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The Afragola settlement near Vesuvius, Italy: The destruction and abandonment of a Bronze Age village revealed by archaeology, volcanology and rock-magnetism

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ABSTRACT

Public works in progress in the Campanian plain north of Somma-Vesuvius recently encountered the remains of a prehistoric settlement close to the town of Afragola. Rescue excavations brought to light a Bronze Age village partially destroyed and buried by pyroclastic density currents (PDCs) of the Vesuvian Pomici di Avellino eruption (3.8 ^{14}C ka BP) and subsequently sealed by alluvial deposits. Volcanological and rock-magnetic investigations supplemented the excavations.

Careful comparison between volcanological and archaeological stratigraphies led to an understanding of the timing of the damage the buildings suffered when they were struck by a series of PDCs. The first engulfed the village, located some 14 km to the north of the inferred vent, and penetrated into the dwellings without causing major damage. The buildings were able to withstand the weak dynamic pressure of the currents and deviate their path, as shown by the magnetic fabric analyses. Some later collapsed under the load of the deposits piled up by successive currents. Stepwise demagnetization of the thermal remanent magnetization (TRM) carried by potsherds embedded in the deposits yields deposition temperatures in the order of 260–320 °C, fully consistent with those derived from pottery and lithic fragments from other distal and proximal sites. The fairly uniform temperature of the deposits is here ascribed to the lack of pervasive air entrainment into the currents. This, in turn, resulted from the lack of major topographical obstacles along the flat plain. The coupling of structural damage and sedimentological analyses indicates that the currents were not destructive in the Afragola area, but TRM data indicate they were still hot enough to cause death or severe injury to humans and animals. The successful escape of the entire population is apparent from the lack of human remains and from thousands of human footprints on the surface of the deposits left by the first PDCs. People were thus able to walk barefoot across the already emplaced deposits and escape the subsequent PDCs. The rapid cooling of the deposits was probably due to both their thinness and heat dissipation due to condensation of water vapour released in the mixture by magma–water interaction.

1. Introduction

Archaeological and volcanological studies have revealed that eruptions of Somma-Vesuvius, near Naples, Italy, have interacted with human life since prehistoric times. The occurrence of high intensity explosive eruptions, interspersed with long periods of quiescence and minor effusive or explosive eruptions, has characterised the last 22 ka of Somma-Vesuvius activity (Santacroce, 1987; Andronico et al., 1995; Cioni et al., 2003; Santacroce et al., 2008). Four Plinian eruptions occurred during this time span: Pomici di Base at 18.3 ^{14}C ka BP (Bertagnini et al., 1998), Mercato, also called Ottaviano, at 8 ^{14}C ka BP (Aulinas et al., 2008), Pomici di Avellino at 3.8 ^{14}C ka BP (Lirer et al., 1973; Rolandi et al., 1993) and Pompeii in AD 79 (Sigurdsson et al., 1985). Of these eruptions, Pomici di Avellino (PdA), which occurred during the Early Bronze Age (EBA), had one of the highest impacts on the Somma-Vesuvius hinterland.

Archaeological and volcanological investigations conducted in advance of public works, including a high-velocity rail link and associated facilities, have furnished a detailed picture of settlements and activities between the Late Neolithic and Late Bronze Age in the

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southern Campanian plain (Laforgia et al., 2008; Marzocchella, 2000). At that time human settlement in the plain took the form of numerous villages (Albore Livadie et al., 2005 and references therein); it appears in certain periods to have been densely inhabited, crossed by long-lived roads and subject to well-organized agricultural exploitation. Volcanic eruptions of both Vesuvius and Campi Flegrei (Cioni et al., 2003; Di Vito et al., 1999) caused significant breaks in the occupation of the area, but also maintained the plain's extraordinary fertility and thus favoured its agricultural development (Isaia et al., 2004; Laforgia et al., 2008; Orsi et al., 2003). Evidence of human settlements buried by PdA deposits has been found in many sites in the Campanian plain (Fig. 1).

The Afragola village, datable to a late phase of the EBA (Palma Campania culture; Albore Livadie, 1999), was excavated over an area of about 5000 m^2; it is thus the most extensively investigated site of this epoch in Italy, and – thanks to the exceptional nature of the surviving evidence – of great importance as an example of internal village structure. Here, for the first time, a combined archaeological, volcanological and rock-magnetic investigation highlights important issues concerning the impact of PDCs on an EBA community, and evaluates the impact of the PdA eruption on this settlement and the influence of human constructions in the village (huts, fences etc.) on the dynamics of PDC emplacement. PDC deposits from within and around the Afragola village and other selected sites (Fig. 1) were mapped in detail, logged and sampled to reveal variations in their geometry, texture, and sedimentary structure. Flow directions were derived from measurement of anisotropy of magnetic susceptibility (AMS), and thermal remanent magnetization (TRM) of lithics and potsherds embedded in the PDC deposits was measured in order to evaluate their equilibrium temperature at time of deposition.

2. Summary of the Pomici di Avellino eruption

The PdA eruption, first recognised by Johnston Lavis (1884), dated by ^{14}C to 3760±70 a BP (Andronico et al., 1995), occurred during the EBA (Albore Livadie, 1981). Lirer et al. (1973) first mapped the isopachs and isopleths of the Plinian fallout deposits, while Pescatore et al. (1987) defined the main physical parameters of the Plinian eruption column. An early map of PDC dispersion can be found in Arnò et al. (1987) and Barberi and Leoni (1980) carried out the first petrochemical study on the products of this eruption. Joron et al. (1987) and Civetta et al. (1991) investigated the eruption's magmatic feeding system. Rolandi et al. (1993) provided a stratigraphic analysis of the eruptive succession, whereas Cioni et al. (2000) made a detailed study of the Plinian fallout deposit. Mastrolorenzo et al. (2006) presented a qualitative scenario of the eruption and the related volcanic hazard. A recent work described the dispersion of fine ash of the PdA eruption in the Central Mediterranean area (Sulpizio et al., 2008a), while Sulpizio et al. (2008b,c) produced detailed reconstructions of both stratigraphy and eruption mechanisms, and provided a sedimentological model for the PDCs, which is used as reference in this study.

The stratigraphic succession of PdA deposits can be divided (Fig. 2) into five eruptive units (EUs) emplaced during three eruption phases: opening, Plinian and phreatomagmatic. The opening phase comprises

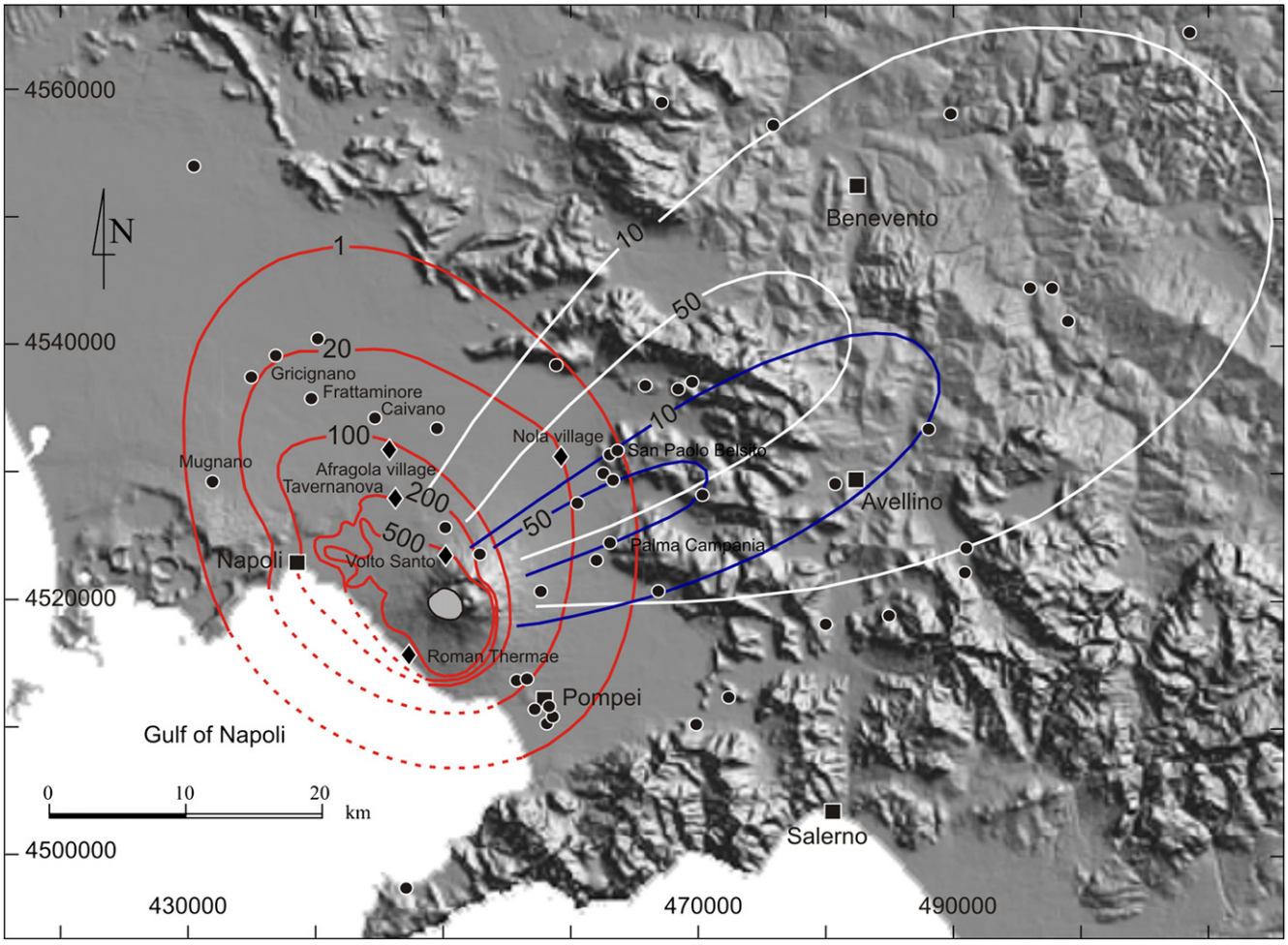

Fig. 1. Shaded relief map of the Vesuvius region and distribution of the Pomici di Avellino deposits. Isopachs in cm: blue=EU2; white=EU3, red=EU5. Light-grey area=inferred vent (modified after Sulpizio et al., 2008b). Symbols: diamond=sampling site; dot=Bronze Age archaeological site. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)