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How huge lava tubes form?

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Located in the north-eastern part of the island of Lanzarote (Canary Islands), the La Corona lava tube with its 7.6 km length and 10-20 m diameter is one of the world's largest volcanic cave complex.
Two different types of volcanic complexes characterized the area: the shield volcano building of the Famara complex (Mio-Pliocene activity) and the later Quaternary activity, which generated the pyroconduct (∼21 ka).
Different field surveys were conducted over the last two years in order to explore its three-dimensional geometry using 3D laser-scan (using a Leica HDS 7000 laser scan and the Leica Pegasus Backpack). These data allowed us to: 1) ascribe the origin of the tube to a process of inflation rather than overcrusting; 2) detect characteristic morphologies showing the effective involvement of thermal erosional processes on the tube development; 3) identify a reference level within the tube walls and relate its position to the geologic units surveyed in the field. We located the reference layer as being a lapilli horizon related to a pyroclastic fallout process found at the base of la Corona volcanic succession. From a mechanical point of view, the lapilli horizon represents a weak anisotropy, separating two different magmatic series of stiff lava flows and may have promoted the placement of the pyroconduct serving as an inception horizon. The outer and inner outcrops, visible for most of the total length of La Corona lava tube, were then fixed respectively on a DTM surface and the 3D model of the tube and interpolated to each other. This allowed us to obtain a reconstruction of the lapilli horizon surface, which mimics the paleo-topography at the time of the pyroclastic fallout. In order to clarify the inception and evolution of the pyroduct, it was also important to understand the geometrical relationships between the tube and its inner associated flows to pre-exiting Mio-Pliocene and Quaternary volcanic complexes. For this purpose, three sections of the tube walls have been sampled in order to perform geochemical analyses (major and trace elements) on both series separated by the pyroclastic event. These results suggest that both magmatic series belong to the Quaternary volcanism. Further information was derived from the analysis of the secondary mineralisation that has allowed to understand the evolution of the tube in the cooling and post-cooling phase.
Studying this exceptional example of terrestrial lava tube will permit a more detailed comparison and comprehension of the formation mechanisms of analogue features observed on other bodies of the Solar System, such as the Moon and Mars.