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Recent Changes of the Mediterranean Environments - A Research Programme

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Energy consumption and land-use activities have created serious, if not catastrophic, environmental problems during the past century or so. Chemical and radioactive pollution are some examples of modern waste that have created increasing degradation of life qualities. Various degrees of environmental perturbations have been observed in the atmosphere, hydrosphere and the biosphere. The atmosphere is constantly contaminated by chemical waste with different damaging effects. Occasional atmospheric contamination by radioactivity, through failure of nuclear power plants and nuclear-weapon tests, have caused an increasing social and political fear. The greenhouse gases and possible impacts on climate change and landscape ecology have created intensive scientific and political debates. Lacustrine, riverine, estuarine and marine water-bodies suffer eutrophication as well as different forms of chemical pollution (e.g. acidification, heavy metal pollution, oil and organic waste). Soil erosion, dessication of vegetation, salinization, water scarcity and ground-water pollution have also been influenced by modern human activities.

Environmental and historical monitoring are thus important steps in evaluating the quality of present and past environments, and represent a basis for environmental protection policies. Such monitoring programmes would allow: 1) an early warning for environmental instabilities and catastrophic events; 2) global and regional chronological records on past environmental changes. Such knowledge is essential for assessing background values of unpolluted environments as well as for modelling sources, pathways and sinks of environmental pollutants and related interactions in space and time.

Routine and historical monitoring of recent environmental pollution/perturbation are now possible through a set of well-developed techniques covering reliable sampling of environmental materials, low-level counting of natural/artificial radioactivity and chemical/physical analyses of organic and metallic species as well as other palaeolimnological and palaeoecological interdisciplinary approaches. Intensive field studies, considerable international collaboration between specialists/ researchers from different sciences as well as solid social and political support are needed for such complicated and resource-demanding studies.

A research programme "The Mediterranean Pollution History: Radioactive and Chemical Mass-Balance Studies" focusing on modelling the history of modern pollution and its influence on the Mediterranean environments is proposed. This programme (MPH-RCM), however, aims at enriching and building up individual data banks on the history of radioactive and chemical pollution of the Mediterranean countries/regions. This programme would also allow exchanging and integrating scientific and intellectual efforts in environmental, earth-sciences, ecological and management (socio-economic) disciplines. These interactions would provide temporal and spatial correlations between chronologically and environmentally important radioactive nuclides, aquatic nutrients and toxic chemicals. A Mediterranean pollution model in space and time would be constructed. It is hoped that our refined techniques would allow us to evaluate available environmental hypotheses related to land-use and water resources and to understand the nature and dimensions of the confusing environmental issues.

The experimental work within MPH-RCM will primarily concentrate on ^{210}Pb , ^{226}Ra , ^{222}Rn , ^{137}Cs , ^{40}K , ^{90}Sr , $^{239,240,241}\text{Pu}$ and ^{241}Am . Nevertheless, some other radioactive nuclides such as ^{14}C , ^{10}Be and ^{32}Si may be considered in some cases. Toxic chemicals such as heavy metals, acid oxides, fluorocarbon, combustion-carbon (aromatic hydrocarbons and soots) and organic-gases, oil and refinery waste, phenols, cyanides, fluorides, synthetic organic chemicals, PCB's, DDT and soil remaining fertilizers have been atmospherically and non-atmospherically injected to the environments at increasing rates during the past century or so. Phosphorus and nitrogen are major nutrients of riverine, lacustrine and marine environments and their enhancement in these environments causes eutrophication, the history of such perturbation would be modelled.

Analyses of the mentioned radioactive and chemical species will be carried out on: 1) air, rain, water, food-stuffs and human organs; 2) depositional sequences with reliable/valuable chronological and environmental records (from undisturbed soils, accumulation bottoms of marine and lacustrine water-bodies as well as suitable wetlands and riverine systems) will be identified, sampled and analyzed. Statistical and modelling tools will be applied to find valid correlations and interactions as well as to construct regional biogeochemical cycles. The influence of climatic, meteorological, hydrological, geophysical and geochemical conditions on biogeochemical cycles will be investigated. The Mediterranean environments would be compared with the Scandinavian ones in order to monitor global trends and to assess the influence of pollution on these very different regions.