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Late Pleistocene geomorphological evolution of Cerro Benitez (Última Esperanza, Southern Patagonia, Chile): new insights on the opening processes of the Mylodon Cave in a context of ice-lobe melting

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At its maximal extant ca. 40.0 ka, the Patagonian Ice Sheet totally covered the current Última Esperanza Province, on the Pacific Coast of Southern Patagonia. Located 51.5°S on the southern side of Cerro Benitez ca. 150 m a.s.l., the Mylodon Cave and surrounding cavities are the earliest known sites occupied by megafauna after the Última Esperanza ice-lobe retreat. Despite their palaeontological and archaeological interest, previous authors rarely questioned the environment in which the caves formed. Opening processes of the caves were subject to several hypotheses. Most of the authors assumed the caves were carved above a 150 m a.s.l. erosional terrace by the proglacial lake Lago Consuelo resulting from the retreat of the ice-lobe. However, previously published palaeontological material predating the earliest known lacustrine sediments recently challenged this hypothesis. In order to understand further the geomorphological evolution of the sites, we mapped the sedimentary formations and bedrock morphologies of Cerro Benitez after field observations, geophysical investigations and new dating on speleothems realised in 2017 and 2018. Our results tell a quite different story. On the southern side of Cerro Benitez, the ice-lobe carved a 120-150 m a.s.l. surface displaying a variety of abraded relieves and sculpted forms, locally covered by a thin till layer. Resistimetric profiles show the bedrock surface occurs at the same level inside and outside the caves, which suggests they were primarily open by synchronous subglacial processes. After a first stage of melting, the ice-lobe split in two residual ice tongues on both sides of Cerro Benitez. Final retreat occurred first on the northern side, where the proglacial lake carved a 150 m a.s.l. terrace on coarse fluvio-glacial deposits. On the southern side, the ice-tongue gradually retreated from the 120-150 m a.s.l. surface on which developed relict cirques. As the ice melted, the caves became accessible to megafauna. Absence of lacustrine deposits at this altitude suggests the ice-tongue dammed the proglacial lake on this side at least until it dropped below 120 m a.s.l. After the final retreat of the glacier, late periglacial conditions kept affecting the sediments inside and outside the caves. This work was supported by the French CNRS PICS GEOCEBE and the Chilean FONDECYT 1150845.