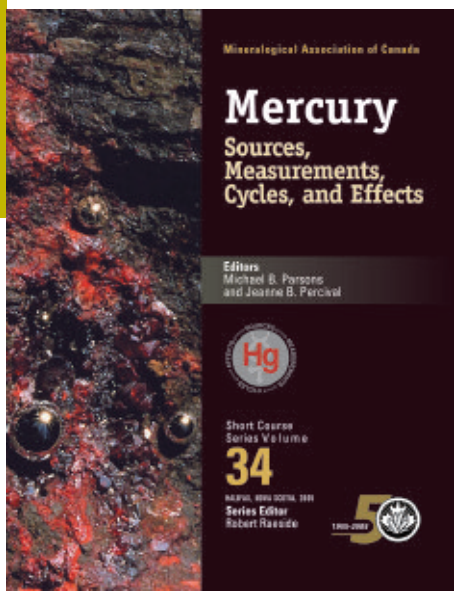
Mercury
Sources, Measurements, Cycles, and Effects[1]



Concern regarding mercury (Hg) as an environmental contaminant has recently come to the forefront of public awareness. Because of this, many involved in Hg research are being increasingly called upon to help understand the sources and sinks for Hg in the environment, the Hg biogeochemical cycle, and the implications for human and ecological health. *Mercury: Sources, Measurements, Cycles and Effects,* short course volume 34 of the Mineralogical Association of Canada (MAC), presents a collection of papers on this timely topic, of significant interest to those in the geologic, environmental, and other sciences, as well as to environmental managers and policy makers. The goal of this volume is to provide "a discussion of the current state-of-knowledge regarding (1) natural and anthropogenic sources of Hg, (2) sampling protocols and analytical methods, (3) transport and transformation of Hg in the environment, and (4) effects on ecosystems and human health." Most of the chapters provide an up-to-date discussion and are excellent reviews. A few are limited primarily to the authors' own research without significant expansion on the work of others, although additional references may be used to begin to investigate the latter. Many of the chapters point out the limitations of the data and the analytical methods applied. This is an important perspective to present given the evolving nature of Hg biogeochemistry.

Mercury is considered a global pollutant because it is present as gaseous phases, rendering the atmosphere an important pathway by which it can cross national and international boundaries as well as oceans. Mercury is found in different chemical species, and transformations of one form to another can occur rapidly as a function of environmental conditions and the role played by microbial communities. These characteristics facilitate the movement of Hg between air, soil, water, and biota, making the biogeochemical cycle extremely complex. Understanding these complexities is important for determining if regulatory controls on anthropogenic sources will be successful in reducing Hg loadings to local, regional, and global ecosystems. It is also important in decision making involving manipulations of Hg-containing systems. Although researchers have made much progress in understanding the sources and sinks, speciation and transformations, and processes controlling the fate and transport of Hg in the environment in the past 10 to 15 years, there are still significant data gaps and limitations to the knowledge base. Additionally, measurement of Hg concentrations and fluxes are constrained by analytical detection limits and available methods, both of which have continuously improved over time. While the limitations and uncertainties associated with the development of the Hg biogeochemical cycle create a field of research that may be exciting for scientists, these uncertainties can result in frustration for policy makers who seek definitive answers to questions and are faced with ones that are complex and multifaceted.

Identifying significant sources and sinks of Hg is important for the recognition of global biogeochemical cycles. The human population's impact on the distribution of Hg in the environment has been significant, and chapter 1 synthesizes research on the history of Hg as a commodity. Chapter 2 provides a discussion of geogenic sources, and chapter 3 is an excellent overview of anthropogenic sources. Chapter 10 discusses the role of marine systems in the global biogeochemical cycle and the potential for oceans to recycle Hg derived from natural and anthropogenic sources. While these chapters provide insight into the first topic of the volume, they are not all-inclusive. Two potentially important sources and sinks not covered in any detail in this volume are vegetation and soils with low Hg concentrations, for both cover large terrestrial surface areas. Additionally, some chapters contain statements that are debated by the Hg research community. For example one chapter indicates that the majority of Hg released from forest fires, oceans, and soils represents re-emission of anthropogenically derived Hg. Others would argue that both anthropogenically and naturally derived Hg are important components of re-emission.

Since Hg is ubiquitous in the environment, analyses of Hg can be a daunting task, and several chapters address this specifically. Chapter 4 provides a good introduction to the clean handling and sampling methods required and discusses some of the standard analytical methods. This chapter would be useful for those getting started with Hg analyses. Most methods for the determination of Hg speciation in air, water, and soil are indirect and operationally defined, and involve conversion of an isolated or selectively extracted species to elemental Hg that is subsequently quantified. Because of this, speciation results must be carefully interpreted. A case in point is the application of thermal desorption to determine Hg speciation (chapter 5). In this method, it has been suggested that the matrix for the Hg species influences release temperatures, complicating data interpretation. This limitation was not expanded upon in the chapter. Chapter 6 describes synchrotron radiation, a direct speciation method that requires very specialized equipment not available to many. Measurement of fluxes of Hg between environmental compartments is difficult and is not discussed in any significant detail in this volume. Measurement of soil–air Hg exchange is only briefly discussed in chapter 7, with the focus more on the limitations of scaling point measurements to large areas and with little review of methods used to obtain terrestrial fluxes.

The primary concern for human health is methyl Hg exposure through fish consumption. Chapter 8 provides an excellent discussion of the means by which Hg may enter aquatic systems, the factors controlling methyl Hg production within them, and the caveats associated with our current knowledge base. Chapters 12 and 13 on human and ecological Hg exposures and health risks provide valuable information regarding relevant exposure concentrations and effects.

This volume contains a lot of valuable information. As could be said for any evolving understanding of a complex biogeochemical cycle, some points made in individual papers are controversial and not necessarily agreed upon by the entire Hg research community. This makes the volume ideal for students and scientists to learn from, to debate, and to use as a springboard for developing research directions. However, managers and policy makers should not take this volume as the gospel but rather as a stepping stone for beginning to understand Hg behavior in the environment.

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1 Parsons MB, Percival JB (editors) (2005) Mercury: Sources, Measurements, Cycles and Effects. Short course volume 34, Mineralogical Association of Canada, Ottawa, Canada, 298 pp, ISBN 0-92129434-4, $40