

MEETINGS

Phosphorus in the Environment

IsoPhos 2012: Development of Isotopic Tracers for a Better Understanding of the Phosphorus Cycle; Monte Verità, Switzerland, 24–29 June 2012

PAGE 405

IsoPhos 2012, a conference dedicated to cutting-edge research on phosphorus, was held in the Centro Stefano Franscini of the Swiss Federal Institute of Technology of Zurich (ETH Zurich). It gathered 63 scientists, 11 of whom were graduate students, from 16 countries and different areas of expertise, including Earth sciences, oceanography, paleontology, microbiology, soil and plant sciences, and hydrology.

The conference focused on the use of stable oxygen isotopes in phosphate. New developments in preparation and analytical techniques have made the application of this tracer viable for fields other than paleoclimatology. However, new challenges with respect to sample preparation, standardization, its use in conjunction with other tracers, and the effect of biochemical processes have arisen.

During the conference several points of consensus were reached:

- For each phosphate pool of interest, the appropriate extraction and purification methods need to be used. Because of the

variety of environmental samples (i.e., from marine waters to fossils and from sediments to soils and plants), preparation protocols should be optimized for the specific samples and thoroughly tested.

- There is an urgent need for certified standards. Sets of silver phosphate standards covering the natural oxygen isotope variability should be produced in large amounts, and interlaboratory calibrations should be carried out. A comparison of the thermal conversion method, the analytical method used by most laboratories, with the classic method using bismuth phosphate and fluorination is necessary to ensure compatibility with the earlier literature. In addition, a set of sediment and soil standards should be prepared for interlaboratory calibrations, which should include all sample processing steps.

- Because of the current uncertainties in standardization, the validity of the Longinelli and Nuti equation (A. Longinelli and S. Nuti, *Earth and Planetary Science Letters*, 19, 373–376, doi:10.1016/0012-821X(73)90088-5), which describes the relation between temperature and the

oxygen isotope composition of water and phosphate, was widely discussed. It was concluded that it is still valid, but it is always essential to state how phosphate is extracted and purified, which analytical technique is used, and how many and which standards are used for calibration.

- Oxygen isotopes in phosphate can be used for a better understanding of the phosphorus cycle in the environment, but more studies of isotope fractionation induced by biological processes, such as enzymatic reactions and organic compound synthesis, are needed. In certain cases, it is possible to use this tool for tracing phosphate in the environment, but a database of oxygen isotope compositions of phosphate sources (fertilizers, manure, detergents, and plant residues) is needed. Stable isotopes studies could/should be combined when possible with the use of radioisotopes because the last will provide unequivocal indications on fluxes.

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