

Rock-fall hazard in the Etruscan archaeological site of Norchia (Central Italy)

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The ancient Etruscan town of Norchia (Central Italy, 80 km North of Rome) is situated on a long volcanic plateau surrounded by steep slopes, at the confluence of rivers Pile and Acqua Alta into the river Biedano. It has been constructed along the ancient Via Clodia, a short-range route intended for commercial traffic between Rome and the colonies in Etruscan lands. The flourishing of the town, evidenced by the beautiful necropolis, is placed between the end of the fourth and half of the second century BC. With its necropolis Norchia is the most significant example of funerary architecture rock Hellenistic period (IV-II century BC.). Its rock-cut tombs, are among the most important archaeological sites of Etruscan civilisation. They are an important and rare example of rock architecture and one of the few preserved in Italy. Also, the necropolis, with an extension of more than 100 hectares, is composed of rock-cut tombs of various types (façade, half-cube, false-cube and temple type) and dimensions (4-10 m in height), exhibiting a remarkable similarity with Asian tombs. From geological point of view, the area is exhibiting the overly of rigid volcanic products from both Vico and Volsini volcanic apparatus; as a bedrock, a plastic clay formation is positioned. The rock-cut tombs were excavated on two main volcanic levels, following the natural profile of tuff outcrops. The tombs located in the upper part of the necropolis have been excavated in a Red Tuff from Vico volcanic district, while those in lower level are dug in a grey tuff (Nenfro) from Vulsini volcanic apparatus. Recent investigations revealed the presence of many threats affecting the conservation of the site, that are including: surface rock weathering, water percolation and infiltration, surface vegetation and biological colonisation, instability and collapse of the cliff. The purpose of this study is mainly focused to verify whether the geological, geomorphological and geomechanical processes that have allowed the creation of a typical "butte" landscape, later inhabited by Etruscans, are still active. Field survey and historical data collection revealed the presence of many rock slope instabilities that have affected the site. Particularly meaningful is the presence of a large debris fan, just at the toe of the most relevant archaeological place, where the half-cube rock-cut tombs are positioned, testifying important rock-falls after the excavation of the necropolis. The preliminary investigation is revealing the importance of rock-fall hazard as well as the other environmental threats for the future conservation of the site. An integrated approach among different experts is now required, to define processes and causative factors and then to establish priorities for conservation