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A critical evaluation of the evidence for multiple Late Pleistocene eruptions of Laacher See Volcano

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The c. 12,900 BP Plinian eruption of Laacher See Volcano is one of the largest known volcanic events of the Late Pleistocene in the Northern Hemisphere. It buried proximal areas under tens of meters of pyroclastic flow, surge and fallout deposits and deposited a widespread tephra layer across much of Europe. Based on changes in tephra composition, bedrock lithology, vent location and eruptive mechanism, the proximal sequence was subdivided into Lower (LLST), Middle (MLST-A, - B and -C) and Upper (ULST) Laacher See Tephra. The geochemical variation allowed fingerprinting the products of the different eruptive phases and determining their spatial distribution within various fallout lobes. Depending on the height of the eruption column and prevailing wind direction at the time, most of the erupted tephra was dispersed to the north-east (LLST, MLST-B and -C) and south (MLST-A, -C and ULST) with a small fan identified to the south-west (exclusively ULST).
Early studies reported the occurrence of Laacher See Tephra from the Baltic Sea to northern Italy and Belgium. However, since then advances in methodology, in particular regarding the identification of cryptotephras, and a better understanding of the importance of such isochronous tephra layers as time markers have led to Laacher See Tephra being recorded at many more sites at even greater distance from source. In addition to revealing a much larger areal distribution of the fallout tephra, new geochemical analyses suggest a more complex pattern of dispersal of the products from varying eruptive stages and some sites even report two distinct Laacher See Tephra layers that have been interpreted as evidence of a precursor eruption. In order to assess the potential for multiple Late Pleistocene eruptions of Laacher See Volcano, we have compiled a database of sites that have yielded possible evidence of multiple (especially precursor) eruptions. We evaluate this data in relation to the sampling strategies used, depositional environment, geochemical composition, suggested date of eruption and consistency of evidence. We conclude that, at present, the evidence for precursor eruptions is weak.