

On the pyritization of the coastal sediments in the Malay Peninsula during the Holocene and its effects on soil

ABSTRACT

Much of the present coastal plains in the Malay Peninsula were inundated by seawater some 6,000 years ago. That was the time when pyrite is believed to have been mineralized in the sediments of the seawater. This paper attempts to explain the process of pyrite mineralization in the coastal sediments during the Holocene as well as to show how pyrite oxidation affects plants and aquatic life in their vicinity. At that point in time, the sea level was 3-5 meters above the present level. Under reduced conditions, Fe^{3+} ions existing in the sediments were reduced to Fe^{2+} ions, while SO_4^{2-} anions from seawater were reduced to S^{2-} ions. These reactions were promoted by microorganisms feeding on the organic matter provided by native vegetation. Finally, the ferrous and polysulfide ions reacted to form pyrite (FeS_2). Over the years, this pyrite accumulated in the sediments, occurring at varying depths. In some sediment of the coastal plains of the Malay Peninsula, there are considerable amounts of pyrite; however, they are environment-friendly. When the areas are developed for agriculture or otherwise, this pyrite is exposed to atmospheric conditions, resulting in its oxidation which in turn leads to acidity and the formation of yellowish jarosite [$\text{KFe}_3(\text{SO}_4)_2(\text{OH})_6$]. Toxic amounts of Al and Fe are usually present in the soils and water in the area, affecting crop growth and aquatic life.

Keyword: Acid sulfate soil; Aluminum; Holocene; Jarosite; Malay Peninsula; Pyritization