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# Preface

Despite the relatively large abundance of phosphorus in the earth's crust (approximately 1000 mg $\mathrm{kg}^{-1}$) it has been accepted since the mid 19th century that it was the paucity of inorganic phosphate in soils that limited plant and crop growth [1]. Numerous soil tests (Olsens-P, Mehlich P, Colwell-P, etc.) have been developed to assay the amount of so-called *plant available* phosphorus present in soils as a means of improving fertility and crop management. Similarly, in aquatic systems it was recognized that P in the form of inorganic phosphate may be limiting in the production of phytoplankton [2], but it was not until the early 1970s that the importance of P as the causal factor in the eutrophication of freshwater bodies was generally accepted [3].

In the subsequent 30 years, there has been intensive study of the biogeochemical cycling of phosphorus in agricultural and aquatic science as a means of controlling eutrophication, and this has been supported by the development of improved analytical methods for quantification of phosphorus in waters and wastewaters. In many cases, these methods have been based on the well-established colorimetric determination of the *filterable* molybdate *reactive phosphate* (FRP, e.g. the Murphy and Riley method [4]) that is often equated with orthophosphate, or of associated methods for the determination of *total P*. Both parameters are widely used in the assessment of the trophic status of water bodies, and for compliance and regulatory purposes.

However, it is arguable that the widespread, and sometimes uncritical use of molybdate reactive analytical methods for phosphorus determination has both helped and hindered our understanding of the phosphorus biogeochemical cycle. Because of analytical convenience, many researchers have based their studies entirely on FRP and or TP measurements, and in doing so have ignored the potentially important *organic phosphorus* component of the phosphorus cycle. However, with the advent of more accessible analytical methods there is a renewal of interest in the role of organic phosphorus in aquatic and agricultural systems (see for example, the recently published monograph *Organic Phosphorus in the Environment* [5]). Similarly, most classical environmental and agricultural texts describe phosphorus as occurring in the +5 and perhaps the +3 oxidation states (e.g. as aminoethyl phosphonic acid), or ignore the redox aspect of phosphorus chemistry altogether. However, phosphorus may also naturally occur in the −3 oxidation state as phosphine that is generated under the anaerobic conditions in sewage treatment processes and marsh sediments. Not surprisingly it was not until an appropriate gas chromatography technique was applied that this phenomenon was detected [6]. Thus, our view of the phosphorus cycle is quite biased by the analytical techniques that have been readily accessible to scientists working in the area. An improved understanding of phosphorus biogeochemistry, and the improved aquatic and agricultural resource management that derives from this, is therefore very much dependant on the application of new and improved analytical techniques.

With the exception of the *Environmental Phosphorus Handbook* [7] and a special issue of *Hydrobiologia* (vol. 170, 1988) there have been few compilations dedicated to advances in the analytical chemistry of environmental phosphorus. This special issue brings together a number of papers that review current trends, and describe timely new developments in the analysis of various components of the phosphorus biogeochemical cycle. The importance of appropriate sampling, sample treatment and quality assurance protocols in any type of environmental phosphorus measurement is emphasized in the first paper. This is followed by papers on extraction methods and papers on improvements to methods based on reactive molybdate based photometry, automated flow methods using spectrophotometric and photoluminescence, enzymatic and electrochemical methods, and separations involving ion chromatography or capillary electrophoresis. The increasing use of 31P nuclear magnetic resonance spectroscopy for characterization of phosphorus species is highlighted in two of the papers, while a third describes the application of high resolution mass spectrometry in environmental P characterization studies. While the coverage of the papers in this issue is by no means all encompassing, the compilation does highlight current research emphases, and emphasizes the advantages of routinely using a much wider range of analytical techniques than has been the case to date.

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