Rough Cilicia Highland Archaeological Survey: Deforestation Research in 2011

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The 2011 season of the Rough Cilicia Archaeological Survey Project was conducted between July 21 and August 12, 2011. The work of the 2011 survey was funded by a grant from the National Geographic Society. The survey team is investigating landscape transformation as a component of its regional survey of ancient Rough Cilicia (Antalya Province, Gazipasha District). We employ paleo-environmental analysis of relic cedar forests in the Tauros Mts. to construct a timeline of anthropogenic disturbances associated with population growth over time and thereby to assess the sustainability of ancient forestry practices. The survey team has been investigating the possibility that resource depletion played a role in population collapse at the end of the Roman era. To obtain this data the team recovers pollen and carbon samples from geomorphologic trenches excavated in the cedar zone (1500-1800m elevation), tree ring data from dendrochronological survey of the existing forest, and archaeological data from remains of ancient highland settlements. Preliminary results indicate that a phase of deforestation coincided with regional site abandonment and population decline at the end of antiquity (ca. 600 AD).

Throughout antiquity the forests of these mountains were praised for their lofty conifer trees, particularly cedar trees whose rot-resistant properties made them desirable for shipbuilding. By the beginning of the 20th century AD, this forest was essentially exhausted. While scholars agree that human activity played a determining role in regional deforestation, the timing and pace of pre-modern forest utilization is poorly understood. Our objective is to reconstruct this timing through paleo-environmental techniques. In recent years the team observed that summer inhabitants of the yayla district have been excavating soil from alluvial deposits for their summer gardens, leaving exposed pits of pollen and carbon rich soil. By dressing the scarps of these pits, the team has been able to extract soil, pollen, and carbon samples to reconstruct depositional soil profiles. The team examined nine such pits and road cuts at the elevation of the cedar forest, essentially in the same areas where Unal Akkemik has conducted dendrochronological survey of relic highland forests since 2007. As an example we present Trench 8 near Mevlutlu Yayla (elevation 1570m). Trench 8 was excavated at a rather steep road cut on the southern flank of the road leading from Maha past Bedem to Mevlutlu Yayla (Figs. 2). The road cut was situated in a dense region of old growth forest consisting of cedar, fir, and black pine. A 764-year-old black pine tree that was sampled by Akkemik in 2007 stands approximately 800

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meters east of the road-cut location (See Rauh, Caner, Akkemik, Anmed 6 (2008): 117-119). The team dressed the uppermost 3.2 meters of the trench and extracted soil samples every 10 centimeters for the first 1.5 meters of the trench, followed by samples every 20 centimeters for the lower 1.7 meters of the trench (Fig. 3). The soil profile exhibited rich, reddish, clay soils (Fig. 4). The upper 80 centimeters of the trench exhibited numerous roots, cobbles, and gravel in a sandy clay matrix. Clay and moisture content increased, but cobbles and gravel decreased lower down. A carbon deposit was visible approximately 3 meters from the top of the scarp and was extracted for carbon dating.

Although the carbon samples of 2011 have not been processed, preliminary pollen analysis of Trench 8 reveals distinct patterns of forest vegetation over time (Fig. 5). The team's working hypothesis is that the historical balance of the region's forest cover can be determined through a comparison of four principle pollen types. In the soil profile of Trench 8 periods dominated by a mature highland forest should exhibit high concentrations of tree pollens such as cedar (Toros Sediri, *Cedrus libani*), and fir (Toros göknarı, *Abies cilicica*); whereas, at times when the natural highland forest cover was depleted, pollens of highland colonizers, such as juniper (Kokulu ardıç, *Juniperus foetidissima*) and black pine (Karaçam, *Pinus nigra*) should predominate. As the table in Figure 5 indicates, diminished quantities of cedar pollen are visible at 60-90cm depth, 190cm depth, and 250cm depth. These patterns appear to be matched by rising counts of juniper and black pine pollen, with a very significant spike of juniper pollen at 270cm and a sustained count of black pine pollen between 110 and 210cm depth. By and large, at trench levels where the pollen count for cedar is pronounced, the other tree pollens are diminished. This suggests that the strategy of comparing relative patterns of pollen concentrations for the four principle tree types of the highland will eventually generate important information about the sustainability of the highland cedar forest over time.

In addition to the trench excavations Unal Akkemik conducted tree ring research in the same approximate area of the Taşeli Plateau (Gazipasha highland). He obtained 25 tree-ring samples from cedar, juniper, and black pine trees. In Figure 6 we display the chronological range of the samples that Akkemik has obtained from the Gazipasha district during the course of the survey. Grouped according to age, Akkemik's dendrochronological data for 47 trees demonstrates that in the last 535 years, forest regeneration in the Gazipasha highland has occurred in six discernible phases, 1475-1500 AD, 1550-1575, 1600-1650, 1700-1800, 1800-1825, and 1825-1750. The four oldest trees (500+ years of age) are black pines that survive in the general vicinity of Maha Yayla. Significant cedar forest regeneration did not occur until 1550 AD. Since cedar trees typically live for 1000 years when left undisturbed, the oldest surviving cedar trees in the Gazipasha highland are relatively young (on average 304-280 years in age). Given the stochastic nature of mortality in undisturbed forests, a wider range of tree ages ought to be visible. The clustering of tree ages in six recognizable phases indicates, therefore, that forest clearance in this region resulted from synchronous "harvest events," such as timbering enterprises. Preliminarily, we can assert that "secondary" growth in the highland cedar forests of this region began some 300-400 years ago and that the "original" forest was depleted significantly earlier. At the very least the dendrochonological evidence demonstrates that the "old growth" forest in western Rough Cilicia was depleted centuries prior to the modern era. The

dendrochronological data can not explain the history of the highland forest prior to 1475 AD, nor the time required for a cleared forest to regenerate in the fragile environment of the Taşeli Plateau. For the answers to these questions we must await the results of the geomorphic trench excavations. Once reinforced by stratigraphically dated carbon samples, polen data such as that obtained at Trench 8 in Mevlutlu Yayla should enable us to reconstruct the remote history of the forest in Gazipasha as well as the degree to which it was affected by human activity in pre-modern times.

FIGURES

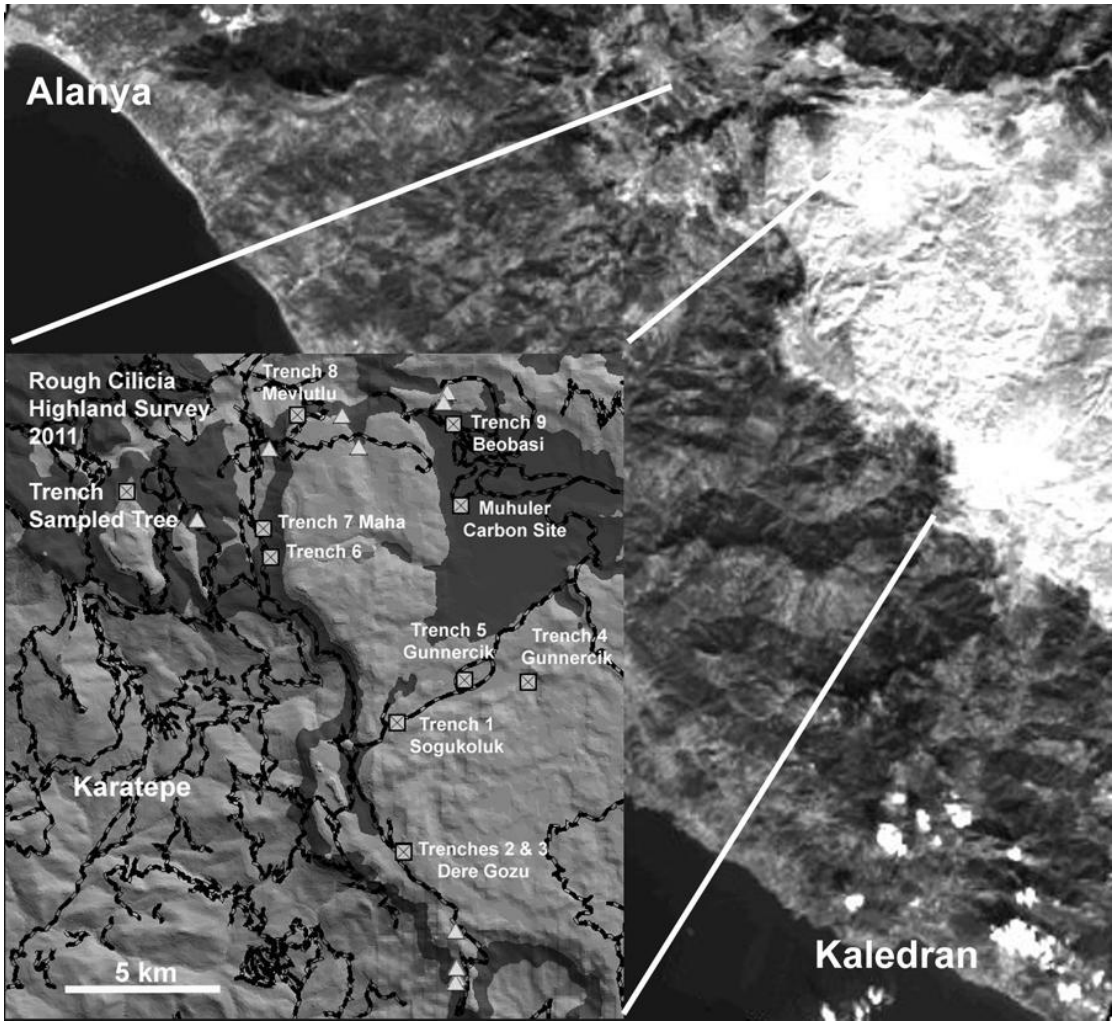


Fig.1, Map of Survey Region

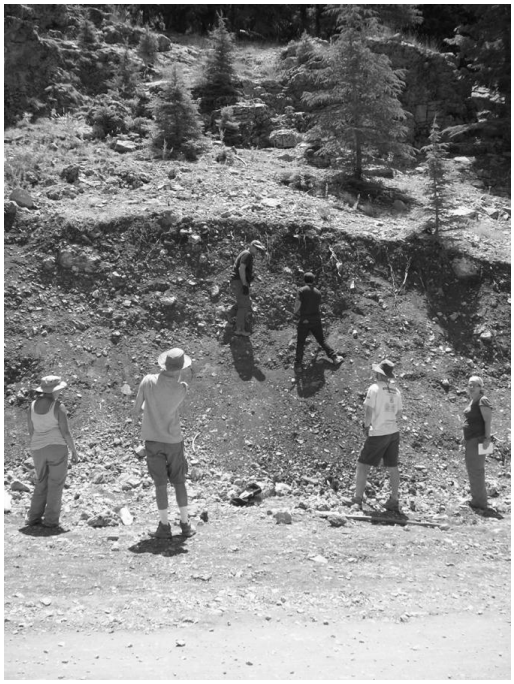
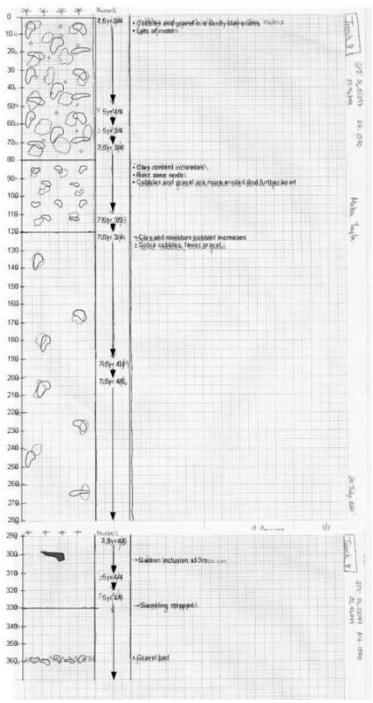


Fig. 2, Trench 8



Figs. 3-4, Trench Profile, Trench 8

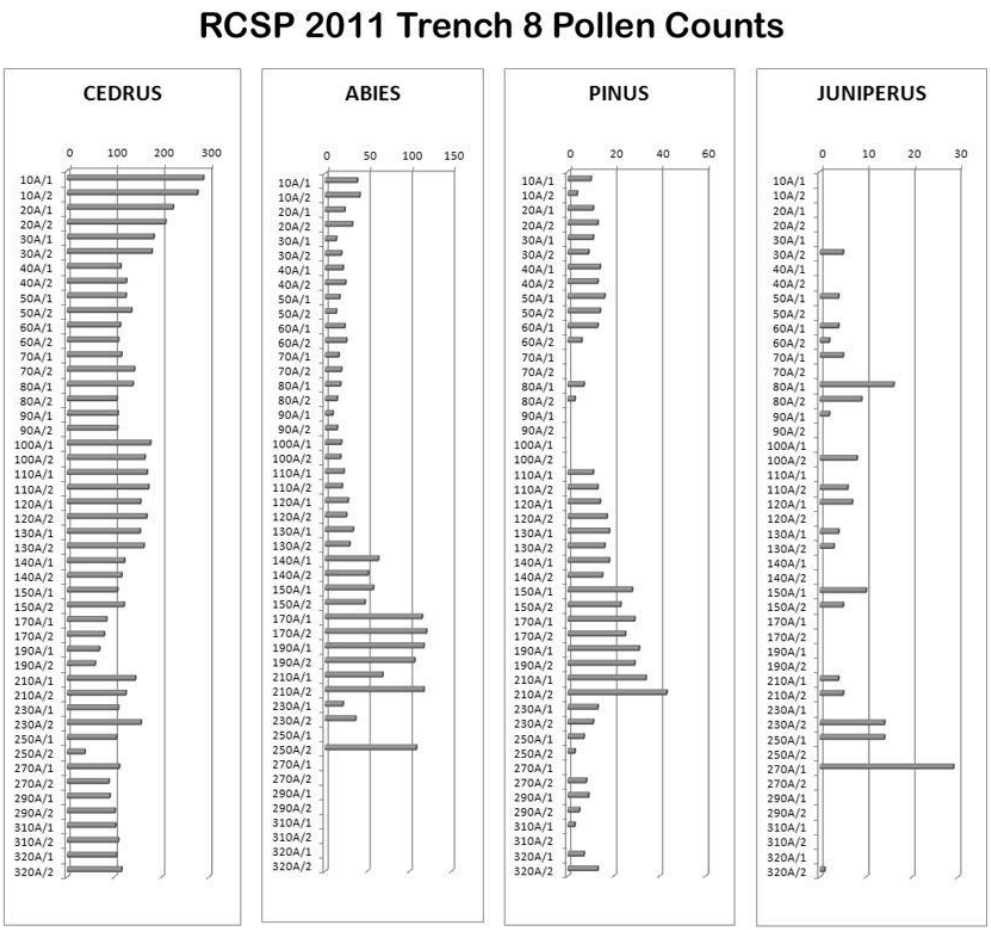


Fig. 5, Pollen Results, Trench 8

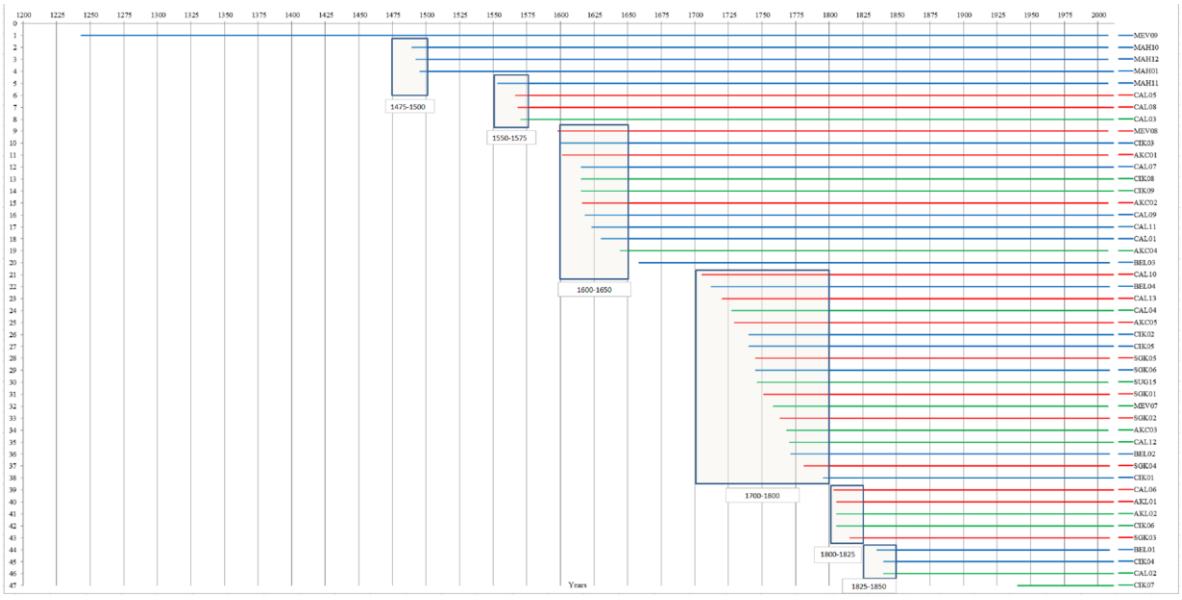


Fig. 6, Tree Ring Data from the Gazipasha Highland

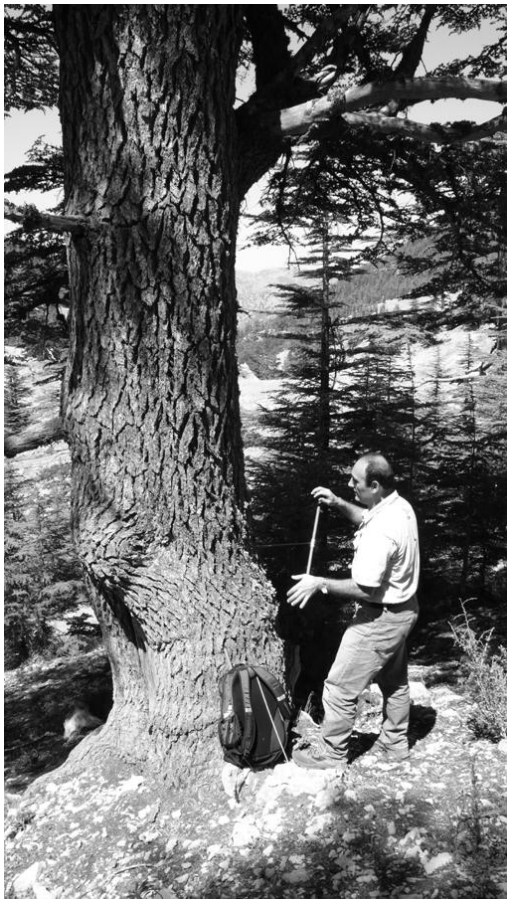


Fig. 7, Unal Akkemik Coring a Cedar Tree

Fig. 8, An Old Growth Cedar Tree in Mevlutlu Yayla