

Forms of Iron in the Phosphorites of Abu-Tartur Area, Egypt

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Abstract: The Campanian-Maastrichtian phosphatic deposits in Egypt, called the Duwi Formation, comprise a part of the extensive Middle East to North African phosphogenic province of Late Cretaceous to Paleogene age. The province holds the greatest accumulation of phosphorites in the geological history, possibly in excess of 70 billion metric tons. The phosphate resources in Egypt alone exceed 3 billion metric tons. Two-third of these three billions occur only in the Abu-Tartur area.

Among the phosphorite deposits in Egypt, the phosphorites of the Abu-Tartur area are characterized by high contents of iron ranging from 3% to 7% with an average of 5%. The detailed mineralogical and geochemical studies on the Abu-Tartur phosphorites revealed that iron is found in the form of pyrite, ankerite, clay minerals, microinclusions, and iron oxide. Pyrite, which is the major fraction, occurs as filling cement and partial to complete replacement of phosphatic grains and confined to the fresh phosphorites while iron oxide occurs as cryptocrystalline aggregates of red to brown particles and is confined to the weathered outcrops. Exclusive relations between pyrite in the fresh phosphorite samples inside the Abu-Tartur mine and iron oxide in the equivalent horizon of the weathered exposure indicated that iron oxide was formed by the oxidation of pyrite as a result of weathering. All of these forms harm the quality of ore, manufacturing processes, and the produced phosphoric acid and fertilizers.

Key words: forms of iron; phosphorite; Abu-Tartur; Egypt

Introduction

The Campanian-Maastrichtian phosphatic deposits in Egypt, called the Duwi Formation, comprise a part of the extensive Middle East to North African phosphogenic province of Late Cretaceous to Paleogene age. The province holds the greatest accumulation of phosphorites in the geological history, possibly in excess of 70 billion metric tons (Cook and McElhinny, 1979). The phosphate resources in Egypt alone exceed 3 billion metric tons (Notholt, 1985). Two-third of these three billions occur only in the Abu-Tartur area (Glenn and Arthur, 1990).

Iron-rich Neogene phosphorite nodules occur on a number of present-day continental shelves including the Agulhas Bank, South Africa (Parker, 1975; Parker and Siesser, 1972), Danios Bank, Spain (Lucas et al., 1978), East Australian Shelf (Marshall and Cook, 1980), and off Morocco (McArthur, 1978b). A close relationship between iron minerals and francolite is recognized in many modern and ancient phosphorites (Glenn, 1990b).

The strong positive correlation between Fe and P in Quaternary phosphorite-bearing sediments from the East Australian Shelf (Heggie et al., 1990; O'Brien et al., 1990) has led to the realization that the diagenetic behavior of the two elements may be closely linked with each other (Jarvis et al., 1994).