**Quick and High Performance Surface Observation Equipments**

**Purpose:**
It is sometimes necessary to observe and analyze very quickly quite a few specimens obtained from drilling samples or so for research activities such as geological CO₂ storage projects and assessment of active faults. Some specimens should be analyzed without any pre-treatments such as carbon coating. The equipments are suitable for quick observation and elemental analysis for solid surfaces at the micro level without requiring any pre-treatments.

**Main Specifications:**
1) Surface observation and elemental analysis with magnification of 100 - 10,000 by environmental scanning microscope (ESEM) and energy dispersive spectroscopy (EDS) x-ray microanalyser.
2) Surface observation with 3D imaging and shape measurement under magnification of 100 - 10,000 by laser microscopy.

**Principal Features:**
1) Compact-size ESEM (Keyence© VE-7800) equipped with EDS x-ray microanalyser (EDAX© Genesis2000) Ready for sample analysis in just 10 minutes after setting a sample to a sample holder
Sophisticated surface observation and elemental analysis without carbon coating
Surface observation and elemental analysis under magnification of 100,000 with carbon coating
2) Laser microscopy (Keyence© VK-8500) with image connection software (Mitani© Virtual View3D)
Sophisticated surface observation, 3D imaging and shape measurement without any pre-treatments
Shape measurement with resolution of 0.01 µm
Seamless 3D images with image connection technology

**Location and Date of Installation**
Abiko Campus, December 2004

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**Isotope ratio Mass Spectrometer for Hydrogen and Oxygen**

**Purpose:** Isotope ratio of hydrogen and oxygen of water can provide important information on movement of water. Movement of ground water can be supposed using profile of isotope ratio of hydrogen and oxygen. Furthermore, high concentrated HDO can be a tracer of water even for the water in rock-pore or layer structure of clay minerals. Thus, measurement of isotope ratio of hydrogen and oxygen of water is required.

**Main Specifications:**
1) Autosampler
An autosampler is fitted with mass spectrometer, and that provides up to 110 sample capacity. Samples are introduced to pre-treatment system automatically.
2) Sample preparation system
A continuous flow sample preparation system is also fitted with mass spectrometer delivering the best speciation for measurement of isotope ratio (CO for oxygen and H₂ for hydrogen).
3) Mass spectrometer
Using magnetic field and electro static filter, (H₂ and HD) or (C¹⁶O and C¹⁸O) are separated and isotope ratio can be estimated. Uncertainty of measurement is within 0.1‰ in each measurement.

**Location and Data of Installation**
Abiko Campus, November 2004

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<table>
<thead>
<tr>
<th>d[‰] Sample</th>
<th>Sample 1</th>
<th>Sample 2</th>
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<tr>
<td>1</td>
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<td>16.85</td>
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<tr>
<td>2</td>
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<td>17.02</td>
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<tr>
<td>10</td>
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</tbody>
</table>

Std dev(‰) 0.37 0.35

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**An Example of Measurement Result of Hydrogen Isotope Ratio**
Hydrogen isotope ratio in 2 samples was measured 10 times. Uncertainty of 10 times pretreatment and measurement are found to be within 0.4 % indicating high accuracy of treatment and measurement system.