focus for glaciovolcanic investigations. Models for glaciovolcanic eruptions are based almost entirely on volcano interactions with wet-based (warm) ice, characteristic of non-Antarctic locations, and our knowledge of eruptions are thus very biased to that glacial regime, despite significant physical differences with cold-based ice. Conversely, Antarctica is the locus of the world's largest cold-based ice sheet. The potential is thus high for evidence being discovered for volcanic eruptions interacting with cold-based ice. The remains of a small volcanic centre on a narrow bedrock ridge in northern Victoria Land are interpreted as a mafic monogenetic tuff cone relict. The eruption occurred at 642 $\pm$ 20 ka, corresponding to the peak of the MIS16 glacial. From unusual characteristics of the deposits and the setting, it is interpreted as a product of an explosive eruption under cold ice, the first example of its type to be described. The lithofacies and the inferred mode of construction of the tuff cone will be described in this talk. Together with cosmogenic isotopic dating of associated erratics, a picture of ice sheet variations in two stages can also be reconstructed for the first time. The results of this study demonstrate, once again, the utility of glaciovolcanic studies as an important palaeoenvironmental tool, capable of deducing the physical characteristics and morphology of past ice sheets that otherwise would be unobtainable.