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CONTRIBUTIONS TO THE EUROPEAN POLLEN DATABASE

19. Mire Kupena, Western Rhodopes Mountains (South Bulgaria)

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Site details

Mire Kupena is a former lake (41° 59' 07.5" N, 24° 19' 05.1" E; 1356 m above sea level (a.s.l.)) located on the territory of the Biosphere Reserve Kupena, Western Rhodopes Mountains, Bulgaria. The reserve is located between 600 and 1400 m a.s.l. on a north-facing slope and its vegetation is rather diverse. In the lower parts, the most common plant communities are those of *Quercus dalechampii* Ten. mixed in some places with *Carpinus betulus* L., *Fagus sylvatica* L., *Pinus nigra* Arn. and *Pinus sylvestris* L. At higher altitudes, plant communities of *F. sylvatica* dominate, followed by those of *Pinus sylvestris* with some *Abies alba* Mill. and *Picea abies* (L.) Karst. The mire is formed in a depression on an area of 6 ha, surrounded by an almost pure forest of *Pinus sylvestris* with an admixture of *Picea abies*, *A. alba*, *F. sylvatica*, *Betula pendula* Roth., *Sorbus aucuparia* L., *Q. dalechampii* and an undergrowth of *Juniperus communis* L., *Vaccinium myrtillus* L. and *V. vitis-idaea* L. The mire vegetation is represented by sparse moss cover (*Sphagnum* spp.) and includes various species of *Carex*, *Juncus*, *Potentilla*, *Ranunculus*, *Galium*. The basin is fed by rainfall and water from melting snow. During the last two decades most of the mire surface on the hummocks has been overgrown by pine trees (Huttunen et al., 1992; Bozilova et al., 2011). The climate in the area is montane with a mean annual temperature of 5–10 °C and a mean annual precipitation of 600–800 mm with a maximum in May–June. The basic soil types are brown forest (60%), humic-carbonate and cinnamomic-forest.

Sediment description

The core Kupena-3 is 200 cm long and was collected with a Dachnowsky corer from the peripheral eastern part of the mire. The sediments are:

0–56 cm: peat
56–60 cm: dark clay
60–70 cm: peat
70–90 cm: dark clay with detritus
90–110 cm: grey clay with sand
110–130 cm: grey clay with detritus
130–200 cm: grey clay with sand

Dating

The radiocarbon age of six bulk sediment samples was determined in the Radiocarbon Dating Laboratory at the University of Lund, Sweden. The calibration (95.4% probability) was performed with the OxCal v4.1 program (Bronk Ramsey, 2011). Results are:

35–37 cm: LuS 9328, 4100 ± 50 BP (4822–4445 cal BP)
52–53 cm: LuS 9329, 7535 ± 55 BP (8421–8201 cal BP)
114–116 cm: LuS 9331, 10 820 ± 65 BP (12 881–12 584 cal BP)
125–128 cm: LuS 9791, 12 145 ± 75 BP (14 212–13 781 cal BP)
142–145 cm: LuS 8989, 20 680 ± 150 BP (25 061–24 293 cal BP)

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161–164 cm: LuS 9332, $23\,730 \pm 160$ BP ($29\,070 - 27\,995$ cal BP)

Interpretation

The pollen sum (100%) includes all pollen grains except those of Cyperaceae, aquatics, spores of mosses and pteridophytes. Selected pollen percentages are shown on Figure 1 and six pollen assemblage zones (PAZ) are delimited.

PAZ Kup3-1, 200–181 cm

Late Pleistocene, older than *c.* 30 000 cal BP. The mountain slopes were covered by sparse *Pinus* forest with stands of *Betula* and *Juniperus* among herb communities dominated by *Artemisia*, *Chenopodiaceae*, *Poaceae*, *Achillea*, *Apiaceae*, *Galium* and *Helianthemum*. *Quercus*, *Carpinus*, *Corylus*, *Fagus*, *Abies* and *Picea* grew at lower elevations under more favourable microclimatic and edaphic conditions. The local hydrological conditions favoured the abundant growth of *Isoetes lacustris* L., Cyperaceae, *Potamogeton*, *Typha* and *Sparganium*.

PAZ Kup3-2, 181–143 cm

Late Pleistocene, upper zone boundary, 24 500 cal BP. A characteristic feature was the expansion of tree vegetation influenced by improvement of the climatic conditions. Forests of *Pinus* with groups of *Betula*, and below them, stands of *Quercus* and other deciduous trees became established and expanded at the expense of the mountain-herb vegetation composed of *Artemisia*–*Chenopodiaceae*–*Poaceae* species. During this time interval, *Isoetes lacustris* reached its maximum abundance.

PAZ Kup3-3, 143–113 cm

Pleniglacial–Lateglacial, 24 500–11 500 cal BP. An important transformation in the hydrological regime of the basin occurred during the Pleniglacial. The lowering of the water level, which is indicated by the sharp decline of *Isoetes lacustris* and the rest of the hydrophytes and hygrophites, resulted from the dry climatic conditions of the Last Glacial Maximum. This in turn led either to very low sediment accumulation rates or more likely to a hiatus until the beginning of the Lateglacial, *c.* 15 000 cal BP (level 140 cm). In either case, there is little information about the composition of the vegetation. During most of the Lateglacial, tree vegetation was rather scarce and consisted of isolated stands of

MIRE KUPENA-3 (Western Rhodopes Mts., 1356 m)

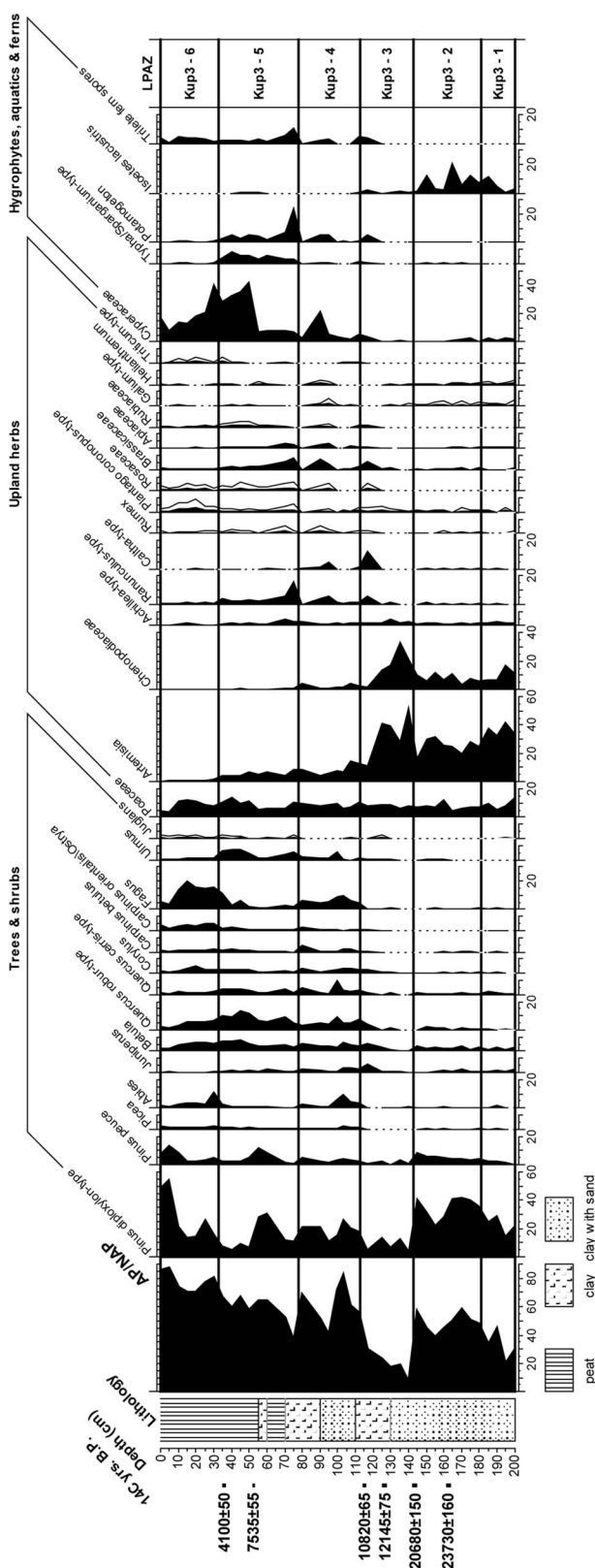


Figure 1. Pollen diagram from Mire Kupena-3 with selected taxa.

Pinus, *Betula* and *Quercus*. Large areas around the basin were dominated again by herb communities of *Artemisia*, *Chenopodiaceae*, *Poaceae* and other cold-resistant heliophilous herbs.

PAZ Kup3-4, 113–78 cm

Early Holocene, 11 500–10 000 cal BP. Tree vegetation expanded, particularly broad-leaved forests of *Quercus* with *Carpinus*, *Ulmus* and *Corylus*. Another important feature was the first substantial, though temporary increase of *Fagus* and *Abies*. The coniferous communities were composed of *Pinus* with stands of *Betula* and *Juniperus* on more open areas. The herb vegetation was rather diverse, represented by *Poaceae*, *Achillea*, *Ranunculus*, *Brassicaceae*, *Apiaceae* and *Plantago* species. Hygrophytes and hydrophytes (*Cyperaceae*, *Potamogeton*, *Typha* and *Sparganium*) spread but without *Isoetes lacustris*.

PAZ Kup3-5, 78–33 cm

Middle Holocene, 10 000–4700 cal BP. The hydrological regime of the basin changed again, particularly after c. 8400 cal BP, when the deposition of clay was replaced by a rather slow accumulation of sedge peat, indicative of lower water level. This led to the disappearance of the aquatic plants (*Isoetes lacustris*) from the local flora and to replacement of the former lake by marshy herb communities. The composition of the forests did not change too much, except for some reduction of *Abies*, *Fagus*, *Carpinus* and *Corylus*. *Pinus* forests expanded but shortly afterwards declined.

PAZ Kup3-6, 33–0 cm

Late Holocene, 4700 cal BP–present. Several significant changes in vegetation cover occurred, one of

the most important being the increases of *Fagus*, *Abies* and *Carpinus orientalis/Ostrya*. The dynamic processes of tree migration ended with the formation of the modern recent vegetation assemblage c. 2000 years ago when forests dominated by *Pinus sylvestris* with an admixture of other coniferous (*P. peuce* Griseb., *Abies*, *P. nigra*) and deciduous (*Fagus*, *Betula*) trees occupied the slopes around the mire. In many places, fragmented mixed coniferous-deciduous communities formed, which can be attributed not only to climate changes but also to human interference.

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