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A RESPONSE

Eppawela phosphate deposit - a truly valuable National asset

By Prof. Oliver A. Ileperuma, Senior Professor of Inorganic Chemistry, University of Peradeniya, Peradeniya

In a recent article in The Sunday Times FT Dulip Jayawardane, a former Director of the Sri Lanka Geological Survey Department portraying the Eppawela phosphate deposit as having "no value apart from sentimental reasons to the effect that it is a national asset," completely ignores what is currently known about this deposit and the latest attempts at its development.

It completely ignores the published literature in local and foreign journals by reputed Sri Lankan scientists on this deposit spanning a period of over 25 years on its geological and chemical aspects. The proposition that it is suitable only for the manufacture of high analysis fertilisers such as dimmonium phosphate (DAP) and monoammonium phosphate (MAP) is both economically and environmentally disastrous. This involves an ammonia plant in addition to the sulphuric acid plant and the disposal of phosphogypsum formed as a byproduct is a major environmental problem.

Premier scientific bodies in the country such as the National Academy of Sciences, Sri Lanka Association for the Advancement of Science, Institute of Chemistry and the National Science Foundation have all voiced their opposition to the manufacture of high analysis phosphate products and recommended that the ore should be used to manufacture SSP. These bodies that comprise independent-thinking scientists of international repute cannot be all wrong?

Since its discovery in 1971, Eppawela rock phosphate (EPR) has been applied to plantation crops such as tea, rubber and the coconut. However, the article of Mr. Jayawardane only highlights its application to acidic soils in the tea plantations and only marginal application in the rubber plantations.

This is far from the truth. Even for rubber, the Rubber Research Institute recommended 100% replacement of Imported rock phosphate (IPR) with EPR for mature rubber and 50% for immature rubber. The fact that EPR is widely used for the coconut industry has not been mentioned. The Coconut Research Institute (CRI) recommended the use of EPR from November 1989 for adult coconut palms. We have used this deposit for long term crops in spite of the recommendation of the International Fertiliser Development Centre (IFDC) mentioned in the above article that it is unsuitable for direct application. Even for long-term crops, rock phosphate was continuously imported perhaps to satisfy the interests of a few businessmen even selling Eppawela apatite labelled as imported rock phosphate. This clearly shows that all phosphate requirements of our long-term crops can be supplied by Eppawela rock phosphate. In addition to the three main plantation crops, ERP is now used for all minor export crops such as cinnamon, pepper, cocoa, coffee and similar crops. The success of ERP is amply illustrated by the fact that in 2004 not a single kilogram of rock phosphate was imported into the country and all fertiliser requirements for the plantation sector are now supplied by ERP and HERP (previously identified as selectively mined rock phosphate or primary phosphate crystals, SERP according to Dahanayake and Subasinghe, Fertilizer Research, 28:233-238,1991) from Lanka Phosphate Ltd. This is no mean feat and Lanka Phosphate Ltd deserves praise for what it has achieved and we Sri Lankan scientists can be justifiably proud of this achievement. The total production of ERP and HERP in 2004 was a record 46,551 tons while profits too soared by Rs 10 million in 2004 compared to previous years.

While Mr. Jayawardane highlights the work done at the International Fertiliser Development Center in Alabama, USA (IFDC) somewhere in the early 1980's, no mention has been made on the research work of local scientists who have published their research findings both internationally and locally on the nature and the exploitation of this deposit. He appears to be unaware of the New Zealand Government's study on this deposit carried out in 1999. In this study, a comprehensive evaluation on the Eppawela deposit has been made with a detailed report to the Sri Lanka government on how best to utilise it to make fertiliser for Sri Lanka's requirements. This report deals with the exploitation of the deposit, evaluation of the types of phosphate fertilisers which could be manufactured and the economic and sociological aspects. The essential recommendations of this report were;

(a) Phosphate mining at Eppawela can be easily and cheaply extended beyond the 30,000 tons per year at present.

A protest to save the national asset

(b) Nature of the Eppawela phosphate deposit strongly favours the production of SSP over other products, particularly TSP for which the ore is unsuited.

(c) The usage of phosphate fertilizer is falling within the region as a whole and there is too much emphasis on nitrogen and potassium fertilizers.

(d) The design adopted eliminates liquid effluent disposal.

(e) Despite the impurities present, good quality SSP can be produced.

(f) ERP can be upgraded by simple screening or autogenous grinding followed by screening. Higher grade SSP can be produced using such upgraded ore. Screening of ore over a 5 mm sieve will help to reduce impurities of iron and aluminium.

Eppawela apatite deposit is one of the best in the world with a high phosphorus percentage in the primary apatite (40-42% as P2O5) and 36% in the Matrix. These are the values reported from samples sent to IFDC for analysis. Our politicians and even some of their scientific advisors have consistently downgraded this deposit without adequate scientific knowledge.

For instance, this deposit was portrayed as an inferior quality deposit with impurities such as fluoride and iron and hence the idea that it cannot be developed by Sri Lankans. However, these conclusions have been conclusively disproved by the work of local scientists and those from New Zealand.

At the present time we import around 80,000-120,00 tonnes of single superphosphate (SSP) and around 30,000-40,000 tonnes of triple superphosphate(TSP) fertilizers into the country. The foreign exchange spent for importing fertilizer to sustain agriculture is enormous. Thus, producing locally made phosphate fertilizers will have a direct benefit to our agriculture sector. Granting of fertliser subsidies to farmers has become an enormous burden on the national economy. The cost of one tonne of SSP is around US$ 200. This can be produced at around US$ 40 and after taking into account the profits, bank interests etc can be sold at around US$ 100 a tonne if it is locally produced. Phosphate fertilizer application for agriculture in Sri Lanka is one of the lowest in Asia and increased phosphate will result in increased yields to the farmer and far reaching economic benefits not only to the farmer but also to the whole country.

Mr. Jayawardane also makes arguments against the choice of SSP as the fertiliser of choice due to (a) high transport costs (it has only 20% P2O5) and, (c) that it has not been tested in the field. Transport costs are insignificant in a small country such as ours if rail transport is utilised for long hauling and this material has already been field tested by the Department of Agriculture.

The main fertiliser used by New Zealand, a much bigger country compared to Sri Lanka, is SSP which completely overrules this argument. Here the authorities have calculated the economic transport distances of SSP over other products like TSP. It was found that 175 km was an economic limit for transportation if sulphur was not costed and 275-325 km if sulphur is costed. Since many soils in Sri Lanka suffer from sulphur deficiency, sulphur has to be costed and the 275- 325 km distance should apply. Since Eppawela is situated right in the centre of Sri Lanka (the exact centre is at Nalanda which is about 30 km away) many parts of Sri Lanka are covered within this distance. Furthermore, if rail transport is utilised over lorry transport, the transport costs will not be a determining factor. The real issue here is the cost of phosphate fertiliser. Many farmers do not apply enough phosphate fertiliser to their fields owing to the high cost. Locally produced SSP fertiliser can be supplied to the farmer at half the cost of imported TSP (after taking into account the P2O5 percentages) and the benefits to the farmer are enormous.

Furthermore, all working soil chemists attached to the Department of Agriculture have agreed that SSP can replace imported TSP for all our phosphate fertiliser requirements. The opposition to make SSP locally from Eppawela rock phosphate (ERP) is not new. Way back in the 1980's there was general opposition sometimes even coming from the agriculture department itself that SSP is unsuitable for our requirements.

There were others in the fertiliser trade who promoted the same idea. All these are part of a sinister plot to prevent the development of the Eppawala deposit to its full potential.

Prof. RP Gunawardane of the Department of Chemistry, University of Peradeniya has three patents out of which two are international on the acidulation and partial acidulation of Eppawela rock phosphate. This work conclusively showed that Eppawela rock phosphate is suitable for making superphosphate fertilizer. Prof Kapila Dahanayake of the Department of Geology, University of Peradeniya investigated the geological nature and the origin of this deposit. His work identified two distinct components, one with the weathered rock rich in iron and aluminium and the other portion consisting of single crystals of apatite which has relatively low iron and aluminium. His findings led to the extraction of HERP (high quality Eppawela rock phosphate), which is now marketed by Lanka Phosphate Ltd. In fact this is what has contributed to the recent success of Lanka Phosphate Ltd and why they have been successful in stopping all imports of rock phosphate.

It has also been shown that HERP is efficient to almost the same extent as triple superphosphate for acidic paddy fields in the southern parts of Sri Lanka. Mr. Jayawardane has also questioned the citric acid solubility of the ERP and the HERP. A glance at the internationally published papers in this area (for example, Dahanayake and Subasinghe, Fertilizer Research, 41:145-150,1995) clearly indicates that the citrate solubility of the green or primary apatite varies between 5.3 - 5.8 % while the weathered matrix has a solubility of between 3.75 - 4.75%. Unfortunately, Mr. Jayawardane is focussing only on his own work done in 1976 and published in an Internal Bulletin of the Sri Lanka Geological Survey Department and ignored all developments and publications in this area during the last 25 years.

Research done by local scientists and published in reputed International journals such as Fertilizer research has shown that the selectively mined Eppawela rock phosphate (HERP) gives almost the same yield as TSP when applied to paddy fields at Matara where the soil pH can be as low as 3.5. At the next crop the HERP treated field fared even better giving a higher yield than TSP. This shows that HERP can be directly mixed with other fertilizers and used as a composite fertilizer for the highly acidic soils of the south-western parts of Sri Lanka. HERP is also better suited to make SSP locally since it is low in impurities such as aluminium and iron, the total of which is less than 0.5% as their oxides (around 0.3% of iron oxides and 0.05% of aluminium oxide). However, these values are slightly higher in the matrix reaching around 10% for the mixtures of these two oxides. I think again Mr. Jayawardane is wrong on this point. Single crystal apatite does not have iron and aluminium to an extent of 10% and chemical analysis both here and abroad point out only to a percentage of less than 1% for the primary apatite. This confusion arises since what was earlier analysed was in all probability the reddish brown ERP which is mined at Eppawela.

The presence of high chloride is also cited by Mr. Jayawardane as a negative point for the acidulation process. This is true only if it is used to make phosphoric acid which is the intermediate product to manufacture fertilisers such as TSP and DAP. Here the tolerance level of chloride is around 200-300 ppm while the primary apatite crystals contain up to about 18,000 ppm chloride. This contradicts his earlier assertion that the "ideal fertiliser to be manufactured is DAP". However, in the case of SSP manufacture this is not an important point since the rock is not totally solubilised. There was no corrosion of the stainless steel vessels which were used to make the trial batch SSP recently at Lanka Phosphate.

This is the reason why even the New Zealand report states that this ore is unsuitable for the production of fertilisers such as TSP and DAP. This further corroborates my point that we should use this deposit to manufacture SSP and not other products. If indeed corrosion due to high chloride is going to be an insurmountable problem, it is difficult to understand why a multinational company such as McMoran would propose to make high analysis phosphate fertilisers such as TSP and DAP where the first step involves the manufacture of phosphoric acid. It may be that they have the technical capability to overcome any corrosion problems.

Then Mr. Jayawardane highlights that if one goes to develop only the green apatite, 43% of the ore is discarded and lost. This is far from true since this "discarded" portion which contains significant amounts of apatite can be used along with ERP successfully to long term plantation crops where the high aluminium and iron is not a major constraint. In the writer's opinion, the green apatite is ideal for manufacturing SSP while the weathered matrix can be applied to other long-term crops ensuring that there is no wastage of any sort.

The question of environmental damage has also been highlighted. Generally, during SSP manufacture, there is some evolution of hydrochloric and hydrofluoric acids and the normal practice in SSP plants is to send these gases to water where the acid fumes dissolve in water. The acidity in the resulting secondary water can be used to the advantage of the industry by using it to dilute the sulphuric acid which is subsequently utilised for acidulation. There is minimal discharge of liquids as all works have full recycling of liquids. With efficient scrubber systems sometimes SSP manufacturing plants are located in close proximity of population centres of cities in many countries.

This will certainly not create an "environmental disaster". The environmental disaster will be real only if we go for TSP and DAP plants.

Phosphogypsum dumped into the Trincomalee harbour according to the earlier proposal of the multinational company will do irreparable damage to the sensitive coastal ecosystem. Residual radioactivity arising from waste dumps of phosphogypsum is a major environmental problem in Florida, USA with the companies facing several lawsuits.

Any industry will pollute the environment to some extent but is that a good enough reason for not exploiting this valuable national asset for the benefit of our farmers?

Eppawela apatite has not been used for the benefit of our agriculture mainly due to the self-interests of our politicians ably supported by their so-called scientific advisors. It is unfortunate that many including some scientists do not understand all the scientific and economic aspects of this deposit. What is lacking in Sri Lanka is the spirit of multidisciplinary team work and to voice a strong collective opinion.