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Raman Spectroscopy: new perspectives for in situ shallow or deep ocean exploration

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A new underwater instrument has been recently developed using Raman Spectroscopy for the direct detection of organic compounds in the sea, thanks to a European close collaboration. Some field experiments have been carried out in coastal areas in the Baltic Sea, in the Atlantic and in Marmara sea. The first objective was initially focussed on the detection of organic pollutants (like PAHs) at trace level, by the way of the SERS transduction techniques coupled to the optical fibre technology. New perspectives for deep ocean applications are in progress, particularly for the identification of gas hydrates on margins and for the research of more complex organic compounds in ultramafic environments on slow spreading mid oceanic ridges. Tests conducted in laboratory on natural gas hydrates recently collected during Ifremer oceanographic cruises, show that, due to the relatively high CH_4 concentration in the hydrate form, the detection of CH_4 is possible by direct Raman scattering. Not requiring a particular excitation frequency range, the use of a visible wavelength gives the advantage to the system to be operated on submarines or ROV for identification of gas hydrates areas on mud volcanoes and pockmarks. Visible range is not exclusive and near Infrared (NIR) can also be managed to prevent sometimes the spectra from possible additional fluorescent response. The multiple inputs of the spectrograph offer the possibility to use a devoted channel (using SERS technique), which allows organic trace analysis in deep waters. Previously designed for in situ shallow waters monitoring, a new set-up is now upgraded for deep sea applications and will be used during the next sea explorations on margins and ridges.