Sample Preparation in the Museum of Mining

The Mining Museum in St. Petersburg, which is part of the Mining Institute, started as “mineral cabinet of Russian and foreign mineral fossil bodies”. All ore mines, coal pits and mining plants were obliged by Catherine the Great to send the most precious items to St. Petersburg.

Nowadays the museum possesses a unique collection of rocks, ore items, minerals, paleontological rarities, models and maquettes of mining machines and tools of different times, cutting weapons, stone ware and jewellery. The total of exhibits is 240 000, many of them are unique: the malachite block of 1504 kilos, the biggest item of massive natural copper named “bear skin”, a polychrome topaz crystal of 11 kilos. The total surface is 4000 square meters.

The Mining Museum is a didactical and scientific unit of the institute and it is involved in the training of skilled students.
RETSCH Equipment in the Research Analytical Center

The Mining Institute hosts a big Research Analytical Center which is equipped with modern scientific equipment. For sample preparation of solids and particle size analysis, they are using RETSCH instruments.

Multi-elemental analysis is essential for the quality control of raw materials and end products in a vast number of industries as well as in research laboratories. X-ray fluorescence analysis is a widely used method to determine chemical elements in a very wide range.

XRF analysis is suitable for a variety of solids: glass, ceramics, metals, rocks, coal, plastics and so on. Before the analysis of any object it is necessary to prepare it for the X-ray spectrometer, that means to reduce it to the required analytical fineness and press a stable pellet.

The process of sample preparation has a crucial influence on obtaining reliable, accurate and reproducible analysis results. If not carried out correctly it can falsify the results. To avoid this, a few requirements of sample preparation have to be observed:

It is necessary to avoid any contamination of the materials from outside. Moreover, the samples have to be prepared under the same conditions to ensure reproducibility. An important precondition to achieve this is to use high-quality sample preparation equipment.

The Research Analytical Institute has a whole range of RETSCH equipment for sample preparation.
Pre-crushing with Jaw Crusher BB 51
Many different samples are sent to the Research Analytical Center of the Mining Institute for analysis, for example soil (see picture below). The first step of sample preparation to XRF analysis is pre-crushing the soil sample with a RETSCH jaw crusher BB 51. The initial size is up to 35 mm, the grind size is approx. 0.5 mm.

Fine grinding with Mixer Mill MM 301
The powder produced by the jaw crusher has approximately 500 microns but to get reliable results with the X-ray spectrometer the sample should have a maximum particle size of 50 microns. Therefore, the second step of sample preparation is fine grinding of the material with a RETSCH Mixer Mill MM 301. They use zirconium oxide jars and balls to avoid any heavy metal contamination. Small quantities of cellulose tablets are added as grinding aid to produce a good pressing mix.
Pressing tablets with Pellet Press PP 40

The last step of the process involves pressing a tablet which is then introduced into the XRF spectrometer for analysis. The homogeneous powder produced with the mixer mill is placed into the pressing tool of the RETSCH Pellet Press PP 40. The sample is pressed into a steel ring with a pressure close to 40 tons. Their experience has shown that for reliable analysis of light elements it is necessary to use more pressure when pressing the tablet to obtain more intensive characteristic X-ray radiation. When the tablet is pressed, it is placed into the spectrometer for analysis.