

# Investigation of trace element mobility in river sediments using ICP-OES

PJ Botes<sup>1</sup> and JF van Staden<sup>2\*</sup>

<sup>1</sup> Department Water Affairs and Forestry, Directorate Resource Quality Service Private Bag X313, Roodeplaat Dam, Pretoria 0001, South Africa

<sup>2</sup> Faculty of Natural and Agricultural Science, Department of Chemistry, University of Pretoria, Hatfield, Pretoria 0002, South Africa

## Abstract

In this study, the column method was used to determine the leachable trace metals present in selected river sediments. In addition the sediments were investigated using a shaker method and these two methods were compared for reliability. For both these methods extract solutions associated with a sequential extraction method were used. However, the sediments were only subjected to one extractant solution and not to the whole sequential procedure. The river sediments were also subjected to a digestion procedure to determine the total trace metal content. Simulated pollution experiments were performed where the sediments were also spiked to give known concentrations of trace metals. These results were very useful, especially in cases where certain trace metals were not currently present in river sediments. From the results achieved in this study the general trace metal status of the sediments can be established. From the results achieved it was established that in the case of the less impacted rivers (Crocodile and Olifants Rivers) only slight changes in the river conditions are needed to mobilise the trace metals present. From the results of the Blesbokspruit it was seen that urgent attention is needed to prevent further damage to the system.

**Keywords:** river sediments; pH dependent extraction; trace metal content; acid digestion; column extraction method; shaker extraction method; simulated pollution; experiments

## Introduction

In the past, water quality assessment techniques were the main tools used to assess the impact of humans on the aquatic environment. However, soil and river sediments are also prone to contamination from atmospheric and hydrological sources. In South Africa, this indicator of pollution is not that intensively investigated in comparison to the water resource component. In the past decades, both industrial development and urbanisation have led to a dramatic increase in the amounts of effluents discharged into the natural environment (Fangueiro et al., 2002).

This study was done to establish ambient concentration values of trace metals in the chosen river sediments. These river sediments originated from the Blesbokspruit (near Witbank in the Mpumalanga Province (25°49'23" S and 29°12'33" E)), the Crocodile River (near Hartbeespoort Dam in the Gauteng Province (25°47'47" S and 27°53'42" E)) and the Olifants River (near Ohrigstad in the Northern Province (24°22'44" S and 30°39'58" E)) (see Fig. 1). The sediment samples were investigated to establish their ability to adsorb or retain trace metals. The mobility of the trace metals was also

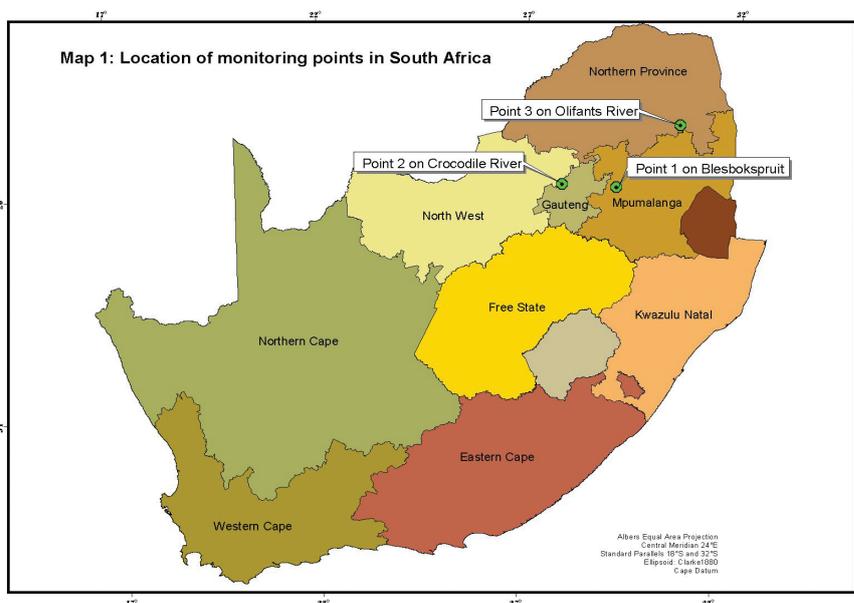


Figure 1  
Map showing location of sample points

investigated to establish the possibility that trace metals present in the sediments could be mobilised under certain environmental conditions. Two different methods were used to extract the trace metals and these methods were evaluated to determine their suitability as assessment tools. The river sediment samples were also subjected to a total digestion procedure to determine the total trace metal content. After sample preparation, all of the samples were analysed using an inductively coupled plasma optical emission spectrometer (ICP-OES).

\* To whom all correspondence should be addressed.

☎ +2712 998 0797; fax: +27

e-mail: [KoosvanStade@telkomsa.net](mailto:KoosvanStade@telkomsa.net)

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