

## CFA measurement methods (nutrients in seawater)

The Central Laboratory for Chemical Analysis at GEOMAR operates a so-called "continuous flow analyzer" (CFA) to determine nutrient concentrations in seawater. The device type is a "QuAatro 30" from the company SEAL.

The basic analytical methods and chemistries that are used to determine concentrations of inorganic nutrients in seawater are well established. Strickland and Parsons outlined the manual methods in their book, "A Practical Handbook of Seawater Analysis" (Strickland and Parsons, 1972). The chemical methods have been changed, optimized and automated over the decades by numerous authors, but the basic chemistries remain the same and are based on colorimetric reactions. The exception to this is the newer methods for ammonium/ammonia determination, which are based on fluorometry.

**Nitrate** is determined by a method described by Armstrong et al. (1967), in which a seawater sample is passed through a copper-cadmium reduction column where the nitrate is reduced to nitrite.

**Nitrite** is then diazotized with sulphanilamide and coupled with N-1-naphthyl-ethylenediamine dihydrochloride (N-1-N/NEDD) to form a red azo dye whose absorbance is measured at 520 nm.

**Phosphate** is converted to phosphomolybdic acid by the addition of an acidic ammonium molybdate solution. The addition of ascorbic acid results in reduction to a phospho-molybdenum blue complex (Murphy and Riley, 1962; Zhang et al. 1999). Absorbance measured at 880 nm.

**Silicate** is converted to silicomolybdic acid by the addition of an acidic ammonium molybdate solution. The addition of ascorbic acid to reduce the silicomolybdic acid results in a blue complex whose absorption is measured at 820 nm (Grasshoff et al. 1983).

(reference: "GOSHIP"; METHODS article; Front. Mar. Sci.  
| <https://doi.org/10.3389/fmars.2020.581790>)

Quality assurance is carried out by measuring certified reference material (CRM) within a respective CFA analysis run. We currently use certified reference material from the company KANSO; Japan.