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DISTRIBUTION OF TRACE ELEMENTS IN LAKE SEDIMENTS: A SCIENTOMETRIC ANALYSIS

PIERWIASTKI ŚLADOWE W OSADACH JEZIORNÝCH - ANALIZA SCIENTOMETRYCZNA

Abstract: This paper examines and compares research activities in the field of lake sediment analysis for the period 2000-2009. The scientometric data is collected from 79 articles published in major journals included in the Science Citation Index (SCI). The most commonly used journals were *Science of the Total Environment*, *Chemosphere*, *Microchemical Journal*, *Applied Geochemistry* and *Environment International*. The trace elements which are analyzed in most cases are Pb, Cu, Ni, Cr, Co, Mn and Zn. None of countries show research effort activity that would be outstandingly higher than the majority, although some of them, eg Sweden, The United States, Canada and China have shown activity above the average level.

Keywords: trace elements, scientometric analysis, sediments

Water body sediments and their characterization from viewpoint of trace element and especially heavy metal concentrations are important ecosystem and environmental quality assessment indicators exactly in long-term significance. Sediment pollution is caused by natural and anthropogenic influence. The physical and chemical characteristics of sediments are a major component in determining the habitat (eg fish, invertebrates and others) quality for aquatic biological organisms as well as indirectly also human health.

The paper examines and compares research activities in the field of trace element analysis in lake sediments for the period 2000-2009.

Materials and methods

Scientific papers analyzed

The scientometric data is collected from 79 articles published in major journals included in the Science Citation Index and Science Direct databases. Only papers about trace metals in lake sediments were included in the analysis database. The journal with most published papers on the particular theme was *Science of the Total Environment*, followed by *Environment International* and *Applied Geochemistry* (Fig. 1).

Results and discussions

Scientometric studies of published papers about trace elements in lake sediments in the last ten years have shown quite even distribution of annual publications - 6 to 7 papers per year with a slight increase in years 2007 and 2008. As seen below (Fig. 2) year 2009 shows a decrease in numbers of published papers but this could mostly be due to the fact that the calendar year was not yet finished in the time of preparation of this study.

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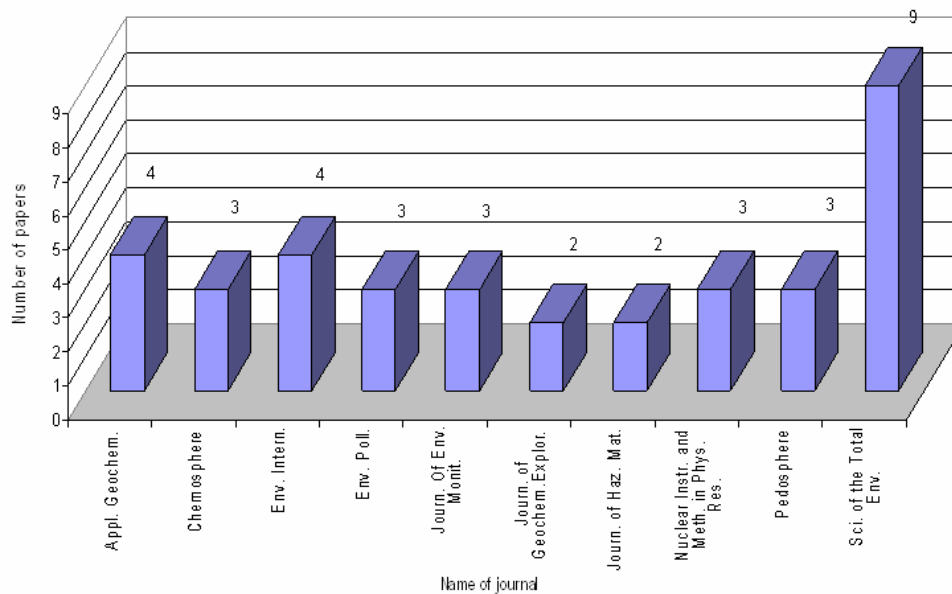


Fig. 1. 10 journals with most published papers on subject of trace metals in lake sediments from 2000-2009

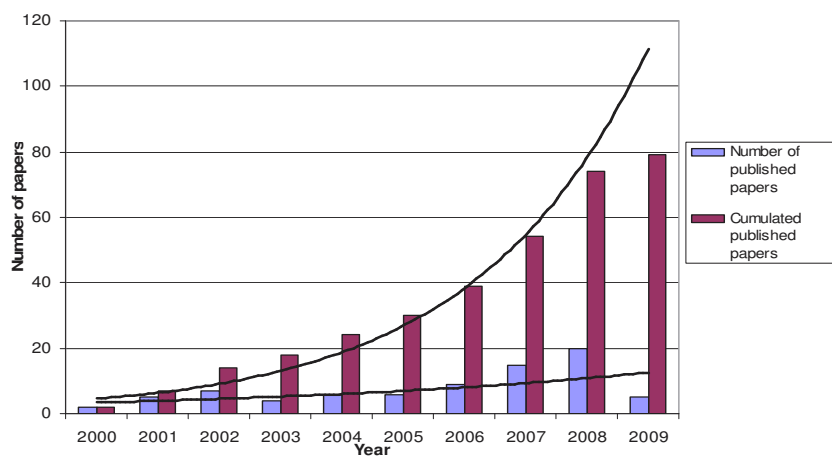


Fig. 2. Number of published papers per year on topics related to trace elements in lake sediments

Most commonly analyzed elements

The papers that have been written in the recent years could be arranged elementwise according to the amount of work carried out on it. Using this criterion, Figure 3 shows that the most studied elements in lake sediments are Zn, Pb, Cu, Cr, Cd, Mn and Ni [1]. The noted trace elements evidently sufficiently characterize sediment pollution level.

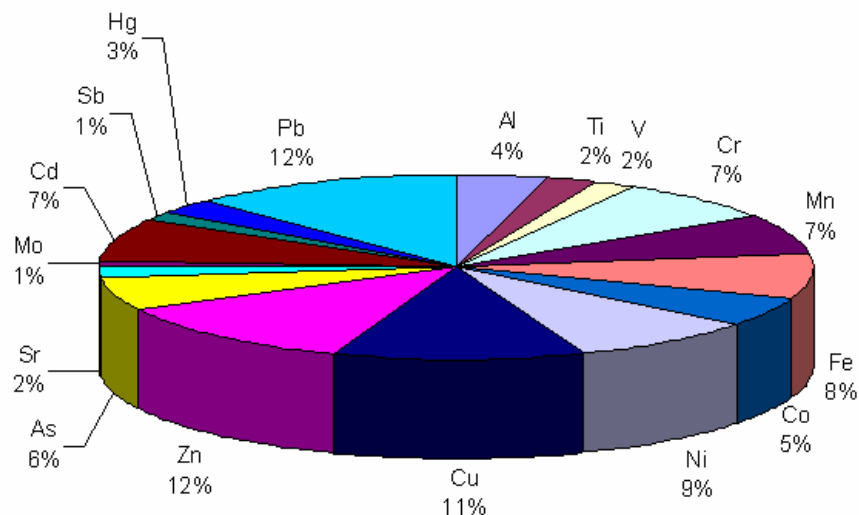


Fig. 3. Distribution of published works on the distribution of elements in lake sediments, as a function of elements involved

Sample collection specifications

Sample collection for analysis can be divided into two major groups according to the goal of the study - deep core samples (>50 cm, reaching 193 cm and more) if study is focused on geochronology or palaeohydrology [2, 3] and shallow core samples (<50 cm) or just the upper layer of sediments if the study focuses on metal composition, distribution, impact assessment or other similar objectives [4-6]. It can be noted that no certain depth of analysis is used by majority of researchers - every individual scientist chooses this parameter by their own technical and scientific possibilities. Naturally, also different geographical, climatic and hydrological aspects are taken into account, as well as the rate of sedimentation in each particular research site.

Treatment and methods of analysis of collected samples

As general methods for analysis of trace elements, three most common can be pointed out - inductively coupled plasma mass spectrometry or atomic emission spectrometry (ICP-MS/AES), atomic absorption spectrometry (AAS) and X-ray fluorescence. In majority of cases HNO₃, HCl and HF in different proportions have been used to acidify the collected samples for further analysis [7, 8]. In separate cases instrumental methods of analysis have been used as well (analyzing collected samples without further pretreatment or dissolving) but this is a distinct minority - only 15÷20% of total research studies have utilized such an approach. This fact could indicate both increased reliability and simplicity of chemical analysis methods.

Regional distribution of studies

None of countries show research effort activity that would be outstandingly higher than the majority, although some regions, eg North America have shown activity above the

average level. In past few years Chinese scientists have shown increased activity in researching this field as well.

Conclusion

Scientometric analysis of published scientific papers on the subject of trace elements in lake sediments in years 2000-2009 have shown that journal with most published articles on this topic is Science of the Total Environment (9 papers), while most commonly studied elements were Zn, Pb, Cu, Cr, Cd, Mn and Ni. Depths of sediment layers collected for samples varied greatly amongst analyzed papers starting from 2 cm and going up to 193 cm and more. Undoubtedly predominant methods of sample analysis were ICP-MS/AES, AAS and X-ray fluorescence.

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PIERWIASTKI ŚLADOWE W OSADACH JEZIORNÝCH - ANALIZA SCIENTOMETRYCZNA

Abstrakt: W pracy przedstawiono analizę scientometryczną wyników badań osadów dennych pobranych z jezior w latach 2000-2009. Analizowano wyniki badań, które były przedstawione w 79 artykułach publikowanych na łamach najważniejszych czasopism zawartych w Science Citation Index (SCI). Najczęściej cytowane były czasopisma: Science of Total Environment, Chemosphere, Microchemical Journal, Applied Geochemistry oraz Environment International. W większości prac przedstawiono wyniki oznaczeń pierwiastków śladowych, m.in.: Pb, Cu, Ni, Cr, Co, Mn i Zn. W żadnej z prac nie stwierdzono zbyt dużych stężeń, chociaż w niektórych krajach, np. w Szwecji, Stanach Zjednoczonych, Kanadzie i Chinach, stwierdzone stężenia były większe od wartości średniej.

Słowa kluczowe: pierwiastki śladowe, analiza pomiarów naukowych, osady