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Eruptions of the last 2200 years at Vulcano and Vulcanello (Aeolian Islands, Italy) dated by high-accuracy archeomagnetism

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Abstract

The recent eruptive history of the Vulcano island (Southern Italy) was investigated through the high-accuracy "large sample" archeomagnetic method (Tanguy, J.C., Le Goff, M., Principe, C., Arrighi, S., Chillemi, V., Paiotti, A., La Delfa, S., Patanè, G., 2003. Archeomagnetic dating of Mediterranean volcanics of the last 2100 years: validity and limits. Earth Planet. Sci. Lett. 211, 111–124; Tanguy, J.C., Principe, C., Arrighi, S., 2005. Comment on "Historical measurements of the Earth's magnetic field compared with remanence directions from lava flows in Italy over the last four centuries" by R. Lanza, A. Meloni, and E. Tema. Phys. Earth Planet. Interiors 152, 116–120; Arrighi, S., 2004. The large sample archeomagnetic method applied to Neapolitan volcanoes and Aeolian Islands. PhD Thesis. University of Pisa, Italy, pp. 1–186). Age determination is based upon directional geomagnetic variation reconstructed from historically dated lavas in Southern Italy, and from archeological sites in Western Europe (Gallet, Y., Genevey, A., Le Goff, M., 2002. Three millennia of directional variation of the Earth's magnetic field in Western Europe as revealed by archeological artefacts. Phys. Earth Planet. Interiors 131, 81–89) relocated to Sicily. Results in the present paper were obtained on 12 sites including 185 samples weighing 0.5–1 kg, distributed over the Vulcanello platform lavas and pyroclastic cones, and on the lava flows from the Fossa cone. It is shown that the Vulcanello platform was built by nearly continuous activity between AD 1000 and 1250, which is more than a millennium younger than believed until now from questionable interpretation of imprecise historical accounts. Most of the lavas from the Fossa cone, whose ages were rather hypothetical or known with a large uncertainty, have erupted within the same period. However, the last "Pietre Cotte" obsidian flow is confirmed to date from 1720 ± 30, in agreement with historical data (1739).

Keywords: Volcanic eruptions; Archeomagnetic dating; Magmatic evolution; Volcanic risk; Vulcano

1. Introduction

Vulcano is the southernmost and the third largest of the seven major islands of the Aeolian arc in the Southern Tyrrhenian sea, with an area of 22 km^2 (Fig. 1). The main island developed during the Pleistocene and Holocene and underwent various stages of stratocone building and caldera collapse (Keller, 1980; De Astis et al., 1997, 2003). It is connected northward through a flat isthmus to the smaller island of Vulcanello, which is composed of a lava platform and three small pyroclastic cones. Both the platform and cones are popularly believed to have emerged in the last 2200 years.

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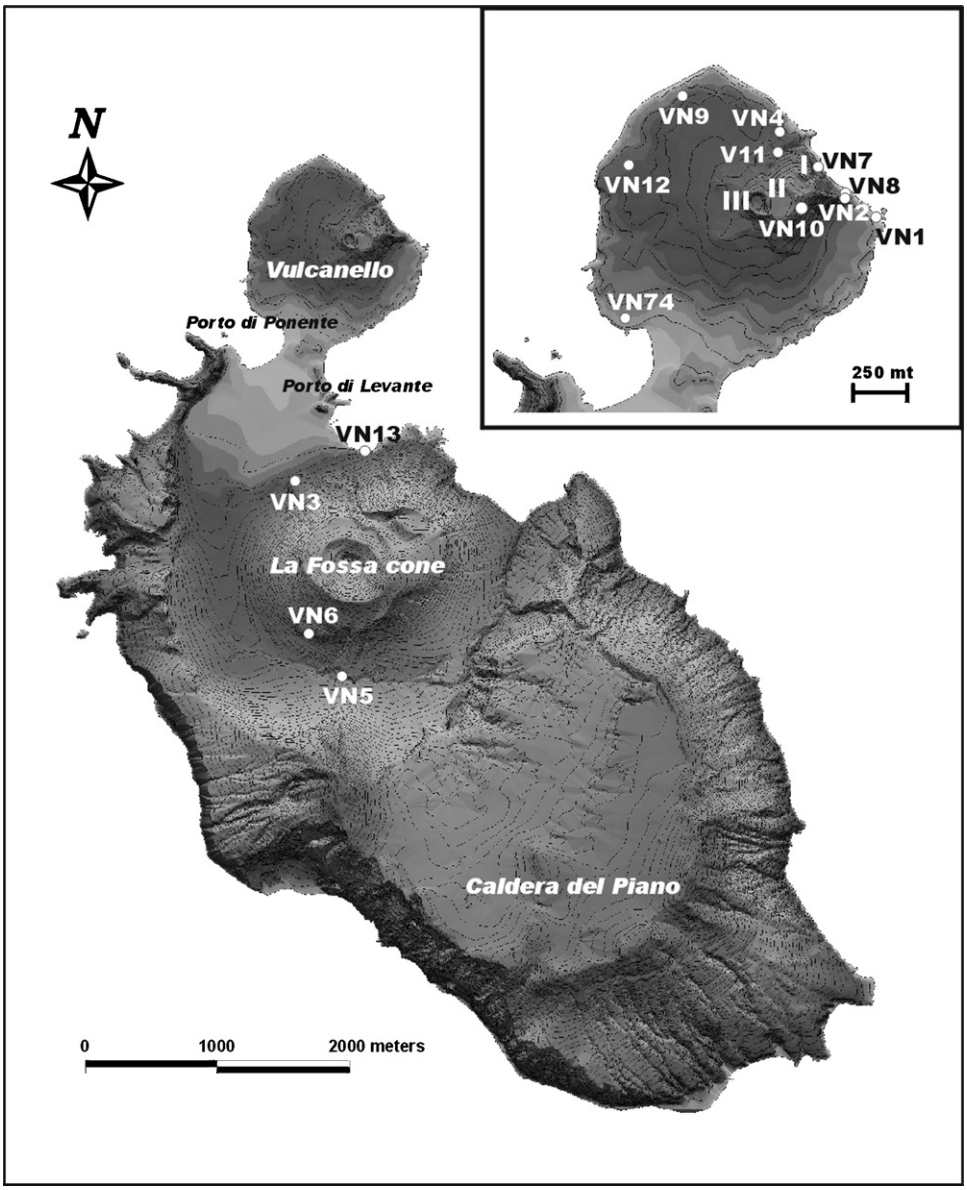

Fig. 1. Schematic map of the Vulcano island with indication of the various sites (VN) sampled for archeomagnetic study (see text for explanation).

In fact, although Vulcano is close to Sicily, it remained uninhabited for most of the historical times (Bernabo Brea and Cavalier, 1991), probably because the only possible harbour was located just below the violently explosive crater of La Fossa. During the Greek epoch (7th–3rd cent. BC), the island was called "Hiera Hephestou", i.e. the Holy place dedicated to Hephestos, the God of Fire, and therefore inaccessible to human beings. From descriptions by ancient authors collected in recent literature (e.g. De Fiore, 1922; Frazzetta et al., 1984), it would appear that eruptions until the medieval times were more frequent and violent than today. Details of these events, however, are largely lacking, so that not only the products from a given eruption cannot be identified, but in some cases it is not even sure whether activity occurred at Vulcano or at the neighbouring island of Lipari (Keller, personal communication). On the other hand, for reconstructing the volcanological evolution of the last two millennia, traditional radiometric methods such as K/Ar dating are too imprecise, and ^{14}C dating is subordined to the finding of carbonized wood which is rarely available. Here we propose a full reexamination of the last eruptions of Vulcano and Vulcanello by using the high-accuracy archeomagnetic dating which was shown