

Mineralogy of a bentonite from Miles, Queensland, Australia and characterisation of its acid activation products

W.P. Gates*, J.S. Anderson, M.D. Raven and G.J. Churchman

CSIRO Land and Water, PMB No 2, Glen Osmond, SA 5064 Australia

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Abstract

The mineralogy of a bentonite from Miles, Queensland, Australia, before and after acid treatment (by reflux in 6M HCl at 80 °C) has been assessed by IR, XRD and chemical analysis. The <2 µm fraction of the Miles bentonite consists predominantly of a dioctahedral smectite (≈69%), but which also contains significant amounts of quartz (≈14%), feldspar (≈8%), cristobalite/opal (≈7%), as well as minor amounts (≈1-2%) of clinoptilolite, mica/illite, gypsum and anatase. The smectite component is similar to that of Wyoming bentonite, having a cation exchange capacity of ≈103 cmol kg⁻¹. Prolonged acid treatment (24 h) led to a breakdown in the structure of this component, and caused a precipitation of hydrous silica phases. Structural decomposition was accomplished by a release into solution of octahedrally coordinated Mg (most readily), Fe and Al (least readily). There were also substantial losses to solution of Na and Ca. The precipitate of hydrous silica was enriched with time of acid treatment. A substantial amount of Al was retained within the solid reaction product, most likely as a constituent of impurities that were resistant to acid attack.