

Advances in Geoarchaeology and Cultural Heritage: Editorial

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1. Introduction

The non-linear trend of evolution of ancient cultures is decisively affected by climatic change, landscape changes, and more. At the same time, natural sciences which are applied to material culture and, simultaneously, delve into the stratigraphic record reveal and document past daily life. The task of modern humanity is to preserve the memories of the past. This Special Issue is based mainly on selected papers presented in the digital 2nd Sino-Hellenic International Conference on Global Issues of Environment and Culture which took place on 17–19 September 2021, and was hosted in Greece (<https://iao.henu.edu.cn/info/1257/5437.htm>, accessed on 10 December 2024). Beyond the selected papers, the SI touches on other issues chronologically covering the Quaternary, e.g., palaeoanthropology and the environment, climate change and ancient cultures, disaster archaeology, geoarchaeological issues, archaeometry–archaeological sciences, and digital and remote sensing applications, to mention a few.

The application of natural sciences to solve problems in the fields of archaeology, anthropology, physical and human geography, cultural heritage, and art, covering a long-time range during the quaternary, has been very popular. The various terminologies used (archaeological sciences, geoarchaeology, archaeometry, and STEM in arts and culture) essentially focus on the tandem of science and art (<https://euro-acad.eu/library?id=17>, accessed on 10 December 2024) (Liritzis 2000 [1]; Liritzis et al., 2024 [2]). After all, such research and its application offers societal and educational benefits, addresses sustainability concerns, and aligns with SDG-11. (With Sustainable Development Goal 11 (SDG 11), countries have pledged to “make cities and human settlements inclusive, safe, resilient and sustainable”. Within this goal, Target 11.4 aims to “strengthen efforts to protect and safeguard the world’s cultural and natural heritage”). (see also relevant articles in: https://www.mdpi.com/journal/sustainability/special_issues/Archaeology_Cultural_Heritage; accessed on 10 December 2024).

2. Brief Summary

The eleven articles cover diversified nature subjects all related to geoarchaeology and cultural archaeological heritage.

Prof. Stoev et al. [3] studied prehistoric astronomical observatories, which include a specific type of rock-cut monument from the mountainous Thrace in Bulgaria that has a specific shape and orientation in space. which is a part of the characteristic representatives of the archaeoastronomical sites on the Balkan Peninsula. They examined 13 prehistoric astronomical observatories using the methods of archaeoastronomy in order to determine the period of their operation. It was shown that changes in climate (and in the astroclimate accordingly) influenced the type of prehistoric astronomical observatories built.

Dr. Kokkaliari et al. [4] referred to recent findings of archaeological research in the Vathy gulf area, Astypalaia Island, Aegean Sea, Greece, which indicate its continuous habitation since prehistoric times, most importantly in the transitional period from the Final Neolithic to the Early Bronze Age (late 4th/early 3rd millennium BC). Using non-invasive analytical methods (Near-Infrared Spectroscopy—NIR) in combination with the



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mineral–petrographic characterisation of the main lithological formations of the island, they were able to identify allogenic geo-materials including chalcedony, mica schist, bauxite and meta-bauxite, steatite, and paragonite. Based on the mineralogical and petrographic characterisation of the stone artefacts, a first attempt was made to evaluate the possible raw material sources and to identify potential intra-island modes of stone exploitation.

Dr. Westra et al. [5] studied disasters in the past that have happened throughout human existence. Their traces are found in the environmental record, archaeological evidence, and historical chronicles. They present the Shang and Mycenaean cultures as prime examples, among others, of Bronze Age societies with distinctive geographical, environmental, and cultural features and structures that defined their attitudes and responses to dangerous natural phenomena, such as floods, earthquakes, landslides, and drought. The cultural landscapes of the Aegean Sea in Greece and Yellow River in China share many similarities and dissimilarities and both had vast territorial and cultural expansions. They have an apparent contemporaneity, and both receded and collapsed at about the same time. Thus, through the microgeography of a few select Shang and Mycenaean sites and their relevant environmental, archaeological, and historical contexts, and through environmental effects on a global scale, we may understand chain events of scattered human societal changes, collapses, and revolutions on a structural level.

Liritzis et al. [6] focused on the geoarchaeology of a Kastrouli Late Bronze settlement in the province of Phocis, central Greece, which has been proved to have been an important centre in the periphery of the Mycenaean palaces during the 13th–11th c BC. A methodological approach was applied at the foot of the hillock near the Kastrouli plain site, combining the digital elevation model (DEM) and GIS with electrical resistivity tomography (ERT) traverses of around 300 and 500 m. The existence of an ancient lake with the presence of two natural sinkholes was revealed, which was apparently engineered using hydraulic works. It was noted that the man-made sinkholes were made to carry out drainage and produce a habitable environment, protecting the cultivated land and avoiding a swamp associated with health issues.

Prof. Koskeridou et al. [7] presented the degradation of coastal environments of an ancient coastal lake wetland, the so-called Lake Lerna in NE Peloponnese, Greece; this is an issue that many areas in Europe are facing. Two drill cores in the area of the ancient lake were analysed and three lithological and faunal units were recovered. The usage of sub-fossil mollusc species for the first time in the region enriched the dataset and contributed significantly to the delimitation of the fauna. They concluded that the lake and its included fauna and flora were mostly affected by climatic fluctuations rather than human intervention.

Dr. Saitis et al. [8] studied beachrocks which are well known as significant proxies for paleoenvironmental analysis as they indicate coastal evolution. The combination of geomorphological and archaeological sea-level indicators significantly contributes to coastal paleogeographic reconstruction. In this study, a beachrock from the Diolkos area (West Corinth canal, Greece) and remnants of the Diolkos slipway were used to reconstruct the coastal evolution before Diolkos' construction until today. They were studied using DGPS-GNSS, and mineralogical analysis and OSL dating of beachrock samples were also carried out. The results showed that the beachrock slab was preserved before the construction of Diolkos below it, followed by its submergence by a co-seismic event after the abandonment of Diolkos during 146 B.C. Consequently, a new beachrock was developed on top of the submerged Diolkos around 120 ± 14 A.D. The RSL was stable until 1596 ± 57 A.D. when the beachrock developed even closer to the present-day coastline. After 1596 A.D., it was uplifted by 12 cm until it reached today's position.

Dr. Howland et al. [9] applied tests that elaborated on the suitability of automated point cloud classification tools provided by the popular image-based modelling (IBM) software package Agisoft Metashape for the generation of digital terrain models (DTMs) at the moderately vegetated archaeological site of Kastrouli, a Mycenaean site in Greece. Based on this case study, the mostly automated, geometric classification tool "Classify

Ground Points” provides the best results and produces a quality DTM that is sufficient for mapping and analysis. Each of the methods tested in this paper can likely be improved through the manual editing of point cloud classification.

Dr. Muskara et al. [10] analysed ancient obsidian tools from Kendale Hecala located on the Ambar River in the Upper Tigris Basin, which is located in the province of Diyarbakır in Southeast Anatolia. Macro-observations and the characterisation of archaeological samples were performed using a handheld XRF and provenance was determined through statistical clustering and multivariate analysis of the data. The authors indicate obsidian from different resources at the settlement was used, including from Nemrut Dağ, Bingöl B, and Group 3d. The technological analysis revealed that obsidian was brought to the settlement as nodules and chipped into various tools at the settlement. Understanding the operational sequence of the lithic industry, the chaîne opératoire, including the distribution of raw material from source to site, is important to demonstrate the socio-cultural organisation of the settlement in Southeastern Anatolia during the Ubaid period.

Dr. Robert Bednarik [11], a specialist in rock art, reviewed the most extensive corpus of ancient immovable cultural heritage, including his current work on the direct dating of Chinese Immovable Cultural Heritage. The dating of Chinese rock art by ‘direct methods’ began in the late 1990s in Qinghai Province. Since then, China has acquired the largest body of direct dating information about rock art of any country. The establishment of the International Centre for Rock Art Dating at Hebei Normal University has been the driving force in this development, with its researchers accounting for most of the results. Dating methods referred to include microerosion analysis, OSL, C-14, and uranium–thorium analysis of carbonate precipitates in caves, and results were reported from Heilongjiang, Inner Mongolia, Ningxia, Jiangsu, Hubei, Guangxi, Yunnan, Qinghai, Tibet, and Xinjiang.

Dr. Rossi et al. [12] reported on the strontium isotopes in archaeology and biogeochemical research carried out over the past 40 years, highlighting its limits and risks. They included basic knowledge material and suggestions for the correct use of these isotopes. The isotopic characteristics of bio-assimilable strontium depend not so much on the isotopic characteristics of the bulk rock but, rather, on those of its more soluble minerals. It is warned that before studying human, animal, and plant remains, the state of conservation and any conditions of isotopic pollution should be carefully checked. Samples should be collected according to random sampling rules. The data should be assessed using a statistical approach. To make comparisons between different areas, it should be borne in mind that the study of current soils can be misleading since the mineralogical modification of soil over time can be very rapidly altered.

Finally, Dr. Anja Hellmuth Kramberger [13] reported on the emergence of the Bronze Age Monkodonja, a Castellieri-type settlement located near Rovinj on the west coast of Istria, Croatia, and the possible effects of climatic changes in the 2nd millennium BC in the Adriatic region. Established around 2000 BC, the settlement experienced significant construction phases, particularly in its defensive architecture built with limestone blocks using dry-stone wall techniques. The settlement appears to have met a violent end around the 15th century BC, which is suggested by destruction layers, widespread burning, and the presence of weapons such as a lance tip, bronze axe, and slingstones. Monkodonja’s destruction raises questions about broader military conflicts in the Adriatic region during this period, and it was proposed that a migration of people to the Istrian peninsula brought this new settlement form and other influences, leading to a significant population increase. The appearance of the Castellieri settlement form coincides with a period marked by documented climatic changes [14] and two major natural disasters in the form of volcanic eruptions.

Conflicts of Interest: There is no any conflict of interest.

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