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Reconstructing the paleo-topography and paleo-environmental features of the Sarno River plain (Italy) before the AD 79 eruption of Somma-Vesuvius volcanic complex

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SSP1.4
Understanding mixed siliciclastic-volcaniclastic depositional systems and their relationships with geodynamics
or
GD2.3/CL4.14/GM5.8/MPRG22/SSP3.5
Reconstruction of ancient continents: Dating and characterization of paleosurfaces

Reconstructing the paleo-topography and paleo-environmental features of the Sarno River plain (Italy) before the AD 79 eruption of Somma-Vesuvius volcanic complex

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Within the geoarchaeological research project „Reconstruction of the Ancient Cultural Landscape of the Sarno River Plain“ undertaken by the German Archaeological Institute in cooperation with the Heidelberg Academy of Sciences and Humanities/University of Tübingen a methodology was developed to model the spatial dispersion of volcanic deposits of Somma-Vesuvius volcanic complex since its Plinian eruption AD 79. Eventually, this was done to reconstruct the paleo-topography and paleo-environment of the Sarno River plain before the eruption AD 79. We collected, localized and digitized more than 1,800 core drillings to gain a representative network of stratigraphical information covering the entire plain. Besides other stratigraphical data including the characteristics of the pre-AD 79 stratum, the depth to the pre-AD 79 paleo-surface was identified from the available drilling documentation. Instead of applying a simple interpolation of the drilling data, we reconstructed the pre-AD 79 paleo-surface with a sophisticated geostatistical methodology using a machine based learning approach based on classification and regression trees. We hypothesize that the present-day topography reflects the ancient topography, because the eruption of AD 79 coated the ancient topography, leaving ancient physiographic elements of the Sarno River plain still recognizable in the present-day topography. Therefore, a high resolution, present-day digital elevation model (DEM) was generated. A detailed terrain analysis yielded 15 different primary and secondary topographic indices of the present-day DEM. Then, a classification and regression model was generated combining the present-day topographic indices to predict the depth of the pre-AD 79 surface. This model was calibrated with the measured depth of the pre-AD 79 surface from the drilling data. To gain a pre-AD 79 digital elevation model (DEM) the modeled depth of the pre-AD 79 surface was subtracted from the present-day DEM.
To reconstruct some paleo-environmental features, such as the paleo-coast and the paleo-river network and its flood plain, the modeled pre-AD 79 DEM was compared with the classified characteristic of the pre-AD 79 stratum, identified from the drilling documentation. It is the first time that the paleo-topography and paleo-environmental features of the Sarno River basin were systematically reconstructed using a detailed database of input variables and sophisticated data mining technologies.

Keywords: Sarno River Basin, Roman paleo-topography, paleo-environment, stratigraphical core drillings, Classification and Regression Trees