ODM

Mineral Extractions Featuring Electric-Pulse Disaggregation at ODM

Introduction

ODM has been performing mineral extractions from rock and sediment samples since 1974 (46 years!). **ODM Mineral Extraction Division** specializes in preparing mineral separates for geochronology and isotopic studies. We are a world leader in utilizing electric-pulse disaggregation ("EPD") to provide clean and superior mineral separates and presently prepare close to 1500 separates annually for researchers from all over the world.

Electric-Pulse Disaggregation ("EPD") at ODM

EPD is a comminution technique that uses high-voltage pulses to sunder a rock into its mineral constituents. The electric pulse travels through the rock along planes of weakness (e.g. grain boundaries) and creates extensional forces within the rock. Laboratory-scale EPD devices (e.g. CNT Minerals Inc. Spark-series and SELFRAG Lab) have been installed in a small number of university and government research laboratories throughout the world, **and at ODM**. ODM has been using EPD since 2008.

At ODM, the primary purpose of disaggregating rocks by EPD is for use in preparing mineral separates for **geochronology and isotopic analysis**. Targeted minerals include: zircon, apatite, monazite, feldspar, baddeleyite, sericite, illite, biotite, hornblende, garnet, sulphides and more. Other applications include mineral exploration and research for gold, and base metal and kimberlite (diamond) indicator minerals. ODM has also utilized EPD for industrial mineral, paleontology and materials recycling studies.

ODM owns and operates a laboratory-scale, Spark-2 disaggregator (Fig. 1) developed by CNT Minerals Inc. The Spark-2 has four main components: (a) high-voltage generator; (b) capacitor bank; (c) electrode; and (d) disaggregation chamber. The high-voltage generator and capacitors generate electrical pulses of ~250 kV. The Spark-2 has a large, 25 cm (10") diameter disaggregation chamber. As a result, the Spark-2 is capable of disaggregating rocks as small as a few grams to as large as 5 kg.

Figure 1 – ODM's Spark-2 Electric-Pulse Disaggregator ("EPD").

A rock sample is placed onto a stainless steel sieve (typically 1 mm) in the disaggregation chamber (Fig. 2a). The chamber is filled with water submerging the rock sample; a large electrode is inserted into the chamber next to the sample (Fig. 2b). Once activated, the Spark-2 subjects the rock sample to high-voltage pulses at a rate of about 1 pulse per second. During EPD, liberated mineral grains settle through the sieve into the bottom of the disaggregation chamber (Fig. 2c, d). Once in the bottom of the chamber, the grains are no longer subjected to the electrical pulses and further breakage.

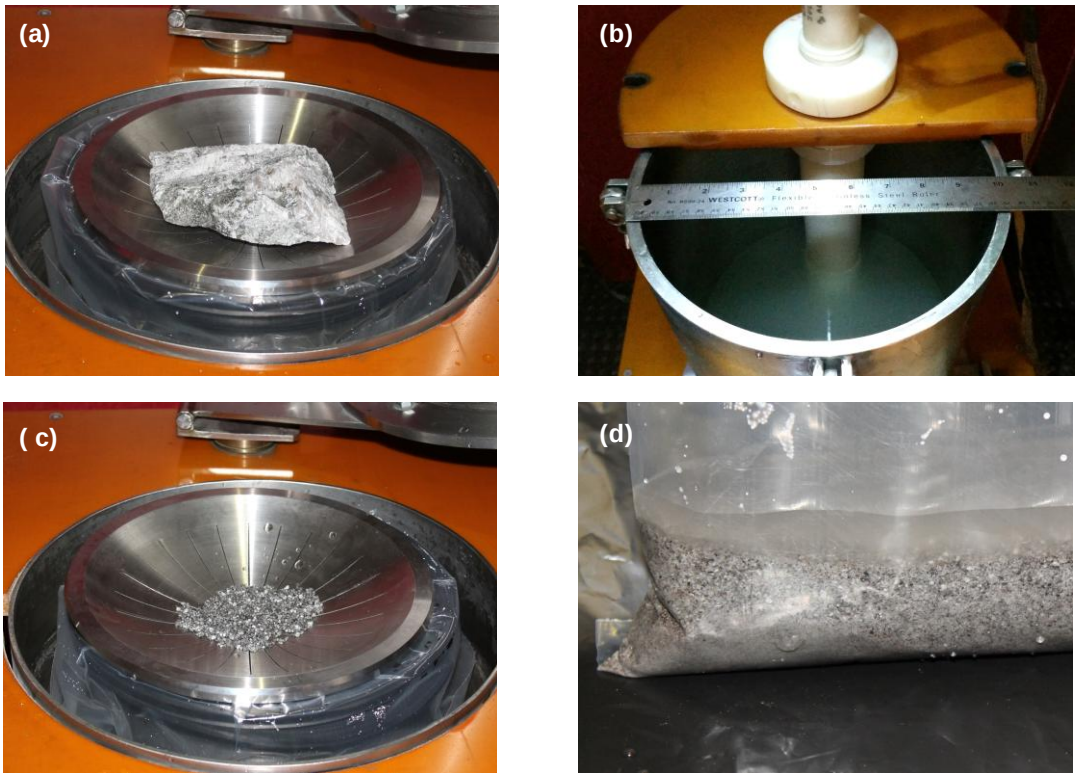

Figure 2 – EPD of rock sample. (a) Rock on stainless steel sieve; (b) electrode placed into water-filled, large capacity disaggregation chamber; (c) +1 mm, post EPD fragments; and (d) -1 mm, post EPD mineral grains in sample bag with process water.

Advantages of EPD at ODM over Mechanical Crushing

With any piece of laboratory equipment, including the Spark-2, unrecognized contamination can be problematic especially in geochronology and isotopic research – **a single grain matters**. Spark-2 EPD offers three quality assurance advantages over mechanical crushing:

- An ODM-exclusive technique is to line the disaggregation chamber with a new plastic sample bag for every sample. This ODM development effectively eliminates inter-sample contamination (carry-over) because the sample and the host water are contained within the sample bag. The bag remains intact and is not melted or perforated during disaggregation.
- The disaggregation occurs in water and does not generate airborne dust.
- The disaggregation chamber is completely accessible and comprises stainless steel which permits it to be rinsed with water before and after every sample.

ODM's internal tests and observations, and those of many clients, have corroborated documented advantages that laboratory-scale EPD has over mechanical crushing. The most striking advantage is that

ODM has effectively eliminated contamination and carry-over during EPD (Fig. 3). Lining the disaggregation chamber with a new plastic bag for every sample prevents liberated mineral grains from coming into direct contact with the disaggregation chamber. Since EPD induces extension forces into a rock, the disaggregation process tends to yield a higher proportion of (1) coarser grains (Fig. 4); (2) undamaged mineral grains (Fig. 5); and (3) monomineralic (or gangue-free) liberated grains.

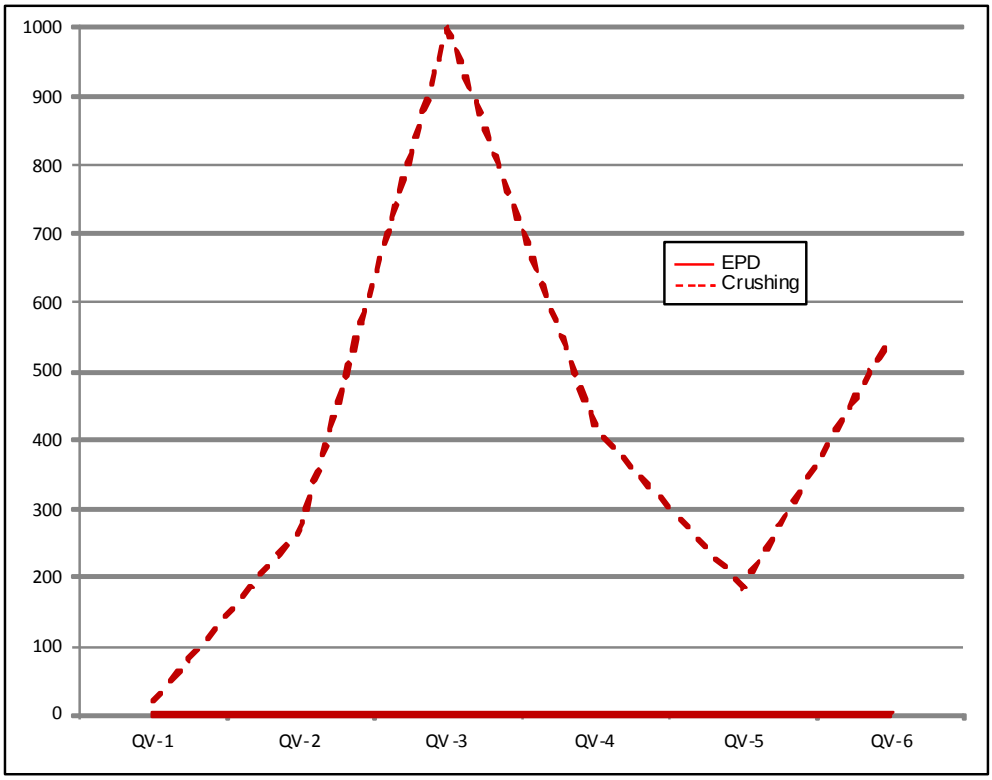

Figure 3 – Number of zircon grains in blank samples after disaggregation. The test included two sets of five granitoid samples and six quartz-vein blanks inserte before and after each sample.

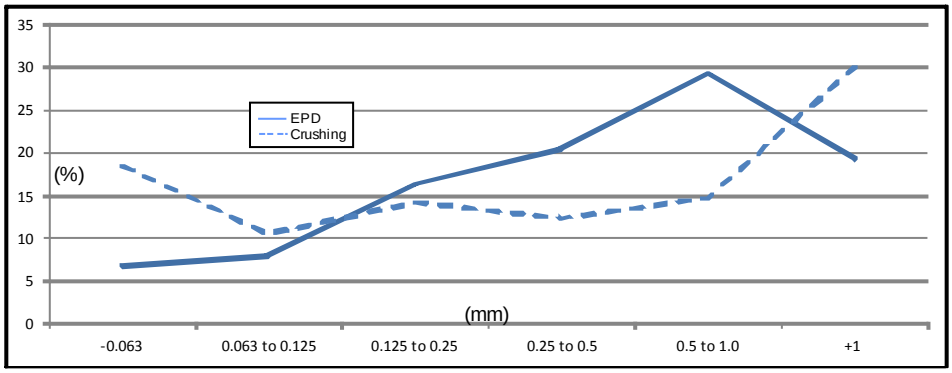

Figure 4 – Average grain size distribution (proportion) of granitoid samples disaggregated by EPD and mechanical crushing. The test included two sets of five granitoid samples and six quartz-vein blanks inserted before and after each sample.

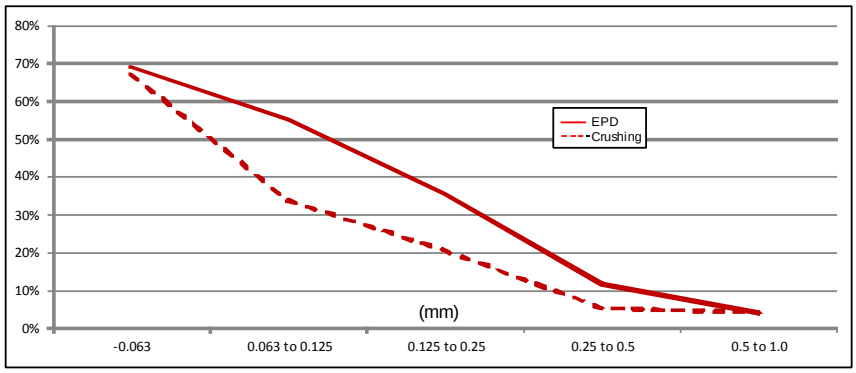

Figure 5 – Average proportion of intact versus broken zircon grains extracted from the granitoid test samples. The test included two sets of five granitoid samples and six quartz-vein blanks inserted before and after each sample.

Mineral Separates

ODM has a full-service mineral processing laboratory. We routinely tailor and modify our processing to: (1) meet your specific requirements; and (2) optimize the quality of any given mineral extraction. Below is a basic description of our processing.

For most applications, a disaggregated sample (whether by EPD, mechanical crushing or sediments) is pre-concentrated on a shaking table to produce a low-grade table concentrate. Most zircon grains are very small (<50 µm) and are extracted from the table concentrate by micropanning. A zircon-rich pan concentrate is produced at this stage. At your request ODM can also isolate representative zircon grains or pick specific varieties of zircon grains with specific characteristics (e.g. colour, size).

To extract other minerals, the -1 mm table concentrate is typically refined by heavy liquid (methylene iodide) separation to produce a heavy mineral concentrate ("HMC"). The density of the heavy liquid can be modified to any specific gravity depending on the targeted mineral. The HMC can be further refined using one or more of the following methods: (a) ferromagnetic separations; (b) electromagnetic separations; (c) sizing (sieving); (d) friction ramp refining; (e) electromagnetic separations; (f) additional variable-density heavy liquid separations; and (g) hand-picking of mineral grains.

Turnaround

ODM prepares close to 1500 mineral separates per year for domestic and international universities, exploration/mining companies, analytical laboratories and research organizations. Our peak period runs from September to March. Normally we strive to provide a 2 to 4 week turnaround, however during our peak period, the turnaround may increase.

International Customers

ODM is located in Ottawa, Ontario, Canada. We routinely receive samples from all over the world. We can supply you with the necessary paper work for stress-free shipping.

Pricing

Our prices make mineral separate processing at ODM very cost effective. A sample processed for one mineral is approximately $200. Please contact Mike Michaud (mikemichaud@odm.ca) or Mike Crawford (odm@storm.ca) for a more detailed quotation.

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