Effusive Activity at Mount Etna Volcano (Italy) During the 20th Century: A Contribution to Volcanic Hazard Assessment

DANIELE ANDRONICO* and LUIGI LODATO
Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania Piazza Roma 2, Catania, 95123, Italy

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Abstract. Mount Etna is an open conduit volcano, characterised by persistent activity, consisting of degassing and explosive phenomena at summit craters, frequent flank eruptions, and more rarely, eccentric eruptions. All eruption typologies can give rise to lava flows, which represent the greatest hazard by the volcano to the inhabited areas. Historical documents and scientific papers related to the 20th century effusive activity have been examined in detail, and volcanological parameters have been compiled in a database. The cumulative curve of emitted lava volume highlights the presence of two main eruptive periods: (a) the 1900–1971 interval, characterised by a moderate slope of the curve, amounting to $436 \times 10^6$ m$^3$ of lava with average effusion rate of $0.2$ m$^3$/s and (b) the 1971–1999 period, in which a significant increase in eruption frequency is associated with a large issued lava volume ($767 \times 10^6$ m$^3$) and a higher effusion rate ($0.8$ m$^3$/s). The collected data have been plotted to highlight different eruptive behaviour as a function of eruptive periods and summit vs. flank eruptions. The latter have been further subdivided into two categories: eruptions characterised by high effusion rates and short duration, and eruptions dominated by low effusion rate, long duration and larger volume of erupted lava. Circular zones around the summit area have been drawn for summit eruptions based on the maximum lava flow length; flank eruptions have been considered by taking into account the eruptive fracture elevation and combining them with lava flow lengths of 4 and 6 km. This work highlights that the greatest lava flow hazard at Etna is on the south and east sectors of the volcano. This should be properly considered in future land-use planning by local authorities.

Key words: Mt. Etna, effusive activity, database, lava flow length, eruptive fractures, vent elevation, hazard zonation

1. Introduction

Mount Etna, located on the eastern coast of Sicily in Italy (Figure 1a), is one of the most studied and documented volcanoes in the world. The hospitable climate has allowed the development of prosperous human settlements near the volcano since the Greek colonisation. The ancient populations

* Author for correspondence: E-mail: andronico@ct.ingv.it
Figure 1. Maps of the study area: (a) location of Sicily; (b) detail of the summit craters; (c) general map of Etna (modified by Andronico et al., 2001). The 20th century total lava flow field with towns, relative age and inhabitants are reported; the dotted lines indicate approximately four sectors (N, E, S-SE and W-SW) as discussed in the text; (d) list of the towns and relative density population (from 2001 official data of Civil Defence of Catania).