

Near Edge X-ray Fluorescence Spectroscopy Data for standard organic phosphorus compounds

Website: <https://www.bco-dmo.org/dataset/762119>

Data Type: experimental

Version: 1

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Project

» [P-NEXFS investigation of the influence of aerosol phosphorus on the Mediterranean Sea](#) (Aerosol P)

Contributors	Affiliation	Role
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Abstract

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Table of Contents

- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

Methods & Sampling

Methodology: X-ray spectromicroscopy data were collected using an energy dispersive silicon drift detector (Ketek with a 5mm² sensitive area). A flow of helium was introduced between the X-ray optical hardware and the sample to reduce X-ray backscatter. An in-line monitor stick composed of hydroxyapatite was measured with each sample in order to identify and correct for any potential drift in monochromator energy calibration that occurred during analyses (de Jonge et al., 2010). Clean areas of Teflon and cellulose acetate filters were examined as blanks and showed negligible background signal. The data for an individual P-NEXFS spectrum were normalized to create a relative intensity value of approximately 1 for post-edge area of the spectra (>2160 eV).

Sampling and analytical procedures: Phosphorus compounds were obtained from chemical supply houses. See papers cited below for details.

Instruments: X-ray fluorescence microscope located at beamline 2-ID-B at the Advanced Photon Source, Argonne National Laboratory. The beamline is optimized to examine samples over a 1–4 keV energy range using a focused X-ray beam with a spot size of approximately 60 nanometers squared. The energy was calibrated using a NIST standard reference material SRM2910 calcium hydroxyapatite. The whitenline energy of the standard was set to 2153 eV.

Data processing: P-NEXFS data were normalized to create a relative intensity value of approximately 1 for post-edge area of the spectra.

Data Processing Description

BCO-DMO Processing: modified parameter names (replaced spaces and hyphens with underscores, removed special characters, replaced ' with "prime"; renamed "2-aminoethylphosphonic acid" to "Two-aminoethylphosphonic acid").

[[table of contents](#) | [back to top](#)]

Data Files

File
Phosphorus_NEXFS_Standards.csv (Comma Separated Values (.csv), 13.01 KB) MD5:5bcfc9b18413185646d88b77132441fd
Primary data file for dataset ID 762119

[[table of contents](#) | [back to top](#)]

Related Publications

De Jonge, M. D., Paterson, D., McNulty, I., Rau, C., Brandes, J. A., & Ingall, E. (2010). An energy and intensity monitor for X-ray absorption near-edge structure measurements. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 619(1-3), 154-156. doi:[10.1016/j.nima.2010.01.001](https://doi.org/10.1016/j.nima.2010.01.001)
Methods

Longo, A. F., Ingall, E. D., Diaz, J. M., Oakes, M., King, L. E., Nenes, A., ... Vine, D. J. (2014). P-NEXFS analysis of aerosol phosphorus delivered to the Mediterranean Sea. *Geophysical Research Letters*, 41(11), 4043-4049. doi:[10.1002/2014gl060555](https://doi.org/10.1002/2014gl060555) <https://doi.org/10.1002/2014GL060555>
Results

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
Energy	X-ray energy	nd
Two_aminoethylphosphonic_acid	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 2041-14-7	x-ray fluorescence counts
Ammonium_OO_diethyldithiophosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 1068-22-0	x-ray fluorescence counts
Ammonium_Polyphosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 68333-79-9	x-ray fluorescence counts
Adenosine_5prime_triphosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 51963-61-2	x-ray fluorescence counts

Glycerol_Phosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 55073-41-1	x-ray fluorescence counts
Hexametaphosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 68915-31-1	x-ray fluorescence counts
Polyphosphate_CL15	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. Chain Length 15	x-ray fluorescence counts
Sodium_tripolyphosphate	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 7758-29-4	x-ray fluorescence counts
O_Phospho_L_Serine	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 407-41-0	x-ray fluorescence counts
O_Phosphorylethanolamine	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 1071-23-4	x-ray fluorescence counts
Propylenediphosphonic_Acid	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 4671-82-3	x-ray fluorescence counts
Phosphotidylcholine	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 97281-47-5	x-ray fluorescence counts
Phytic_Acid	Name of organic phosphorus compound. Units (x-ray fluorescence counts) are normalized to incoming radiation. CAS# 83-86-3	x-ray fluorescence counts

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	X-ray fluorescence microscope
Generic Instrument Name	Fluorescence Microscope
Dataset-specific Description	X-ray fluorescence microscope located at beamline 2-ID-B at the Advanced Photon Source, Argonne National Laboratory. The beamline is optimized to examine samples over a 1–4 keV energy range using a focused X-ray beam with a spot size of approximately 60 nanometers squared . The energy was calibrated using a NIST standard reference material SRM2910 calcium hydroxyapatite. The whteline energy of the standard was set to 2153 eV.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments.

[[table of contents](#) | [back to top](#)]

Project Information

P-NEXFS investigation of the influence of aerosol phosphorus on the Mediterranean Sea (Aerosol P)

Coverage: Mediterranean

NSF Award Abstract:

Primary nutrients, such as nitrogen and phosphorus, are critical for all life on earth, and limited quantities in the marine environment can inhibit primary productivity. Atmospheric aerosols are a significant source of these nutrients to nutrient-poor ocean regions, such as the phosphorus-limited Mediterranean Sea. The availability of phosphorus in aerosols has traditionally been linked to the composition and abundance of different phosphorus phases present. Unfortunately, investigating phosphorus composition in aerosols has been challenging due to methodological limitations until recently. In this study, researchers from Georgia Tech will use a new technique known as synchrotron-based P Near Edge X-ray Fluorescence Spectroscopy, in conjunction with X-ray fluorescence microscopy, to examine the diversity of aerosol phosphorus phases delivered to the Mediterranean Sea. By defining the relationship between air mass source region, aerosol composition, and bioavailability, results from this work will improve current knowledge of the factors regulating productivity in the Mediterranean Sea and help to clarify the potential response of this region to different climate change scenarios.

Broader Impacts: In addition to the valuable insights this project will provide on the controls on productivity and nutrient cycling in the Mediterranean Sea, this study will further education of young scientists, broaden participation of under-represented groups in ocean science, and enhance research infrastructure.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357375

[[table of contents](#) | [back to top](#)]