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Tracking Environmental Change Using Lake Sediments. Vol. 2: Physical and Geochemical Methods, by William M. Last and John P. Smol, first printed in 2001, and reprinted with corrections in 2004, Kluwer Academic Publishers, P.O.Box 17, 3300 AA Dordrecht, The Netherlands; 504 pages, hardbound; price USD 132.00; EUR 120.00; GBP 83.00. ISBN 1-4020-0628-4.

This volume is the second one of the so-far four-volume book series on Developments in Paleoenvironmental Research Series (DPRS). Fifteen chapters within three thematic sections summarize and bring together various aspects of new advances in physical and geochemical analytical techniques, and the contents concerned with physical and geochemical methods are, in our opinion, clear and authoritative. Such a well edited handbook is useful not only for the relatively small number of newcoming paleolimnologists but also for a much wider readership in fluvial, glacial, marine, peatland and modern soil erosional/sedimentary processes, because most of the articles contain new material and are presented by experienced and distinguished research workers, which are difficultly seen in journal-based references.

The book starts with an overall review of investigating techniques for deciphering physical lithostratigraphic features, with special attention to the latest techniques developed for obtaining quantitative information such as radiography, X-ray imaging, CT and computer imaging analysis. Most of the descriptions are, however, on methods for the recognition of sediment fabric and texture. Those who are particularly interested in surface features or in the structure of individual particles may be somewhat disappointed with this section.

In the second thematic topic of mineralogical and geochemical indicator techniques, Boyle introduces various inorganic elemental determination and model methods to establish links between sediment composition and environmental change in the catchment area. This part pays particular attention to two of the most commonly used methods of mineralogical assessment, i.e. X-ray diffraction and optical petrography. Potential future developments in these two areas are also commented upon.

Lowenstein & Brennan discuss the methods of using trace elements, ions and stable isotopes in primary fluid inclusions to determine the depositional environment, such as lake depth, temperature and salinity. This approach may be rapidly developed in the near future, with wide application of new inclusion sampling techniques and advanced testing instruments such as SEM-EDS and Laser Raman microspectroscopy.

Sandgren & Snowball summarize the various analytical components and techniques of environmental magnetism, and its wide potential application for understanding the variety of processes operating in lakes and their catchment areas in response to changes of climate, human activity and limnology.

Organic matter constitutes a relatively minor proportion of most lake deposits, but it provides a wealth of valuable information for paleo-environmental reconstructions of lakes and their watersheds. Meyers & Teranes give an example using proxy indicators of carbon/nitrogen ratios, carbon/nitrogen isotopic compositions to trace eutrophication process of lacustrine systems, vegetation changes and agricultural history of the watershed, and other processes active in the lakes and their catchment areas.

Blais & Muir review the major processes that govern the fate of persistent organic pollutants (POPs) in lake systems and the current analytical methods for POPs. Although the processes of transportation, degradation, desorption and diffusion of POPs are not well understood, the use of lake sediments to track contaminant loading of the environment through time and to help identify sources of chemical pollutants is an extremely important application of paleolimnology. An example of long-range transport of POPs to polar regions demonstrates the usefulness of paleolimnological approaches to understand global transport processes.

Korsman et al. briefly present an alternative tool for chemical and biological analyses of organic matter in lake sediment, the near-infrared spectrometry (NIRS). This technique is potentially useful, for the NIRS is sensitive to all types of organic molecules, and the method obviously has many advantages such as simple pretreatment of samples, easy handling without advanced training, rapid testing and low cost. On the contrary, Rose introduces the concepts and methodology of the use of fly-ash particles in paleolimnological investigations, which involves complicate pretreatment of bulk samples. Spheroidal carbonaceous particles (SCPs) and inorganic ash spheres (IASs) produced from combustion of non-gaseous fossil fuels, together termed fly-ash particles, are interpreted as ideal stratigraphical markers by paleolimnologists. Their profile shape in different cores allows core cross-correlation from place to place all over the world, and reflect emission sources and patterns.

In the third thematic topic, on stable-isotope techniques, three chapters do not provide all possible isotopic applications in paleoenvironmental researches, but rather highlight a few of the most commonly used and well-established techniques of carbon, hydrogen, oxygen and nitrogen isotope analyses. Wolfe et al, provide a complementary discussion of $\delta^{13}C$ and $\delta^{18}O$ of lake-sediment cellulose. This section is particularly valuable and useful for newcomers and students, for it gives a guide for the isotopic analysis of lacustrine sediments and a comprehensive interpretation of the environmental implications.

On the whole, the book provides ‘a state-of-art summary of the major physical, mineralogical and geochemical laboratory techniques in lacustrine sediment’. As indicated by its title (Physical and Geochemical Methods - tracking environmental change using lake sediments), this volume of the book series focuses on testing techniques and methods for proxy indicators of past condition changes of lake systems; much less attention is paid to geomorphological processes in the catchment areas when the analysis data are interpreted. It is also unfortunate that this book does not touch any approaches using radionuclides. We hope that another volume in this series will encompass this topic.

For those interested in using radionuclides to study upstream catchment erosion and sedimentation process, the “Handbook for the Assessment of Soil erosion and Sedimentation Using Environmental radionuclides,” edited by Zapata (2002), and ‘Sedimentary Processes: Quantification Using Radionuclides, edited by Carroll and Lerche (2003), should proved a very useful complement. Notwithstanding,” the book in hand must been seen as a major contribution to the field, and a very useful complement to other DPRS books. It deserves to be read by both new and established researchers in this tremendously interesting field.

References

Zapata, F. (Ed.), 2002. Handbook for the assessment of soil erosion and sedimentation using environmental radionuclides. Klumer, Dordrecht.

Carroll, J. & Lerche, I. (Eds), 2003. Sedimentary processes: quantification using radionuclides, Elsevier, Amsterdam.

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