

ESTABLISHMENT OF VEGETATION ON PORPHYRY COPPER MINE WASTES  
AT BOUGAINVILLE, P.N.G. : PLANT NUTRITION STUDIES

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Ian Archer,  
Bougainville Copper  
Limited,  
Panguna. P.N.G.

## ABSTRACT

Bougainville Copper Limited operates a large open-cut porphyry copper mine on Bougainville Island, Papua New Guinea. The mining operation entails disposal, and storage on land, of large quantities of waste rock and tailings. Bougainville Copper Limited is committed to revegetating waste rock and tailings as a matter of company policy and through agreements held with the Government of Papua New Guinea. This thesis documents experiments carried out to determine the principal plant nutrient limitations of the mine wastes and to determine ways of overcoming the limitations. Common plant nutrient problems associated with mineral soils in a tropical environment are reviewed.

Soil testing for plant nutrient availability, a lysimeter leaching experiment and nutrient addition and omission pot trials are used to show that the mine wastes are inherently deficient in plant available nitrogen, phosphorus, potassium and boron. The wastes contain sulphide minerals that oxidise, releasing acid. Acidification of the wastes causes aluminium and possibly copper and manganese toxicity. Soluble inorganic fertiliser added to the wastes may be rapidly leached.

Pot and field trials are used to test methods of amelioration. Lime can overcome the problems associated with acid wastes in the plant establishment phase. Large additions of phosphorus fertiliser are required for satisfactory plant establishment and growth, with very large additions of soluble phosphorus fertiliser capable of supplying acid buffering capacity to the wastes. Rock phosphate was tested for use as a residual phosphorus fertiliser. Acid wastes can effectively mobilise phosphate from rock phosphate and rock phosphate can supply acid buffering capacity to oxidising mine wastes.

It is concluded that vegetation can be successfully established on Bougainville mine wastes if acidity is corrected with lime and if nitrogen, phosphorus, potassium, magnesium and boron fertilisers are applied. Types and rates of fertiliser are suggested. It is suggested that the use of plant species suited for growth on acid mineral soils in the humid tropics, and the use of rock phosphate and effectively nodulated leguminous plants, would be advantageous to the objective of establishing minimum maintenance revegetation.

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