

# The impact of a sewage treatment plant's effluent on sediment quality in a small bay in Lake Geneva (Switzerland–France). Part 2: Temporal evolution of heavy metals

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## Abstract

The Bay of Vidy is the most contaminated area of Lake Geneva, Switzerland, as a result of the release of treated and untreated waste water from the municipal sewage treatment plant of the city of Lausanne and its surroundings. The reconstruction of the historical deposition of heavy metals in the sediment of the bay has been performed by the analysis of several dated (radio-caesium) sediment cores. The presence of sewage-derived contaminants in the Bay of Vidy since the beginning of the sewage treatment plant's operations in 1964 is clearly observed, when a sharp increase in heavy metal contents is recorded, with maximum concentrations of cadmium, copper, zinc and lead occurring between the late 1960s and early 1970s. Despite considerable improvement in recent times, the present concentrations of the investigated heavy metals in sediments of the Bay of Vidy are still higher than concentrations measured at the centre of the lake, the latter close to Lake Geneva's natural background values. It is concluded that the quantity of heavy metals deposited in the bay is considerable and, because of sediment instability, will constitute a potential hazard for biota.

## Key words

heavy metals, Lake Geneva, pollution, sediment, sediment dating, sewage treatment plant.

## INTRODUCTION

Many contaminants introduced into aquatic ecosystems via industrial and domestic sewage discharge, surface run-off and atmospheric fallout are adsorbed onto, and transported by, suspended sediments. After cycles of deposition, resuspension, transport, and biological and chemical interactions, contaminants associated with particles can be buried in bottom sediments, which become the ultimate pollutant sink (Burton 1992; Luoma & Ho 1993).

Studies assessing environmental contamination are complicated by a number of factors that contribute to pollutant carrier transport and distribution. Despite the

possibility of remobilization, however, sediments can record states of environmental stress dating far back into the past. In that sense, lake sediment cores provide an invaluable record of the past variations occurring both in a lake and its watershed (e.g. Dominik *et al.* 1984, 1991; Wessels *et al.* 1995; Loizeau *et al.* 1997; Von Gunten *et al.* 1997; Mecray *et al.* 2001). It is difficult, however, to quantify the severity and extent of sediment contamination when, in many countries, criteria for distinguishing 'clean' from 'contaminated' sediments are either non-existent or are still being developed (Smith *et al.* 1996). Among different approaches, the degree of anthropogenic sediment contamination is evaluated by comparison of heavy metal concentrations in recent sediments to the natural background concentrations (Förstner & Wittmann 1979; Håkanson & Jansson 1983).

The companion study, which focused on the assessment of the quality of surface sediments collected in the Bay of

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