NMBU gets complete digestion of difficult geological samples for ultratrace metal analysis with the UltraWAVE and UltraCLAVE

**Background**

The Faculty of Environmental Sciences and Natural Resource Management (MINA) of Norwegian University of Life Sciences is the University’s competence center on nature and the environment, sustainable use of natural resources, biological and geological processes. MINA is also home to two of NMBU’s centers:

1. **CERAD** - a Center of Excellence - which conducts research on environmental pollution and radioactivity.
2. **Bio4fuels** - a Center for Environment-friendly Energy Research - developing innovative technology to convert biomass and organic residues to sustainable fuels and energy.

**Instrumentation**

MINA is responsible for research and education in various disciplines, such as environmental, radionuclides, and nutrients. Due to this, handling of many different sample matrices in their lab has become routine. Furthermore, obtaining complete digestions is vital even with samples of high carbon and fat content.

MINA analyzes many different samples, such as plants, roots, soils, sediments, geological samples, blood, milk, serum, meat, fish, high fat samples, catalyst with precious metals, bones, wood and samples for separation of many radionuclides. Any combination of sample types needs to be digested in the same run.

**Customer**

The Faculty of Environmental Sciences and Natural Resource Management (MINA) of Norwegian University of Life Sciences is the University’s competence center on nature and the environment, sustainable use of natural resources, biological and geological processes. The facility has approximately 200 employees and 650 students in 13 different study programs.

**Challenge**

“We have a wide range of different samples, some of them very challenging. We need high pressure and temperature capabilities, while assuring maximum safety for operators.”

**Solution**

Back in 2005-2006 the MINA Facility invested in two UltraCLAVE systems to increase throughput and reduce costs. With the addition of an UltraWAVE platform, they can achieve 100% recovery for almost every element in the periodic table for their difficult geological samples. Ease of use and low maintenance costs contributed to improving their lab’s routine work.
Their lab analyzes between 50 and 1000 samples per week, depending on the research project in implementation.

With a long history in ICP analysis, their lab is well equipped for metals testing with three ICP-QQQ, and one ICP-OES.

They were originally using an open vessel digestion system and two multimode closed vessel platforms. After the acquisition of an UltraCLAVE Single Reaction Chamber (SRC) microwave system in 2005-2006, use of these systems drastically decreased.

With conventional microwave systems, it was not possible to achieve complete digestions of some sample types. The limitation of this technique was mainly due to different temperatures in different vessels, resulting in undigested carbon. This in turn, yielded interferences in the ICP plasma and an underestimation of Hg in fish when using CVAAS. To accommodate the use of HCl and for the digestion of radioactive samples, the CERAD Center of Excellence decided to buy an UltraWAVE in 2016. The UltraWAVE is capable of working at very high temperatures. The analysis of the residual carbon content is a good indication of the digestion completeness. The lower surface area of vials results in lower cross contamination and digestion becomes very predictable, since the same result can be obtained run by run.

“Safety is a crucial factor for us. We have had some issues with conventional microwave systems in the past with high fat samples, which is why we wanted to find the safest system available on the market.”

The UltraWAVE & UltraCLAVE
Karl Andreas Jensen, Senior Engineer at MINA Faculty, was first attracted by the UltraCLAVE due to its ability to digest mixed sample types, and secondly, by the UltraWAVE’s ability to achieve complete digestion of difficult geological samples.

“We were looking for a system capable of a higher throughput. We invited Milestone into our lab to demonstrate the UltraWAVE and we were impressed by complete digestion, low blanks, high throughput and easy handling. Even our students use the UltraCLAVE and UltraWAVE, because they are very easy to operate. The vials fit perfectly into the balance.”

Last but not least, both the UltraWAVE and UltraCLAVE have very low maintenance costs. “The first UltraCLAVE is almost 12 years old and we only had to replace minor parts after 11 years. Moreover, we still have most of our 12 year old vessels. They last a long time due to the same pressure inside and outside the vessel. This reduces the “consumables” cost compared to pressurized MW vessels”.

New Possibilities
The SRC systems have transformed their detection capabilities with ICP-MS triple quadrupole (ICP-QQQ) by assuring complete digestion and significantly increasing the number of samples digested.

The UltraWAVE fully matched their expectations because of its ease of use. “We only use two programs, one for high fat/organic samples and one for inorganic samples, and both oing to 260°C. With correct acid usage, the digestion is always perfect with these conditions. This allowed us to substantially increase our productivity”.

The MINA Faculty also purchased a Milestone DuoPUR system in 2006, a quartz sub-boiling distillation system. They are able to produce about 1 L of ultrapure nitric acid every day. “The blanks are much better, especially for Pb, Hg, Cu and Zn.”

Learn more or request an onsite demonstration: visit milestonesci.com or call 866-995-5100