

## **Multi-proxy analyses of geo-bio-archives – a key to reconstruct major environmental and ecological changes in the Ephesia, W Turkey, during the last eight millennia**

Friederike Stock (1), Maria Knipping (2), Anna Pint (1), Marc Krichel (3), Jan Schwarzbauer (3), Larissa Dsikowitzky (3), and Helmut Brückner (1)

(1) Institute of Geography, University of Cologne, Cologne, Germany, (2) Institute of Botany, University of Hohenheim, Stuttgart, Germany, (3) Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Aachen, Germany

This interdisciplinary geoarchaeological research in the environs of the ancient city of Ephesus (W Turkey) focuses on (i) Holocene landscape reconstruction along with sea-level changes, and (ii) human impact on landscape evolution. More than 200 sediment cores were retrieved from geo-bio-archives and analysed with a multi-proxy approach (geochemical, sedimentological, microfaunal, palynological, and parasitological methods).

The Holocene palaeogeographic changes in the embayment of the Küçük Menderes (Kaystros) on the Aegean coast of Turkey with the famous ancient city of Ephesus are counted amongst the most dramatic ones in the Mediterranean. About seven millennia ago, the maximum marine transgression filled the Küçük Menderes graben up to 20 km inland. Since then, the coastline has continuously shifted westwards due to the progradation of the deltas of this river and its tributaries. Besides other natural factors, like sea level fluctuations and tectonics, the speed of delta progradation was mainly governed by the riverine sediment load, which, in turn, was very much dependent on the human impact on the vegetation cover of the drainage basins. The sedimentation rates confirm this assumption: While low rates occurred between the 5th and the 1st millennia BC (up to 1 mm/year), much higher rates (4 – 30 mm/year) can be calculated thereafter. In response to these dramatic environmental changes, human settlements and their harbours had to be relocated several times from the 1st millennium BC onwards. The Koressos harbour and the Roman harbour were important hubs for commerce with the islands in the Aegean Sea. The nowadays silted-up harbour basins are valuable geo-bio-archives. The Roman harbours inventory shows high heavy metal concentrations (lead, copper), fruit tree pollen and eggs of intestinal parasites from the 1st millennium BC until the 7th century AD, as evidence of intensive human impact during that period of time. The occurrence of organic compounds (abietane, retene, loliolode and  $\beta$ -cyclocitral originating, e.g., from natural resins, tar and bitumen) also correlate with the intensive use of the harbour. In contrast, the lake and swamps of Belevi, located 14 km upstream of Ephesus, represent a geo-bio-archive with a quasi-natural sedimentation. However, even there the palynological analysis clearly reveals settlement activities already since the 7th millennium BC. The proof of the Santorini tephra of 1630 BC is an excellent marker horizon; it is the first time that this ash was detected in the environs of Ephesus.