Chapter 4
Phosphate Raw Materials and Fertilizers:
Part I—A Look Ahead

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1. INTRODUCTION
Perhaps no other industrial mineral commodity shows such diverse chemical and physical characteristics as the phosphorus (P) raw materials supplied to fertilizer manufacturers. Most mineral raw materials generally have more narrowly defined geochemical origins and mineral compositions. Beneficiation requirements are most stringent, yielding more highly purified concentrates, and product specifications are mutually defined by mine producers and end-product consumers.

None of these constraints apply to the phosphate rock (PR) market. With the supply of premium-grade PR product shrinking in the face of rapidly increasing demands, the changing character of P raw materials will have increasing impact on existing P fertilizer process technology, product compositions, and will very likely necessitate innovations in types of P fertilizer formulations.

Commercial mineral phosphate, known collectively as phosphate rocks, have but one property in common. Their P and F are contained in minerals of the apatite structure in association with Ca.

Calcium apatites constitute one of the most common and widely distributed mineral groups in the earth’s crust and are the most abundant of all P-containing minerals. Occasionally, they occur in massive accumulations of economic importance in several hundred deposit locations throughout the world. These apatitic deposits occur under all geological settings in igneous, metamorphic, and sedimentary structures in an almost infinite variety of deposit characteristics.

Despite crystal structure similarities, the compositions of these apatites show significant departures from the idealized fluorapatite formula, \( \text{Ca}_9(\text{PO}_4)_6\text{F}_2 \), which has been the commonly assumed P mineral in PR.

This chapter examines the nature of commercial P raw materials as