



FORAMS 2006

## Recent foraminifera from the Croatian Adriatic seacoast

Vlasta Cosovic<sup>1</sup>; Mladen Juracic<sup>1</sup>; Alan Moro<sup>2</sup>; Morana HERNITZ KUCENJAK<sup>2</sup>;  
Sanja RUKAVINA<sup>1</sup>; Nevio PUGLIESE<sup>3</sup>; NATASA STUPER<sup>3</sup> & INES VLAHOV<sup>1</sup>

<sup>1</sup>Department of Geology and Paleontology, Faculty of Science,  
University of Zagreb, Horvatovac 102a, 10000 Zagreb, Croatia  
vcosovic@geol.pmf.hr

<sup>2</sup>INA-Industrija nafte d.d., Research and Development Sector,  
Lovinciceva bb, 10000 Zagreb, Croatia

<sup>3</sup>Dipartimento di Scienze geologiche, Ambientali e Marine,  
University degli studi di Trieste, Via Weiss 2, 34127 Trieste, Italia

The need to assess the impact of pollution (industrial, agricultural, and other anthropogenic chemicals) in the Adriatic Sea leads to the study and use of foraminiferal assemblages as environmental quality indicators in coastal settings. From the time of Dezelic (1896. *Foraminifere Jadranskog mora. Glasnik Hrvatskog naravoslovnog drustva, Zagreb, 9: 97*) until the 1990s and the appearance of *Mediterranean Foraminifera* (Cimerman & Langer, 1991. *Mediterranean Foraminifera. Dela – Opera, Ljubljana, 30: 118*), the study of foraminifera has included sporadic collecting of samples from particular sites (Cimerman *et al.*, 1988. *Rev. Paléobiol., vol. spec. 2, Benthos '86: 741-753*) during a very short time interval or collecting of samples from a site over an extended period of time (Daniels 1970. *Götting. Arb. Geol. Paläont., Göttingen, 8: 109*). The knowledge we gained from such studies was general, such as that 583 Recent foraminiferal species (19 are planktonic forms) live in the Croatian coastal region of the Adriatic Sea. The growing interest in the subject of environmental changes and concern for Croatia's main export product (tourism) suggested the need for systematic investigation of foraminiferal assemblages. From Croatia's 1000km long, geomorphologically diverse coast with more than 1000 islands, we have chosen four particular sites to initiate monitoring. The sites were chosen to show the relationship between enclosed circulation patterns, karstic drainage (subsurface and surface), and anthropogenic influence (eutrophication). We studied (from northwest to southeast): the Mirna river estuary (intensive agriculture locally), Plomin Bay ("measurable" river input and power plant contamination), Rijeka Bay (municipal sewage and effluent from the busy cargo port), and Mljet lakes (restricted marine environment with summer stratification and sporadic agricultural activity). Scuba divers collected sediments from several stations in

a transect from the most landward station towards the open sea (down to 55m depth), and we studied stained and unstained and total assemblages from samples prepared according to standard procedures (around 300 specimens obtained by splitting after washing the samples over 0.063mm sieve). The foraminiferal assemblages from sites where freshwater input is considerable show the following characteristics:

- 1) an *Ammonia beccarii* association typical for lagoons along the Mediterranean coast (Murray, 1991. *Longman Scientific and Technical, Harlow, Essex: 391*) is identified in the region closest to the discharge area;
- 2) the assemblages are composed of a great number of megalospheric forms of *A. beccarii*;
- 3) dead tests are much more common in the assemblage than living ones (regardless of season when sampling takes place);
- 4) there is a predominance of species belonging to Rotaliina over Miliolina (Textulariina specimens do not exceed 10%);
- 5) indices of biodiversity imply marginal to normal marine conditions;
- 6) an *Ammonia/Elphidium* ratio from 46% to 92%;
- 7) dissolved tests are less than 5% of the living assemblages; and
- 8) species diversity corresponds positively with Fe, Mn concentrations in the sediments from Rijeka Bay and negatively with Pb concentrations (relative abundance of deformed tests is less than 1%).

It is clear that constant fresh water input is a stressful influence, but neither intensive agricultural or industrial activities in the vicinity nor intensive marine traffic have left a noticeable impact on the foraminiferal morphologies. Foraminiferal assemblages from restricted marine settings are characterized by a low biodiversity index, depth dependence of “specialist” miliolids over rotaliids, and in temporarily hypoxic lagoons, the presence of species tolerant of low oxygen conditions (in “dead” assemblages).