ABSTRACT BOOK
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Scales of Social, Environmental & Cultural Change in Past Societies

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Titel: Excavation of Neolithic wooden trackway from Aschen Moor, Lower Saxony, Germany. (Photo: Jan Piet Brazio)

the varying waterscape of the Kato Zakros valley consisting from a main river with its delta, three smaller ravines, a marshland and the sea in a map in his short report of the excavation. This consitutes an irregularity for the rather dry island of Crete. Nikolaos Platon, the second excavator of the site, refers in almost every excavation report to the technical means used to overcome the difficulties posed from the high water-table and stagnating water (eg. Platon 1966, Zakros Excavations, in *PAE* 1962, 142-168).
So how did the Minoans manage to tame such a wild and complex waterscape, and built a palace and a city there? The archaeological work in the broader Zakros region has revealed a series of elaborate infrastructure dating in the Middle and Late Bronze Age (Platon 1974, *Zakros: the New Minoan Palace*, Athens; Chrissoulaki & Vokotopoulos 2018, Ένα εγγειοβελτιωτικό έργο της Νεοανακτορικής εποχής στην ενδοχώρα της Ζάκρου in Gavrilaki E. (eds.), *Proceedings of the 11th International Cretological Conference*, Rethymnon). This consists of dams, wells, sewers and conduits, each providing ingenious solutions of high technical quality to varying problems posed by the water in the Zakros region.
The presentation will present the geological data available for the site, as well as the best preserved and most characteristic infrastructure. It will also attempt to explain which problem was each feature solving and how one can interpret those features within the broader climatic and cultural context of the Middle and Late Bronze Age in the Aegean.

S05+15.070

Living Dikes: People and the coast in the Wadden Sea area of the northern Netherlands

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People have been living along the coast of the Wadden Sea for many centuries. Throughout time, they found various ways to deal with periodic storms and flooding. These measures evolved in time from defensive diking, offensive land reclamation and adaptive strategies. In the past decades, people abandoned the explicitly offensive strategy, opting for an approach that takes the natural values of the Wadden Sea area into account as well.

Relative sea level rise forces societies to reconsider static 'grey' flood protective dikes, and move towards a more adaptive, hybrid system in which the dike itself is an element of a wider protection landscape, including the salt marshes at the seaside. The highly interdisciplinary project includes specialists in engineering, geomorphology, ecology, sociology, and landscape history. Linking on to the broader engineering concept of building with nature, Living Dikes contributes to the development of innovative coastal protection systems. The project investigates the potential of making the ecologically and culturally valuable landscape zones in front of the dikes an effective element of our coastal protection.

In this paper, we will explore the degree to which these new systems, may interact with, or even make use of, existing cultural landscape structures currently present in the landscape. This includes the 'man-made' reclamation marshes, as well as associated ditch systems and dikes. The continuous interaction between changing geomorphological and ecological circumstances and human responses to flooding demand a thorough study on how and where to apply nature based solutions, considering the inevitable effects it will have on man and nature. The Living Dikes project includes a study on the longer time frame, from the early inhabitants and their ways to deal with flooding throughout the contemporary challenges towards sustainable future living in the area.

S05+15.071

Water use in settlements of Trypillia culture

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When studying settlements, especially those whose territory covered tens or hundreds of hectares, the question of water sources for residents repeatedly arose. The water needs of the villages were significant, if we take into account the needs of people, domestic animals and crafts production. It was especially relevant for the cases of settlements located on high areas of the plateau. Surveying the territories of these settlements and their immediate surroundings was useful for finding answers. It was also useful to study the modern water use system in this area.
For small settlements and temporary sites the issue was resolved by location on the banks of rivers. In the case of the location on the plateau, the territory of the villages was adjacent to ravines, where the exits of aquifers are located either on the slopes or at the bottom. In both cases, the distance to the water did not exceed 100 meters. There is also a hypothesis regarding the possible construction of dams for the formation of reservoirs in the area of settlements.
In the case of large settlements (50-300 hectares) the choice of location was the key. Maidanetske (about 200 hectares) is an example of solving the problem for mega-sites. A significant part of the settlement was located along the banks of the Talyanka River, and in this case the distance to the water for the nearest two rows of houses did not exceed 100-200 m. The northern part of the settlement was adjacent to ravines with water outlets on the slopes. The southern part partially adjoined the valley of the stream, on the slopes of which valley there are numerous springs. In these areas, it was possible to use wells, the depth of which would not exceed 3-5 m. The most problematic for water supply was the central part of the settlement. Transport sledges equipped with containers, which are known from finds of ceramic models, could be used to

deliver water here.
Feeding of animals was decided directly on pastures located near the valleys of rivers and streams. In the Dnieper region, shepherds' camps near the Dnipro are well-known.
In our opinion, the study of the water supply of residents of Tryypillia settlements should be included in the program for the study of settlements of various types, especially in the light of hypotheses regarding the impact of epidemics on the existence of mega-sites.

S05+15.050

Oasean water dynamics: Disentangling climatically- and anthropogenically-forced environmental change in the Western Desert of Roman Egypt

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The oases in the Western Desert of Egypt were crucial agricultural, economic and administrative districts between Pharaonic times and the Roman period. The Bahariya, Farafra, Dakhla and Kharga oases are highly fertile areas situated in one of the harshest climatic regions in the world, receiving, on average, only 5mm of rain annually. What makes these areas so fertile are extensions of the Nubian Sandstone Aquifer System – the world's largest known fossil water aquifer which spans 2 million km² beneath south-eastern Libya, north-western Sudan, north-eastern Chad, and nearly all of Egypt. From the Pharaohs to the Romans, the oases were exploited agriculturally, and irrigation techniques that centred on tapping Nubian aquifer extensions evolved over time. While qanats – a type of underground aqueduct designed to draw from such aquifers – and wells were dug in the oases in late Pharaonic and Ptolemaic times, Rome ramped up water-extraction and management early on in its control of Egypt, and the Empire reaped the benefits, seeing economic and urban growth that seems incongruous with the terrain in which it blossomed. Growth and prosperity did not sustain, however, as many oasean urban centres and villages experienced degradation, both environmentally and economically, in the Middle and Late Roman periods. Following environmental changes, the archaeology shows that in late antiquity many sites shifted cultivation and settlement patterns in attempt to combat seeming agrarian stagnation, with some areas even transitioning from agriculture to caravan trade and support as their main commodity. While other towns were totally abandoned in the face of both cultivation problems and wind-erosion that, in a few cases, abraded and buried entire settlements.
This paper examines whether the observed environmental changes in Rome's Western Desert were the consequence of climatic changes, or Rome's overexploitation of aquifer extensions – a common environmental response in the oases to anthropogenic subterranean pressure. It looks at oases, and the settlements therein, on a case-base-case basis to determine whether or not a broader trend is observed in the archaeology, and what the result might tell us about oasean environment and society in the Roman period.

S05+15.051

Ancient saltmaking in coastal areas

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Before the invention of the solar evaporation process for the manufacture of salt out of sea water, a particular ignition method was widely practised around the globe since the late Neolithic age. The proto-industrial extraction of sea salt layed the foundation for fundamental cultural achievements. Owing to the high demand for fuel, woodlands got converted into open landscapes, smoothing the way for agriculture.

When highwater spring tides leave saline efflorescenses on coastal mudflats, people turn up for scraping the saline soil. They leach it for obtaining a concentrated brine, with a salinity significantly higher than the salinity of sea water. The culinary salt is produced by heating that brine (the crystallization starts already far below the boiling-point).

Characteristical indicators of this ancient saltmaking technique are:
constructs for leaching the saline soil (ground filters or filters on wooden stilts); basins, ditches, pits or bowls for storing water, drainage tubes and channels; pits or bowls for receiving the concentrated brine; typical pottery (briquetage) for heating the brine; kilns or hearths;
burned wood (charcoal) or charred remains of low calory fuel (reed, grass, dry leaves); open sheds or boiling huts for weather protection; racks for drying the wet salt; palisades as wind breakers; baskets for collecting the saline soil, or to transport the salt; postholes (related to sheds, huts, palisades, supports of wooden filters or drying racks); piles or hills consisting of potsherds; mounds consisting of disposed leached soil.

Many of these earth mounds are amazingly big (piled up by generations of saltmakers), but their origin remains often unknown. Their secondary use as cementary or for horticulture is a common practice.