

(Late) Holocene landscape development of the lower Bakırçay plain (Pergamon Micro-Region, western Türkiye) and its modern alteration

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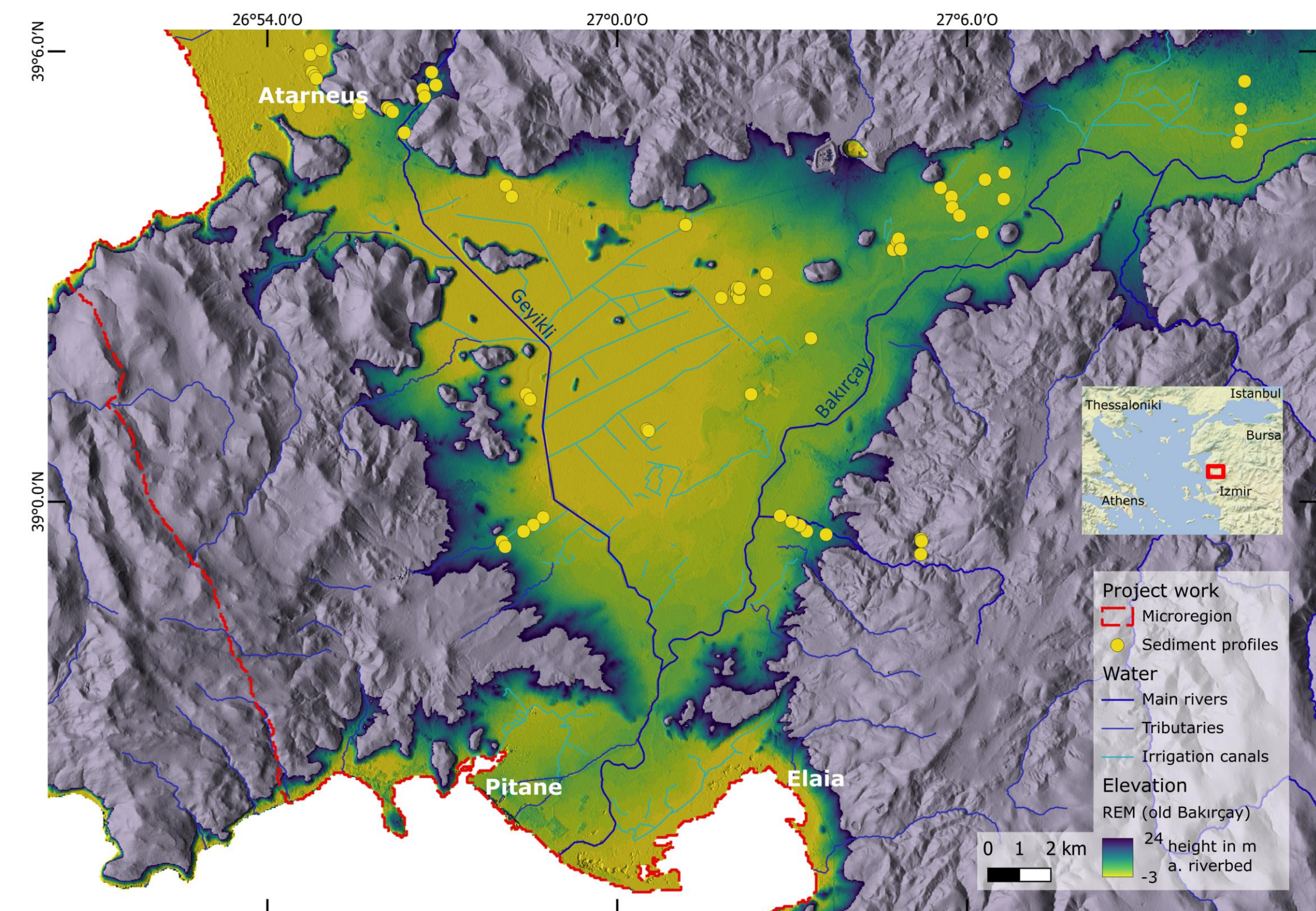


Fig. 1: Map of the western lower Bakırçay plain with Bakırçay base river-relative elevation model. Elevation model based on TanDEM-X data. Micro-Region based on two 8h walking days.

Introduction

The lower Bakırçay plain is located about 100 km north of İzmir, western Türkiye, and borders the Aegean Sea (Fig. 1). The ancient city of Pergamon lies on the northern edge of the plain, surrounded by a number of other smaller settlements, some of which date back to prehistoric times. The TransPergMicro-Project aims to reconstruct the transformation of the Pergamon Micro-Region between Hellenism and the Roman Imperial Period. As part of this project, archaeological surveys are combined with geoarchaeological work to investigate the human influence on landscape development during the Holocene.

Modern alterations in the Micro-Region

- Diversion and canalisation of major rivers
- Construction of dams in the headwater areas
- Establishment of an irrigation and drainage network
- Levelling on the alluvial fans

These melioration measures challenge the fieldwork within the project.

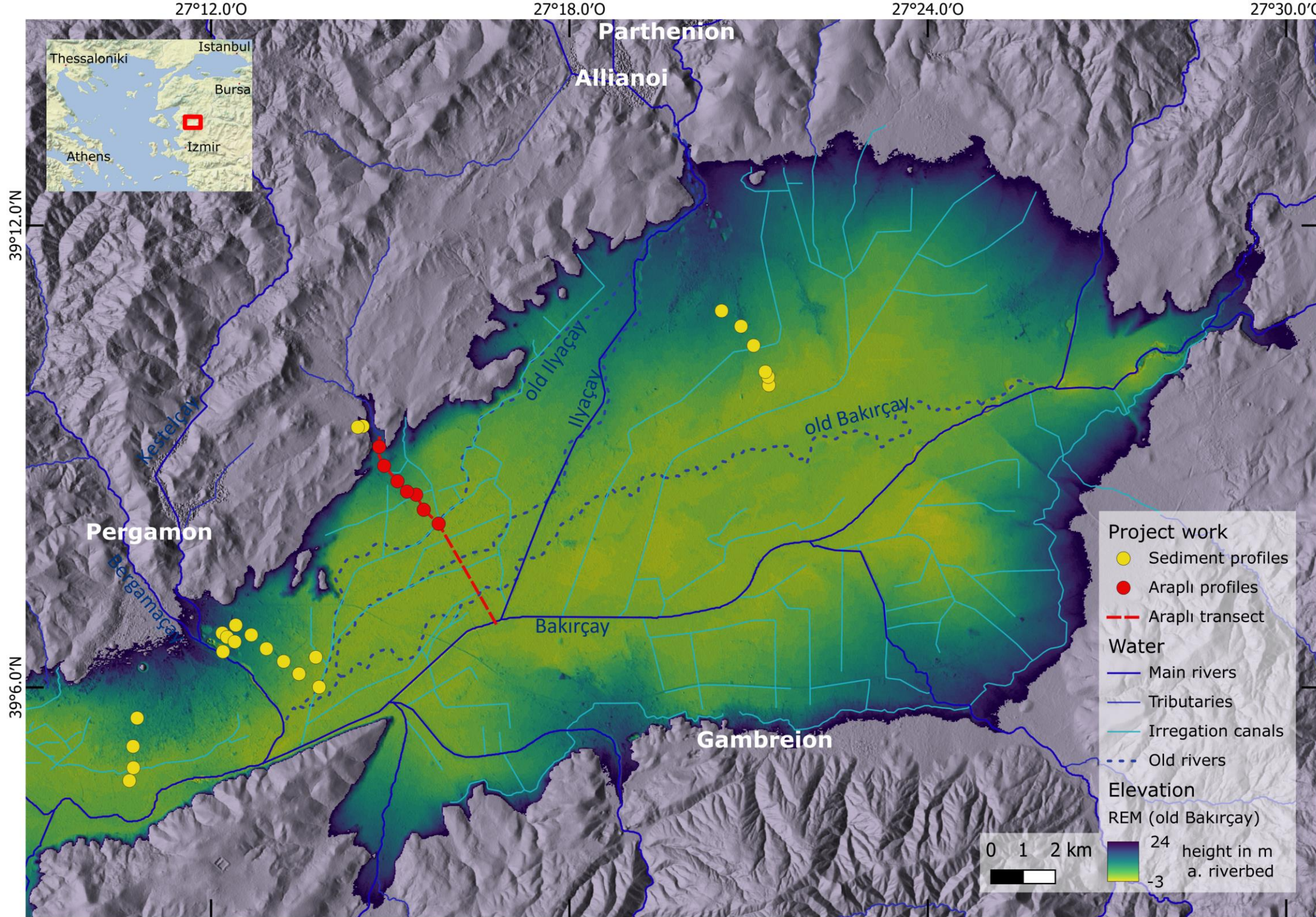


Fig. 2: Map of the eastern lower Bakırçay plain with Bakırçay base river-relative elevation model. Elevation model based on TanDEM-X data. Transect line shown in Fig. 4.

Connections: harbours and route network

Pitane and mainly Elaia were used as harbours for ancient Pergamon. The possibility of a (limited) navigability of the Bakırçay and Bergamaçay is still being investigated. A route network reconstruction was done by combining historical and archaeological sources with a least-cost path analysis, showing connections of divers function and type. Research into other connections outside the micro-region is planned for the future.

The western lower Bakırçay plain

The western part of the lower Bakırçay plain (Fig. 1) was subject of multiple geoarchaeological studies, mostly by Schneider et al. and Yang et al., focusing on different subjects. No marine sediments were found in the plain, which means that coastal progradation in a ria setting can be ruled out as a major process shaping the (late) Holocene landscape.

Course of the Bakırçay

The 'Dörpfeld-scenario', discussed since the late 19th century, suggested a paleo-bay and mouth of the Bakırçay more than 20 km to the north of its present delta near ancient Atarneus / modern Dikili (Fig. 1). This hypothesis was rejected after fieldwork in the area. Instead, the Bakırçay follows the Bergama-Graben in the eastern lower plain and switches into the Zeytindağ-Graben in the western lower plain, not following the steepest incline within this plain.

Current study: Araplı region

The current study aims to extend the knowledge into the eastern lower Bakırçay plain (Fig. 2), upstream of ancient Pergamon, an area characterized by its proximity to the city hill with a distance of only 3.5 km and its location within the assumed boundaries of the ancient city's chora. Within the Araplı catchment area, a large number of archaeological findings have been made that point to an intensive land use during the Hellenistic period. During the Roman Imperial period, different but continuous human impacts on the landscape were found, with the construction of several aqueducts within the catchment area and the intensification of traffic towards ancient Allianoi.

Archaeology

The project's 2022 survey of the surrounding area made various discoveries (Fig. 4) within the catchment area of the Araplı Valley. In addition to several country estates (Fig. 4, Nr. 26, 30, 31) and burial sites (25) from the Hellenistic period, several quarries (28, 29) with associated dwellings were found. For the Roman Imperial period, the course of the Bakırçay waterline (27) through the region was confirmed, which was constructed during this period and required several aqueducts within the catchment area. The catchment area was presumably also crossed by an important transport axis that connected Pergamon with the quarries, the agricultural estates and areas as well as with the neighboring town of Allianoi.

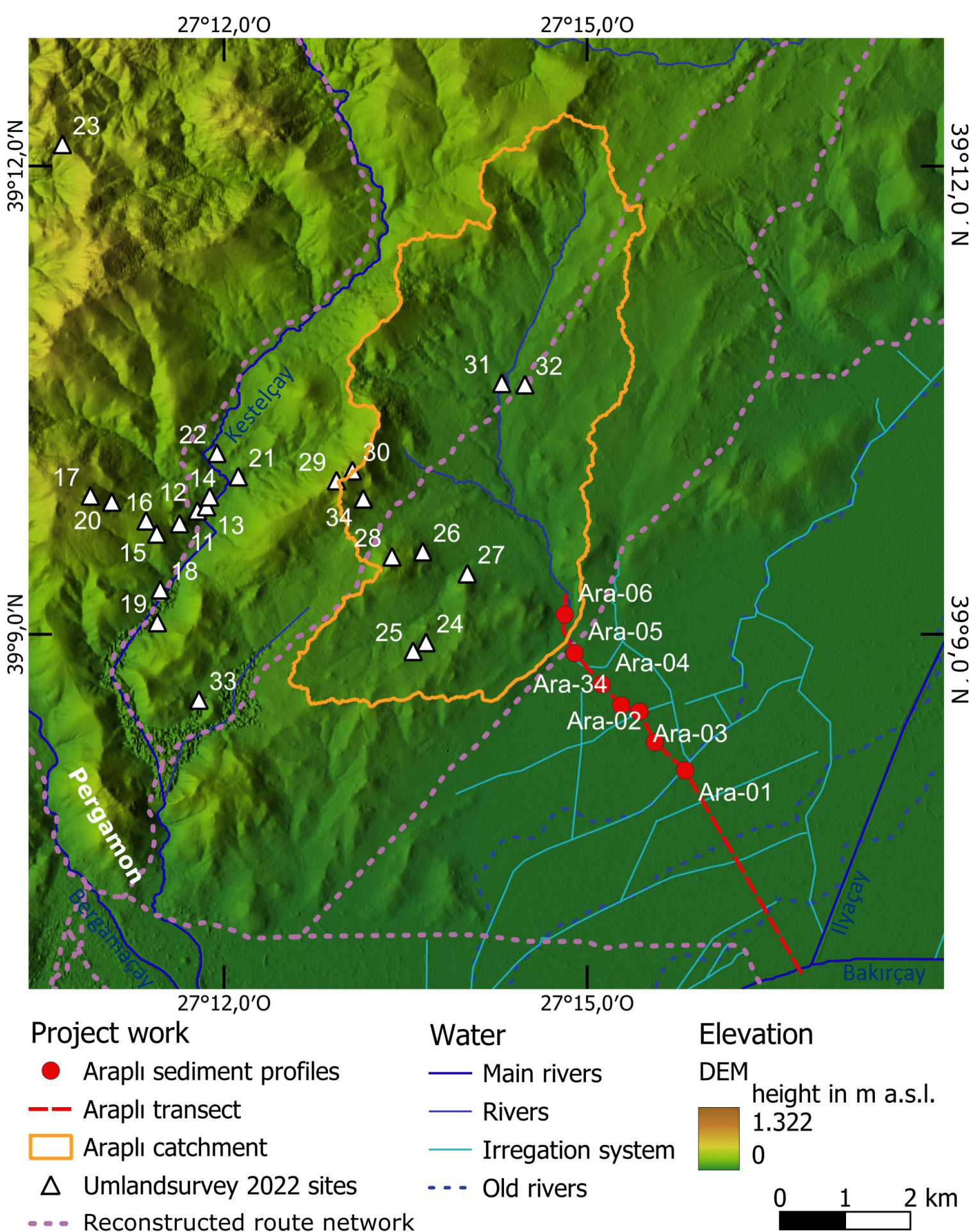


Fig. 4: Map of the Araplı catchment and transect with sites of the Umlandsurvey 2022. Elevation model based on TanDEM-X data.

Results

- (1) Geoarchaeological fieldwork (Fig. 3) showed that the landscape at Araplı was characterized by a palustrine environment in the Mid- or early Late Holocene, as evident in highly carbonatic stillwater sediments. The corresponding conditions, similar to the fluctuation range of a lake, could possibly have been created during seasonal flooding or by a damming situation downstream.
- (2) At the beginning of the Late Holocene, most of the overbank sediments typical of the Bakırçay alluvial plain were deposited.
- (3) These were eventually buried by the Araplı Valley alluvial fan. Although the dating is limited by the usual age inversions, the sediment stratigraphy allows to date the main phase of the alluvial fan growth to a period around 2000 years ago, which supports the dating of the main fan development to the Roman Imperial period.
- (4) Meliorations since the 1950s.

Conclusions and implications for the landscape development

The geoarchaeological results suggest that the increased geomorphodynamics occurred mainly during the Roman Imperial period, most likely triggered by changing land use patterns and construction works, population growth in the urban center in the immediate vicinity of the catchment area. This timeframe of alluvial fan growth found in the Araplı area differs from the results of our case studies in the region, which did not identify a clear change in the depositional system during Antiquity, but early in the Late Holocene (ca. 4.2-3.7 ka BP).

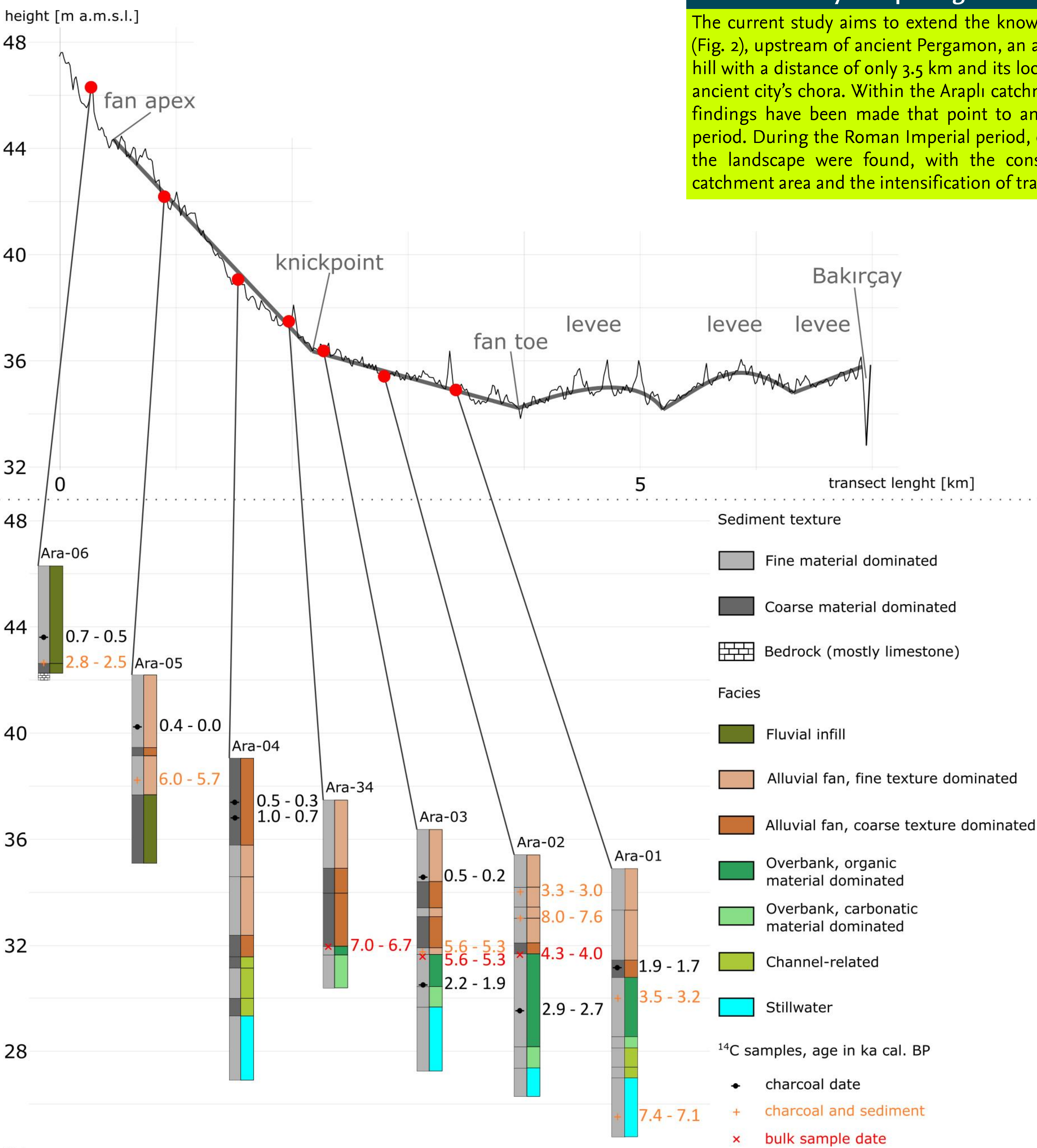


Fig. 3: Transect's elevation profile as provided from TanDEM-X data (individual and smoothed data) is sketched in 250x vertical exaggeration as well as the associated graphs with allocated simplified sediment profiles and assigned facies extracted along the transect including ¹⁴C-dating results.

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Project

The Transformation of the Pergamon Micro-Region between Hellenism and Roman Imperial Period (TransPergMicro)

