

Variations in trace element geochemistry in the Seine River Basin based on floodplain deposits and bed sediments

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Abstract:

Between 1990 and 1995 a series of bed sediment, suspended sediment and fresh floodplain samples were collected within the Seine River Basin, in France, to evaluate variations in trace element geochemistry. Average background trace element levels for the basin were determined from the collection and subsequent analyses of bed sediment samples from small rural watersheds and from a prehistoric (5000 BP) site in Paris. Concentrations are relatively low, and similar to those observed for fine-grained bed sediments from unaffected areas in the United States and Canada. However, the concentrations are somewhat higher than the reference levels presently adopted by French water authorities for areas north of the Seine Basin, which have similar bedrock lithologies. Downstream trace element variations were monitored in 1994 and 1995 using fresh surficial floodplain samples that were collected either as dried deposits a few days after peak discharge, or immediately after peak discharge (under ≤ 30 cm of water). Chemical comparisons between fresh floodplain deposits, and actual suspended sediments collected during flood events, indicate that, with some caveats, the former can be used as surrogates for the latter. The floodplain sediment chemical data indicate that within the Seine Basin, from the relatively unaffected headwaters through heavily affected urban streams, trace element concentrations vary by as much as three orders of magnitude. These trace element changes appear to be the result of both increases in population as well as concomitant increases in industrial activity. This article is a US government work and is in the public domain in the United States.

KEY WORDS trace elements; geochemistry; Seine River; bed sediments; floodplain sediments; suspended sediment

INTRODUCTION

The Seine Basin in France encompasses about 67 500 km² from its headwaters to Poses, the last lock on the river before it enters the estuary (Figure 1). Fortunately, for purposes of establishing local trace element background concentrations, the basin is essentially monolithogenous, being underlain by more than 97% sedimentary rocks of which better than 78% are carbonates in the form of chalk and limestone (Thibert, 1994). The only crystalline rocks in the basin are located in the Morvan region in the headwaters of the Yonne River (Figure 1). Basin relief is gentle; maximum elevations do not exceed 902 m (Meybeck, 1998). The major Seine tributaries are the Aube (4750 km²), the Yonne (11 250 km²) and the Marne (13 160 km²) which join east of Paris, and the Oise (16 900 km²) which joins downstream of central Paris near where the

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