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A genetic classification of collapse calderas based on field studies, analogue and theoretical modelling

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Collapse calderas represent one of the most catastrophic volcanic events on Earth. Their potential role on climate changes and mass extinctions has been invoked several times and their direct impact on neighbouring or on relatively distal areas has been dramatically illustrated by some historical or recent eruptions. Additionally, collapse calderas are significant geological structures as in several cases they host ore deposits of high economic interest. Furthermore, collapse calderas are also of interest because they represent the culmination of long term geological processes that involve particular lithospheric dynamics, which conduct to an exceptional behaviour of some volcanic systems. Generally, studies on collapse calderas are based on fieldwork and tend to offer detailed descriptions of particular examples and to explain their origin from the available field data. The characterization of the caldera morphology and structure inform us about the subsidence mechanism and some geometrical aspects of the associated magma chamber, while the study of the caldera products addresses us to the magma chamber and eruption dynamics. In addition, a few field based studies offer a more generalised approach comparing different caldera types and classifying them according to coincidence in some of the apparent caldera characteristics. However, although field studies constitute an essential step in the study of collapse calderas, in most cases they do not allow to determine the exact mechanisms of their formation and, consequently, to classify calderas using criteria other than their resulting morphology or their assumed collapse mechanism. New complementary lines of research, based on the application of analogue and mathematical modelling, are progressively emerging and becoming essential to understand the causes of the formation of collapse calderas. In this contribution, we present a comprehensive analysis of field studies of

several well known collapse calderas, and compare the field data available in order to establish similarities and differences among all them. This allows us to distinguish between different caldera types or groups and to determine a physical scenario for of each group. Comparison of field data with analogue and numerical models permits to establish a relationship between each caldera type with its particular genetic pattern, so that a new classification scheme, based on the conditions that lead to caldera-formation, is proposed.