The river basin-coastal zone continuum: heavy metal contents in stream and marine sediments, NW Aegean Sea (EUROCAT Project)

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Introduction: The Axios River (Vardar) drains the Former Yugoslav Republic of Macedonia (FYROM) and Greece, where it discharges into the NW Aegean Sea [Fig. 1]. The river water is loaded with dissolved and particulate heavy metals, which in turn affect the marine sector [1, 2, 3, 4]. This contribution aims at highlighting the direct relationships existing between the catchment basin and the adjacent coastal zone, focusing on heavy metal enrichment, in stream and marine sediments.

Methods: Active stream sediments were analyzed for a series of major, minor and trace elements by the Greek Institute of Geology and Mineral Exploration (in total 3237 samples; see [1] for details). Thirty-seven surface marine sediments were analyzed for major and minor elements at the laboratories of the Hellenic Centre for Marine Research [1, 3]. Here we report data on Zn, Cr, Pb, and As.

Fig. 1: Spatial distribution of Pb (μg/g) in active stream sediments of the Axios R. Note the decreasing Pb content southern of the Prochoma dam, indicated by a black triangle.

Results: Heavy metal content ranges in active stream sediments from the Axios R. (Fig. 1) were 42-271, 39-180, 11-140, and 1-40 μg/g for Zn, Cr, Pb, and As, respectively, whilst ranges for the Thermaikos Gulf surface sediments (Fig. 2) were 96-429, 147-458, 42-264, and 11-29 μg/g [1].

Discussion: Heavy metals in the area originate in various sources, i.e. industrial activities (FYROM and Thessaloniki) as well as the natural enrichment attributed to the weathering of ultra-mafic and volcanic rocks of Axios and other catchments. Although heavy metal values appear to be occasionally higher than the ones found in other European coasts, sediment quality criteria are violated only for Cr and As [1].

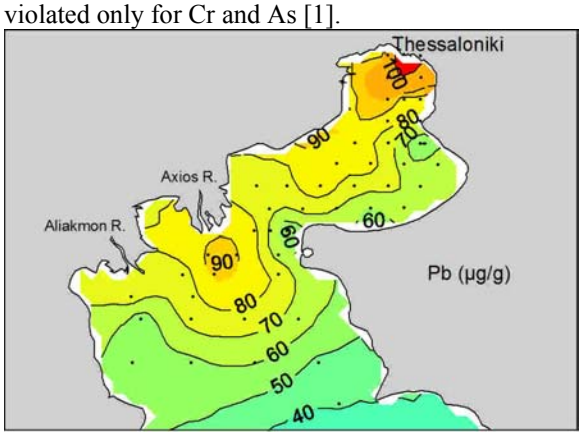

Fig. 2: Spatial distribution of Pb (μg/g) in surface sediments of the NW Aegean Sea.

Conclusions: The spatial distribution of Pb (Figs 1, 2) shows clearly the effect of the Axios R. discharges into the Thermaikos Gulf. It appears, therefore, that sediments can act as excellent indicators of environmental quality, especially when combined with biological indicators [e.g. 5 and references therein], as well as when compared to Direct Exposure Soil Action Levels (SALs) Standards for residential land use, which were developed by the Environmental Protection Agency of USA [1]. The European Union Water Framework Directive 2000/60/EC (WFD) while it establishes an integrated and coordinated framework for the sustainable management of water (rivers, lakes, estuaries, coastal waters, and groundwater) pays little attention to sediment quality, which, in our perspective, deserves more study.

References: [1] Karageorgis et al. (2003) *Cont Shelf Res* **23**: 1929-1944; [2] NEAP (1996) *Ministry of Urban Planning, Construction and Environment, Skopje*; [3] Karageorgis et al. (2005) *Appl Geochem* **20** 69-88; [4] Karageorgis et al. (2005) *Cont Shelf Res* **25**: 2456-2575; [Malea et al. (2000) *J Appl Phycol* **12:** 169-176.