

In memoriam Professor Josip Benić ("doktor Jožo", co-founder of the study of nannofossils in this region) (03.05.1939-26.07.2016)

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A long time teacher of geology, Professor Josip Benić passed away on July 26, 2016. His colleagues, friends, and students will remember a researcher with a profound knowledge of the Mesozoic and Cenozoic geology of Croatia and its adjacent regions. During his professional career, Josip Benić proved to be a responsible and precise teacher who was always open to co-operation and constructive dialogue and who never hesitated to offer help and advice to his younger colleagues.

Josip Benić was born in Osijek on May 3rd, 1939. He graduated and received his PhD degree from the Faculty of Science, University of Zagreb (title of PhD Thesis was "Calcareous nanoplankton and its application on biostratigraphy of Cretaceous and Palaeogene sediments of Croatia"). In 1969, Josip Benić joined the Faculty of Science and, in 1976 became a full-time Assistant Professor at the Department of Geology (Institute of Geology and Palaeontology). He served (1985 – 1989) as head of the Institute of Geology and Palaeontology, and in 1996 he accepted the chairmanship in the Department of Mineral Resources at the Croatian Geological Survey, where he remained until he retired in 2004. Josip Benić remained a faculty member and part-time Associate Professor, teaching the geology of Croatia and adjacent regions, and whenever it was necessary he joined a mapping course (both theoretical and field based).

His studies of Cretaceous – Eocene calcareous nannofossils and their biostratigraphic and palaeoecological application began following the advice of professors Vanda Kochansky-Devidé and Milan Herak. Calcareous nannofossils are considered to be one of the most powerful biostratigraphic tools for marine carbonate sediments, especially in open ocean settings. The beginning of his research coincided with an intensive investigation into this

group all over the world (by researchers including K. Perch-Nielsen, E. Martini, D. Burky, W.W. Hay, B.U. Haq). It was a time when standardized quantitative counting methods were "discovered", and when unambiguous taxonomy and highly resolved data sets provided high-quality biostratigraphic data. The first papers on nannofossil physiology and ecology and the parameters that controlled their distribution appeared, illustrating their application in facies reconstruction and palaeoclimatology and palaeoceanography reconstructions, for which they are still used today.

However, the most time-consuming part of his research was gaining knowledge about nannofossil taxonomy. He overcame several major obstacles, the most important of which was that no local specialists were on hand to teach him and help with ambiguous specimens as well as his limited access to literature. However, it was worth the hard work. Years of field sampling and hours and days studying the nannofossils under a light microscope resulted in the broadly accepted nannofossil biozonation for the Late Cretaceous and Paleogene strata in the Dinarides. He recognized and determined the age of two flysch belts in the Dinarides. Quite diverse sedimentation characterizes the northern flysch basin. In some areas sedimentation was continuous from the Upper Campanian to the middle Eocene, while in others emersion took place across the K/Pc boundary and the re-establishment of sedimentary environments suitable for flysch deposition varied from the Middle to Upper Palaeocene. In the southern belt, flysch deposition followed shallow-water platform sedimentation, and corresponds to the Middle and Upper Eocene in one zone and to the Upper Eocene in another. Moreover, his conclusions about the variable duration of tectonic changes in the studied belts contrasted with the traditional view about the origin, age, and distribution of flysch. Not to mention that subsequent studies have proved that he was right. His last work published in 2014 with another nannologist is homage to his work, in which he discussed and concluded about the age of the Bosnian flysch, an enigma which he began to study in his thesis and in this work was finally completed. Nowadays when quantitative studies present a very important tool in scientific ranking, his thesis is one of the most cited works from this area of study.

After Josip Benić obtained his PhD degree, he continued to investigate the calcareous nannofossils from different areas within the Dinarides, and his results were published in several articles and chapters in books (see Appendix). What made him unusual is the fact that he generously shared his knowledge and therefore he is acknowledged in many studies and papers. His palaeoecological interpretations of assemblages have yielded improved interpretation and reconstruction of the evolution of the Dinaric foreland basin, when shallow-water carbonate environments temporarily were suspended and when they again emerged.

His pioneering work is seen through his publications. They are not numerous when counting the number of papers themselves, but they are very important. In his work the Cretaceous and Paleogene sediments within the Dinarides are age interpreted by calcareous nannofossils, in some places in more detail, in others less, forming an excellent base for future studies on the Dinarides.

But these facts do not come close to capturing the wonderful essence of Professor Josip Benić who was an individual of great intellectuality, humor, and generosity. He had a modest, honest, earnest, and very human personality as a professor, colleague, and friend. His generosity was, amongst other ways, reflected in sharing his time, advice, and especially helping with analysis necessary for the age attribution of deposits. His students are indebted to him for his generous guidance, the humor he knew to share with them, and his friendship and help. "Caring mentor" is the best expression for him.

If we want to summarize his professional work then we have to stress that he co-founded the study of calcareous nannofossils in Croatia by classifying them and applying them to biostratigraphy. He was the pioneer in applying academic knowledge in petroleum geology and an expert in the geology of the Dinarides. His work advanced the understanding of these fossils and more importantly, their role in applied geology.

He enjoyed photography and was fascinated by the Second World War (especially by the lives of some of the well-known soldiers and leaders, he liked the exposure of "secrets" behind the war scene). He indulged in spending time at and taking care of summerhouses (one on the **lowest island** in Croatia and another one close to Zagreb) and being with his family.

He touched the lives of many students and colleagues in and out of the scientific world and has left a great legacy, personal and professional. We are going to miss him greatly!

Vlasta Čosović and Matija Panić

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