

Project NEREUS: Concepts and principles for in-situ mass spectrometry

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Measurement of pressures of dissolved volatile substances can contribute to progress in many areas of aquatic and marine geochemistry. Mass spectrometry is well matched to these needs, but until recently its in-situ application has been problematic. The performance required is problem-specific, and engineering trade-offs related to size and weight, sample introduction, vacuum, control, and power consumption are involved. Focusing on metabolic gases, we review approaches to underwater, in-situ mass spectrometry, and describe the approach selected for NEREUS. System configuration features a membrane inlet and a magnetic, cycloidal mass analyzer. The electronics, using energy-efficient switching circuitry and low-power microcomputer boards, consume less than 25 watts. The instrument covers the major metabolic gases, with an m/z range from 2 to 100 at unit resolution. Enhancements that may enable in-situ isotopic measurements and measurement of trace-level gases are also discussed.