carbonate platform of the Ionian Basin began to break up in the early Pliensbachian. The first deepening of the basin has been recorded in Siniais Limestones that are followed by Posidonia Beds. The occurrence of macroremains of the conifer *Brachyphyllum nepos*, together with geochemical and palynological studies of Toarcian deposits of the Ionian Zone, suggested the presence of a tropical biome in the broader area.

The 20-m outcrop examined (Toka section) begins in the upper part of the Siniais Limestones and continues into the lower part of the overlying Posidonia Beds. In the studied deposits previous research has documented the local expression of the global Toarcian Oceanic Anoxic Event. The Early Toarcian Oceanic Anoxic Event has been associated with exceptionally high rates of organic-carbon burial, marine anoxia to euxinia, sea transgression, high palaeotemperatures and mass extinction and is generally considered as a significant climatic driven event**.**

Palynological investigation of the deposits aims to contribute further to our knowledge about the Toarcian palaeoenvironmental conditions, while the resulting dataset is an additional contribution to the Jurassic biostratigraphy of the Ionian Zone. Most studied samples yielded a considerable amount of palynological residue, including moderate diverse and fairly well preserved palynomorph assemblages of pollen, spores and dinoflagellate cysts. Additionally in palynospectra from organic rich horizons a significant quantity of amorphous organic matter has been recorded.

## Fission-track constraints on the thermotectonic evolution of the Apuseni Mountains (Romania)

Kounov A. and Schmid S.M.

*Institute of Geology and Paleontology, Basel University, CH-4056 Basel, Switzerland, a.kounov@unibas.ch, stefan.schmid@unibas.ch*

The Apuseni Mountains, located inside of the Carpathian arc and bounding the Transylvanian basin to the west, constitutes the largest outcropping part of the Tisza block. This crustal fragment consists of a stack of several nappe sequences formed in response to continental collision, which followed the closure of the Neotethys Ocean. The northwestern part of the Apuseni Mountains represents a coherent nappe sequence consisting of the Bihor and Codru nappe systems. The tectonically highest Biharia nappe system, previously considered as part of Tisza plate, is attributed to the Dacia Mega-Unit. The assignment of the Biharia nappes to Dacia is made on the basis of the fact that both structurally underlie the obducted remnants of the Neotethys (Transylvanian Ophiolitic unit) leading to the assumption that an oceanic suture needs to be placed between Biharia nappe system and the Tisza block.

The main high-grade metamorphic event in the basement rocks, outcropping in the Apuseni Mountains, is of pre-Mesozoic age because the metamorphics are covered by Triassic or Jurassic non-metamorphic sediments. The first Alpine tectonic event was probably related to the obduction of the Eastern Vardar Ophiolitic unit (Transylvanides) onto parts of the Dacia Mega-Unit (Biharia) in the latest Jurassic. This was followed by late early-Cretaceous final closure of the Neotethys remnants and the collision between Tisza and Dacia blocks producing top-E nappe stacking. The final emplacement of the nappes in the Apuseni Mountains involving top-W to NW superposition of the Biharia, Codru and Bihor nappe systems did not occur before Turonian time as documented by the late Turonian “Gosau” unconformity. Subsequent compressional deformations in the area are reported for the end of the Cretaceous and the Eocene.

The Jurassic volcanics of the Transylvanides and their sedimentary cover, as well as the underlying Baia de Aries nappe (the highest structural unit of the Biharia nappe system) exhibit late early-Cretaceous zircon fission-track (FT) ages (Aptian and Albian, 120-103 Ma). The more westerly and structurally lower units (Biharia nappe of the Biharia nappe system, Codru and Bihor nappe systems), however, exhibit Late Cretaceous (Turonian to Campanian, 95-71Ma) zircon FT ages. The late early-Cretaceous zircon FT ages from the Baia de Aries nappe, together with the Jurassic ophiolites and their sedimentary cover, suggest that these rocks must have been buried to a minimum of 8 km during this time. Such associated temperatures have probably been attained during underthrusting of these units below the Tisza megatectonic unit (thrusting being top-east). The ages obtained from the Bihor, Codru and Biharia nappes (Turonian to Campanian, 95-71Ma) correspond to the age of the late Cretaceous top-NW event that led to the present-day nappe stack in the Apuseni Mountains. The internal parts of the Baia de Aries nappe and the overlying Transylvanides were not reheated during this second event since they occupied the highest tectonic position.

Zircon FT age distribution, combined with thermal modelling of the apatite FT data, show that rapid post-tectonic cooling of the area during the late Cretaceous was followed by relatively slow cooling during the early Paleogene.

## Role of climate and carbon dioxide in tree-ring growth of Greek firs from Ainos Mountain, Western Greece: 1820-2007 AD

Koutavas A.

*Department of Engineering Science and Physics, College of Staten Island, City University of New York, 2800 Victory Blvd, Staten Island, NY 10314, USA, tom.koutavas@csi.cuny.edu*

Nine billion metric tons of carbon are emitted annually by human industrial activities around the world. Approximately 30% of this is taken up by the oceans, and another 20% by the land biosphere. The land uptake has long been known as the “missing carbon sink” and has remained elusive, in that the underlying processes remain unidentified. A major mechanism contributing to this uptake is thought to involve enhanced growth of forests as a consequence of increased photosynthesis due to elevated atmospheric $CO_2$. This mechanism, known as the $CO_2$ fertilization effect, is well documented in controlled laboratory and field studies but remains controversial in natural forests bathed in ambient air. If $CO_2$ fertilization is indeed operating in natural ecosystems it could have important implications for terrestrial ecosystem and carbon cycle dynamics around the world.

Here I present tree-ring evidence for $CO_2$ fertilization in Greek firs (Abies cephalonica, Loudon) growing at 1300-1600 m elevation on the Ainos Mountain forest on the island of Cephalonia (Kefalonia) in western Greece. Core samples were collected from firs growing near the peak of the mountain, and ring widths were measured and processed into a master chronology extending from 1820 to 2007 AD. Standardized ring-width variations were regressed with instrumental records of temperature, precipitation and Palmer Drought Severity Index (PDSI) to identify growth-climate relationships. It was found that growth is favoured by late spring and early summer moisture availability, with wet and cool June conditions being optimal for growth. Surprisingly however these relationships have degraded or vanished in recent decades, indicating that growth sensitivity to moisture has declined. This is an unexpected finding in light of recent trends toward aridification of the background climate extending over the entire Mediterranean basin. In addition to loss of moisture sensitivity, the tree-rings from Ainos firs indicate significant acceleration of radial stem growth, which is especially pronounced after 1990 AD. The combination of enhanced growth and loss of moisture sensitivity despite increased aridity are diagnostic of a $CO_2$ fertilization effect operating via a “water use efficiency” mechanism. Elevated $CO_2$ induces stomatal closure, which helps conserve leaf water by limiting evapotranspiration, thus allowing greater growth and reducing sensitivity to moisture. This effect is predicted to be strongest in moisture-stressed, arid and semi-arid environments such as the eastern Mediterranean basin. Its detection in greek firs from western Greece may not be an isolated process, but possibly indicative of broader forest responses to elevated $CO_2$ over the greater Mediterranean basin. Further tests are needed to establish the spatial extent and regional or global significance of this effect.