Compound-specific nitrogen isotope analysis of amino acids: Implications of aquatic food web studies

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Nitrogen isotopic composition ($\delta^{15}N$) of amino acids has recently been employed as a potential tool for estimating the trophic level of organisms inhabiting aquatic environments [1]. During the metabolic processes, a group of amino acids (e.g., phenylalanine) has little change in their nitrogen isotopic composition, whereas the other group (e.g., glutamamic acid) has large isotopic fractionations up to ~8 permil. Such a fractionation could be associated with the cleavage of carbon-nitrogen bond during the metabolic processes of amino acids [2]. Here we have established an equation for estimating the trophic level (TL_{AA}) of aquatic organisms by analyzing nitrogen isotopic composition of amino acids from a number of natural and laboratory grown organisms in the following equation:

$$TL_{AA} = (\delta^{15}N_{glutamic\ acid} - \delta^{15}N_{phenylalanine} - 3.4)/7.6 + 1$$

A key advantage of this "amino acid method" is that trophic level is estimated based on the $\delta^{15}N$ values of amino acids from a single organism; consequently, unlike the bulk method, it is not necessary to characterize the $\delta^{15}N$ values of primary producers in the food web. In the presentation, we will overview this method and show its applications to various natural organisms in marine environments (Fig. 1.) (e.g., [3]).

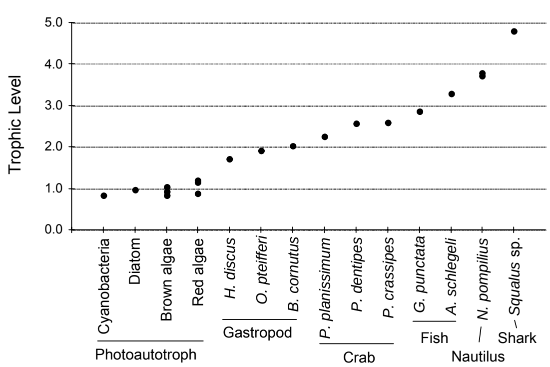

Figure 1. The trophic level estimated by the amino acid method for natural organisms in marine environments.

[1] McClelland & Montoya (2002) *Ecology* **83**, 2173-2180.
[2] Chikaraishi *et al*. (2007) *Mar. Ecol. Prog. Ser.* **342**, 85-90.
[3] Popp *et al*. (2007) In *Stable isotopes as indicators of ecological change*. Academic Press. pp 173-190.

Possibilities and challenges in using satellite aerosol data for surface air quality studies

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Surface concentration of aerosol particles, also known as particulate matter (PM), is a key component determining air quality, especially with small articles (diameter less than 2.5 µm, or PM2.5) which are known to cause respiratory diseases. Local emissions and long-range transport can both contribute to the PM2.5 levels at the surface. In the past decade, satellites remote sensing measurements of global aerosol distributions have become available, continuously providing large-scale 'chemical weather' pictures, which can be potentially useful for estimating surface PM2.5 levels. In this presentation, we discuss the possibilities and challenges in using satellite data for air quality applications, in particular, we will address the following questions: (1) What is the relationship between column aerosol optical depth (AOD), which is the quantity measured by satellite, and surface PM2.5 concentrations? (2) How and why this relationship varies with time and location? (3) What is the optimal approach to use model and satellite data for air quality studies? We will present case studies over the U.S. using the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model, satellite data from MODIS and MISR, and surface PM2.5 concentration data from the U.S. EPA and IMPROVE monitoring networks.