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The AD 79 Vesuvius eruption: stratigraphy, lithofacies variations and impact of the pyroclastic current deposits within the archaeological sites of Pompeii and Stabiae (southern Italy)

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Plinian eruptions are powerful explosive volcanic events that impact large areas with cubic kilometers of magma emplaced as pyroclastic material accumulated in thick blankets around the volcanic vents. The violence of the emplacement mechanism (i.e., fallout or pyroclastic density currents, PDC) and the sudden burial of the landscape, make these types of eruptions extremely dangerous. Aiming to fully understand these phenomena, an accurate reconstruction of the physical behaviour and the historical record of a volcano is critical as starting point for the assessment of volcanic hazard. In this scenario an excellent case is the worldwide-known Plinian AD 79 Vesuvius eruption, which destroyed Roman towns with large effects preserved in different sites around the volcano. This study reports the results of a collaboration between the Archaeological Park of Pompeii and the University of Napoli Federico II to document the stratigraphic sequence and the type and extent of damage and victims buried under meters of pyroclastic material within the Pompeii and Stabiae archaeological sites. A systematic survey of well exposed outcrops along the recent excavations front allowed us to study in detail the facies variations of the different PDC stratigraphic units and how their distribution is affected even by urban structures. At Pompeii, the stratified ash PDC succession ranges in thickness from few tens of centimetres to two metres and shows considerable vertical and lateral variations in its sedimentological features. The layer associated with the most destructive impact on the Roman buildings shows down-current variation in thickness (0 to 330 cm) and texture. Where it is less than 30 cm thick, the deposit is fine-grained and thinly stratified, with few rounded pumice clasts scattered inside the matrix. Where it thickens, the lower part is rich in coarse pumice lapilli and locally shows well-developed stratifications, while the upper part shows an internal arrangement of alternating layers of fine and coarse ash, forming progressive bedforms. Upwards, the sequence is made up of a succession of plane-parallel ash layers with rare pumice lapilli clasts and diffuse accretionary lapilli. This ash sequence is interstratified with four well-sorted, thin lithic-rich layers that exhibit mantling structures of fall deposits. All PDC layers, except the lowermost, are dispersed across the entire Pompeii area, although some are locally missing as a result of the

erosive action of the following PDC. At Stabiae, the ash PDC sequence is 83 cm thick. In few rooms of the Roman villa the ash deposits thicken up to 150 cm. Most of the ash layers identified at Pompeii are recognized also at Stabiae. In the upper part of the sequence a new PDC layer, never reported at Pompeii, is here documented for the first time. Damages are documented inside the more destructive ash layer and even in the upper ash layers, providing new insights about the risk assessment in distal areas.