Rare earth elements (REE) are as well classified as EU critical metals. The Finnish apatite minerals, industrially utilized for manufacturing phosphate fertilizers represent a potential secondary source of REE. In the current fertilizer manufacturing process even 80% of the REE will end up in the phosphogypsum (PG) side product, which then holds 0.15–0.5 % of REE. So far economical means of recovering REE from apatite or PG have not been found. Novel active extraction or ion exchange methods have been recently examined by UrFU.

**Figure 1 – The technological scheme of countercurrent REE recovery from PG**

Sorption and extraction are currently the most promising methods for extracting REEs from dilute solutions, since they have a high-performance and simple hardware design. They are also selective and well suitable for construction of closed circulation. The REE from phosphogypsum have been recovered by counter current acidic sorption leaching as described in figure 1.

With sulfuric acid leaching and commercial cationites as sorbents extraction efficiency of 60-65 % has been gained. The respective minipilot has been operated continuously to process a batch of 45 tonnes PG. The REE concentrate obtained was ca 100kg's with 48-54 % of rare earth elements.

Desorption was carried out with a solution of ammonium sulphate. The choice of this reagent was dictated by the fact that further processing of the eluates will involve the use of ammonia and ammonium salts to precipitate concentrates. Ammonium ions also have a good desorbing capability because of the affinity to cation binding functional groups in the adsorbent resin. To further refine the desorbed REE solution it was treated with 10% NH₄OH. Pre-neutralization of the excess acidity with ammonia was necessary, firstly, to help reduce the formation of ammonium carbonate salts, and secondly, to precipitate bulk metal hydroxides such as Fe³⁺, Al³⁺ simultaneously sorbed with REE. Precipitation led to pH 4.5-5. This interval is characterized by the end of the precipitation of hydroxides of the above metals. Precipitation of REE as carbonates is a well-known process and can be performed by use of ammonium carbonate. With this treatment, a recovery rate of 75-80 % of REE as Ce₂O₃ and light and heavy REM carbonate concentrates has been achieved with purity exceeding 99 % when up to 50 kg's of original REE concentrate solution has been treated.