

Phosphate and associated strategic elements: A European perspective

Sophie Decree*, Peter M. Ihlen, Henrik Schiellerup, Anders Hallberg, Alecos Demetriades,
Margus Alvar Soesoo

*Geological Survey of Belgium, Brussels, Belgium, Email: sophie.degree@naturalsciences.be

Phosphate deposits and occurrences are widely distributed in Europe. However, too little phosphorus is produced in the EU to satisfy the growing demand for fertilizers. As a consequence, the European countries are net importers of phosphate, with an average of 4, 000, 000 tonnes of natural phosphate-rich material imported per year (EC, 2015).

In 2014, phosphate rock was added to the list of critical raw materials (CRMs) for the EU (EC, 2014). Other elements pertaining to this list can also be recovered from the phosphate deposits, such as rare earth elements (REEs) and fluorspar (the commercial name for fluorite). It has recently been highlighted that phosphate deposits actually represent a potentially significant source of REEs (Christmann, 2014; Emsbo et al., 2015; Goodenough et al., 2016; Ihlen et al., 2014).

Phosphate deposits and occurrences in Europe are igneous or sedimentary in origin. Their ages vary from the Archean to the Pleistocene. Most of the igneous deposits occur in the Fennoscandian Shield. They are related to (i) alkaline complexes and carbonatites, such as the Precambrian deposit in Siilinjärvi (Finland) and the phosphates associated with the Devonian-carboniferous carbonatites at Sokli (Finland); (ii) massif-type anorthosite and monzonitic complexes (Ihlen et al., 2014; Hallberg et al., 2016), where phosphate is part of complex apatite-iron-titanium oxide (AITO) ores. Such deposits are found in the Northern Norrbotten district and in the Bergslagen district (Sweden), in the Neoproterozoic Rogaland Anorthosite Province, and in the Paleoproterozoic Lofoten-Vesterålen Mangerite Complex (Norway).

The sedimentary phosphate deposits are geographically dispersed in Europe. Lower Paleozoic phosphorites are the most important in Europe. They testify to the presence of a phosphogenic province within the Avalon and the Baltic Platforms and are commonly associated with glauconitic sediments or black shale (Notholt and Brasier, 1986). More attention should be paid to these black shales that possibly contain significant amounts of elements listed as CRMs by the European Commission (e.g., Co, PGM, and Cr). An important sedimentary phosphate unit of Upper Cretaceous age is also known throughout the Paris and Mons basin (France and Belgium), where it forms economic deposits of phosphatic chalk. These deposits reveal that a significant phosphogenic episode prevailed at that time on the NE margins of the Anglo-Paris Basin (Jarvis, 1992). Other major phosphogenic episodes have been identified during the Cenozoic (Arthur and Jenkyns, 1981), and result in the formation of numerous phosphorite occurrences/deposits.

Considering the variety and abundance of phosphate deposits in Europe, the evaluation of their economic potential and an assessment of their possible by-products (including those occurring in the host-rock), could significantly contribute to a secure sustainable access to several of the elements listed as critical raw materials in Europe.