

# Early Pleistocene plant macrofossil remains from Kalavryta, a new asset for the Chelmos – Vouraikos Unesco Global Geopark

George Iliopoulos<sup>1,2,\*</sup>, Eleni Liapi<sup>3</sup>, Vasilis Golfopoulos<sup>1</sup>, Ioannis Zidianakis<sup>1</sup>, Maria Panitsa<sup>3</sup>, Eleni Koumou

<sup>1</sup> Department of Geology, University of Patras, University Campus, GR 265504, Rio, Greece

<sup>2</sup> Chelmos – Vouraikos Unesco Global Geopark, 35 Ag. Alexios str, GR 25001 Kalavryta, Greece

<sup>3</sup> Department of Biology, University of Patras, University Campus, GR 26504, Rio, Greece

\* iliopoulosg@upatras.gr

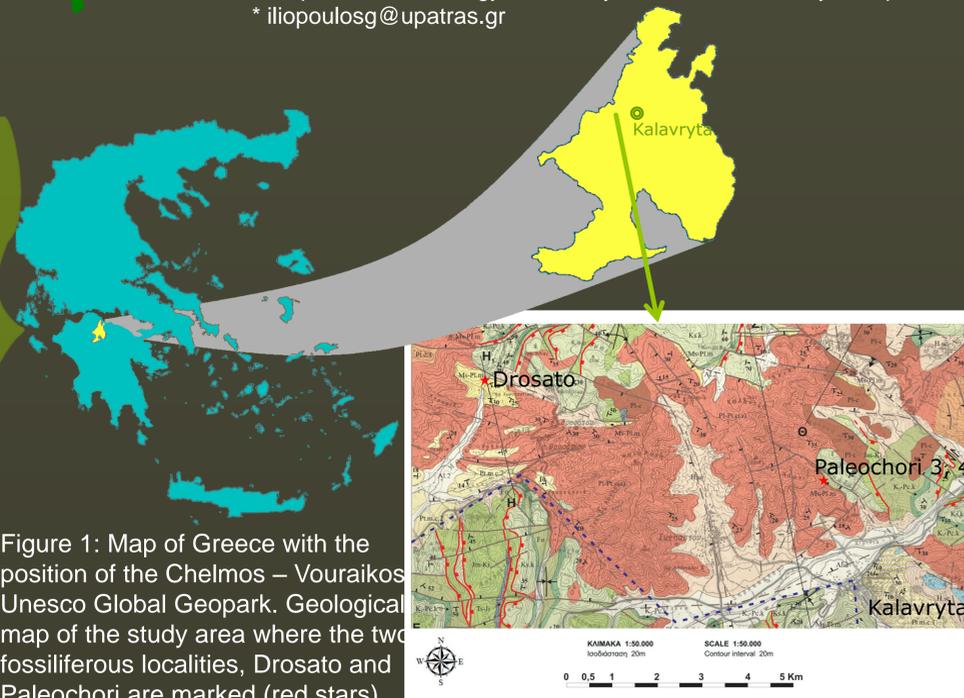


Figure 1: Map of Greece with the position of the Chelmos – Vouraikos Unesco Global Geopark. Geological map of the study area where the two fossiliferous localities, Drosato and Paleochori are marked (red stars).

## Introduction

29 designated geosites can be found in the Chelmos – Vouraikos Unesco Global Geopark (Fig. 1), such as the Cave of the Lakes, the Styx Waters and the Vouraikos Gorge, representing the main geological rocks and geomorphosites found in the geopark. Until now, no geosite hosting fossils except for the xylitic remains in the lignite beds of the Kalavryta basin. Last year systematic fieldwork allowed us to discover for the first time numerous well preserved plant macrofossil remains from three different localities in the Kalavryta basin, namely Drosato, Paleochori 3 and Paleochori 4 (Fig. 1). The fossiliferous marly beds are part of the sequences that contain the lignite beds, consisting of Pliocene lacustrine deposits. Despite the fact that the lignitic deposits had been well studied in the past (Koukouzas, 1992; Trikolos, 2008), it seems that plant macrofossils were not tracked or given attention before.

## Material and Methods

Sediment samples were collected from three different localities in the Kalavryta basin, namely Drosato, Paleochori 3 and Paleochori 4 (Fig. 1), and were carefully prepared in the Palaeontology and Stratigraphy Lab of the University of Patras. 311 plant macrofossils, mostly leaves or leafy twigs, were finally exposed, prepared and studied (37 from Drosato, 195 from Paleochori 3 and 85 from Paleochori 4).

## Results

The plant macroremains from all three localities have been commonly preserved as compressions and less frequently as imprints characterized by high quality of preservation. To date, 15 different taxa have been determined (6 in Drosato, 14 in Paleochori 3 and 7 in Paleochori 4) comprising 1 conifer and 14 woody angiosperms (Table 1). Drosato assemblage is dominated by *Quercus* (96%) and more specifically by *Q. roburooides* and *Q. kubinyi* (Fig. 2a). Conversely Paleochori 3 and 4 assemblages are dominated by *Glyptostrobus europaeus* (Figs. 2b, 2c), whereas *Q. roburooides* and *Q. sp.* significant components. In addition, except backswamp forest elements, such as *Glyptostrobus*, other riparian (*Platanus*, *Salix*) and forest elements (*Acer* (Fig. 3a), *Populus*, *Zelkova* (Fig. 3e) are found as well (Table 1).

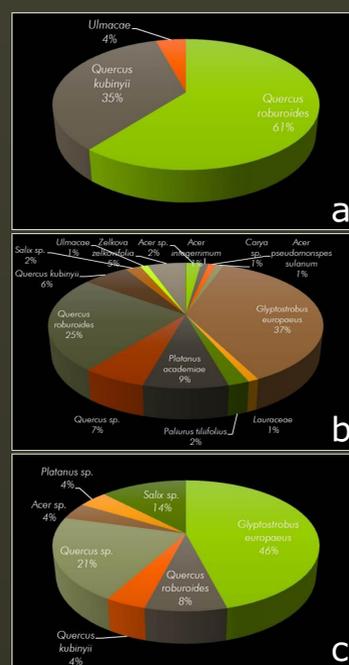


Figure 2: Percentage distribution pie plots of the plant macrofossil assemblages in a) Drosato, b) Paleochori 3 and c) Paleochori 4.

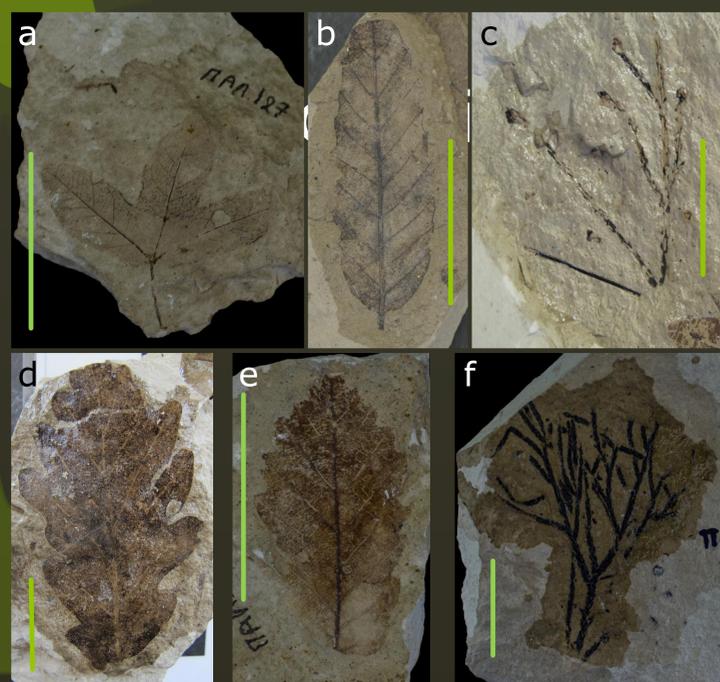


Figure 3: Typical representatives of the Kalavryta basin palaeoflora, a) *Acer pseudomonspessulanum*, Leaf specimen, b) *Quercus kubinyi*, Leaf specimen, c) *Glyptostrobus europaeus*, Leafy twigs with seed cones at the edges, d) *Quercus roburooides*, Leaf specimen, e) *Zelkova zelkovaefolia*, Leaf specimen, f) *Glyptostrobus europaeus*, Leafy twigs. Scale bars 3cm.

Species	Drosat o	Paleochori 3	Paleochori 4
1 <i>Glyptostrobus europaeus</i>		+	+
2 <i>Salix</i> spp.	+	+	+
3 Lauraceae		+	
4 <i>Platanus academiiae</i>		+	
5 <i>Platanus</i> sp.			+
6 <i>Acer integerrimum</i>		+	
7 <i>Acer pseudomonspessulanum</i>	+	+	
8 <i>Acer</i> spp.		+	+
9 <i>Carya</i> sp.		+	
10 <i>Quercus kubinyi</i>	+	+	+
11 <i>Quercus roburooides</i>	+	+	+
12 <i>Quercus</i> spp.	+	+	+
13 <i>Zelkova zelkovaefolia</i>		+	
14 <i>Paliurus tiliifolius</i>		+	
15 <i>Ulmaceae</i>	+	+	

## Discussion

The fossil plant material provides information on the palaeoenvironment and the palaeoclimate of the Geopark area during the Pliocene – Lower Pleistocene. The three localities present significant differences and despite the fact that they share elements of the *Quercus* genus, which dominate Drosato, Paleochori localities present a more diverse flora which represents different vegetation zones. Our preliminary data indicate that during the Pliocene in the area around Kalavryta there were lacustrine environments characterized by backswamp forest elements such as *G. europaeus* (Paleochori 3, 4). These environments were fed by rivers and around their beds riparian elements were found, whereas at the slopes of the adjacent hills a mixed mesophytic forest was developing (all three localities). The climate was temperate with a Mean annual temperature around 18°C and cold season mean month temperatures >0°C.

Two of the taxa, *G. europaeus* (Figs 3c, 3f) and *Z. zelkovaefolia* (Fig. 3e), are now extinct deciphering the respective evolutionary trends of the vegetation during the Pliocene and Pleistocene.

Moreover, after the fossils are properly studied, part of them will be placed in the exhibition room at the Geopark's information centre and will certainly comprise a central exhibit in a gallery of a future exhibition centre. Consequently, soon Chelmos – Vouraikos Unesco Global Geopark will be able to designate its first fossiliferous geosites.

## References

- Koukouzas, K., Vagias, D., Xenakis, M., Chantzis, M., 1992): Project VALOREN Kalavryta. Technical Study. E.T.B.A. Produced by I.G.M.E./Δ.Ε.Π.Υ. Tripolis. (In Greek).  
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