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# Potential use of naturally occurring sulphuric acid to beneficiate poorly soluble phosphate from Eppawala, Sri Lanka

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**Abstract**

A 29 000 yr old high-sulphur peat deposit occurs in the western district of Colombo, Sri Lanka. This permanently submerged deposit has several pyrite-rich layers in 8 to 10 m sequences and is connected to the open ocean. Sea water intrudes to the peat deposit during tidal movements. Villagers have excavated the peat to form islands which serve as foundations for their dwellings. The areas around these peat-rich man-made islands are inundated daily due to tidal movements. The interstitial waters of these tidal zones indicate low pH (2 to 5) and high Eh and are rich in sulphuric acid.

Selected samples from the poorly soluble phosphate deposit at Eppawala were left buried in the sulphate-rich zones for fixed periods of time. Some phosphate samples when retrieved from the peat deposit showed four-fold increases of solubility. Preliminary agronomic experiments to grow paddy in P-deficient soils with the beneficiated phosphate fertilizer have given favourable results.

## Introduction

A high sulphur peat deposit is found in the coastal region of Muthurajawela in Western Sri Lanka [1]. The deposit occurs as a swamp and lies a few centimeters below mean sea level and is constantly supplied with sea water during the high tide. These saline intrusions are facilitated by a man-made channel connecting the deposit to the open ocean (Fig. 1).

The permanently submerged peat deposit at Muthurajawela (Fig. 1) dated to be 29 000 yr of age [1] and covering an area of 20 $km^2$ is composed of three types of layers – a top zone of clayey sediments with partially decomposed plant material, a middle formation of peat associated with terrestrial plant debris and a lowermost layer of lagoonal sediments overlying a Precambrian lateritized basement. The laterites extend towards the Eastern hinterlands of the peat deposit where they form isolated hills.

The present Negombo lagoon is considered to be the extension of an earlier lagoon (Fig. 1) which had existed towards the South. The earlier lagoon has been filled up to form the peat deposit due to the eastward development of a sand bar which had cut the lagoon from the open ocean [2]. The area had been used for paddy cultivation until the deposit was opened to intruding sea waters with the construction of a sea-side channel nearly a century ago. This had resulted in excess salinity which had destroyed the paddy cultivations.

## Natural development of sulphuric acid-rich waters

The villagers of Muthurajawela have excavated the pyrite-rich layers to construct islands suitable

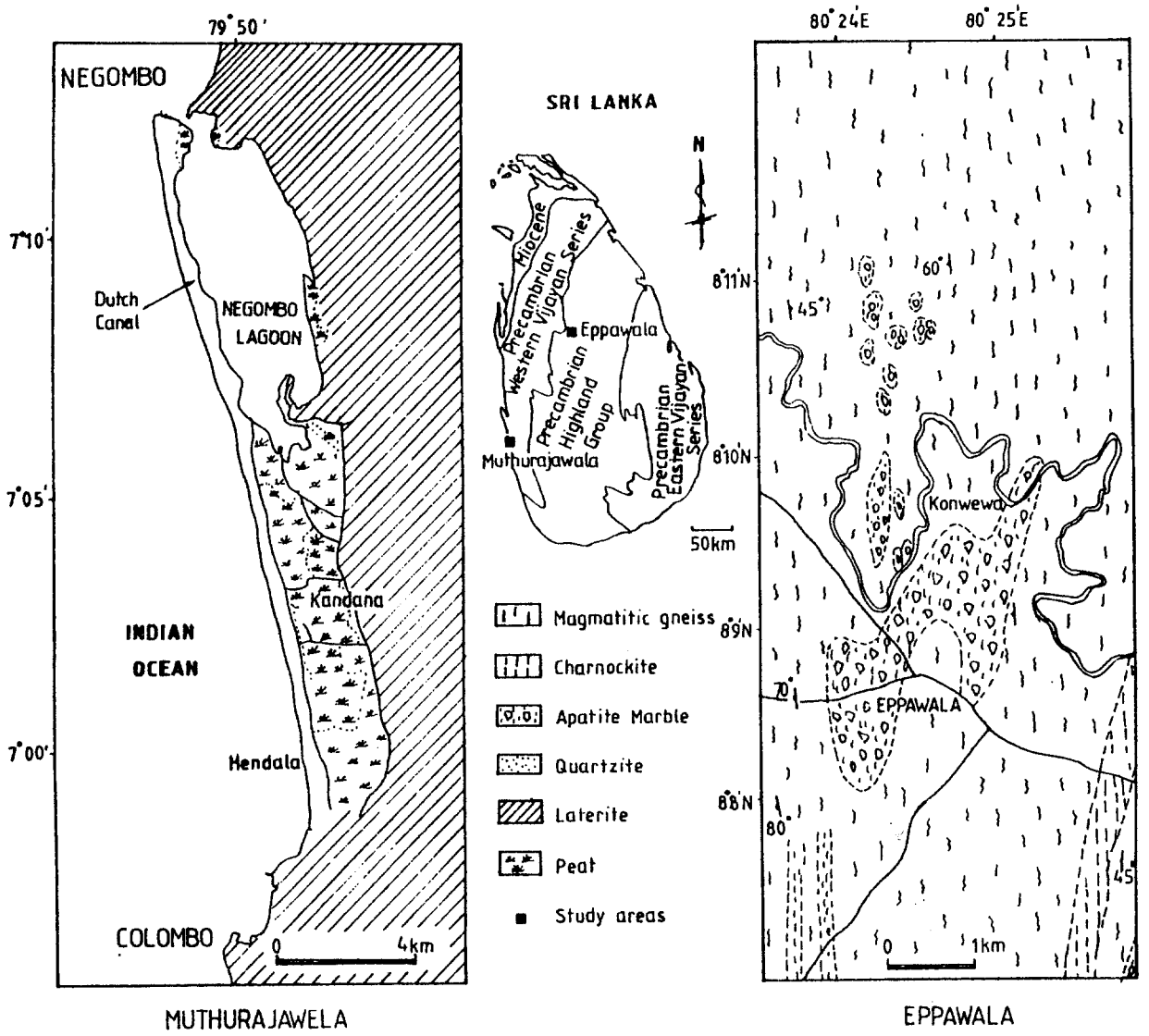


*Fig. 1.* Location of the Peat and phosphate deposits studied giving the general geology.

for their dwellings on the water-logged peat deposit. These man-made islands with local reliefs of about a meter are subjected to tidal fluctuations and intertidal and supratidal zones can be recognized around them. Some of the exposed areas of the tidal zones of the man-made islands show layers of precipitated elemental sulphur (Fig. 2). Our observations on the interstitial waters of the tidal peat masses show low pH values (2 to 5) and high concentrations of sulphate (~3000 ppm). $H_2S$ formed by the bacterial activity in these waters could be noted in the tidal regions. The high iron content derived from the weathering of lateritic hinterlands seems to facilitate the formation of pyrite in the reducing environment [4]. The following pathways [5, 6, 7] are envisaged for the formation of iron pyrite in the peaty marshes of the man-made islands.

$$Fe^{2+} + S^0 + H_2S \longrightarrow FeS_2 + 2H^+$$

$$Fe^2 + S_x^{2-} + HS^- \longrightarrow FeS_2 + S_{x-1} + H^+$$

Significant amounts of pyrite also occur in the subsurface layers which have been unearthed to form the islands [1, 3]. The pyrite freely avail-