The occurrence of trona, $Na_3(CO_3)(HCO_3).2H_2O$, indicates presence of both CO_3^{2-} and HCO_3^- ions in ground waters in the oxidation zone.

Physical properties. The georgeite coatings are pulverulent or have an appearance of a desiccated gel; thicker coatings appear quite coarsely crystalline but are also amorphous. The colour of the mineral is Ridgway Light Cerulean Blue 45-BG-Bb, Pale Cerulean Blue 45-BG-Bd to Calamine Blue 45-G-Bd, streak is very pale blue, lustre vitreous to earthy. The mineral is very soft and brittle and has sub-conchoidal fracture; no cleavage was observed. Sp. gr. determined by the sink-float method, is 2.55 (10). Georgeite is subopaque in pulverulent aggregates but transparent in dense layers: in transmitted light it is pale blue, isotropic, and has $n(Na_D) = 1.593(2)$.

Thorough examination using both X-ray (Debye-Scherrer and Gandolfi methods) and electron-diffraction techniques proved georgeite to be totally amorphous.

Chemical composition. The chemical analysis gave (wt%) CuO 54.9, ZnO 0.4, Na_2O 2.7, CO_2 20.8, H_2O 21.7, sum 100.5. It was carried out by M. H. H. by microanalytical methods on a very small sample contaminated with chalconatronite, the presence of which was established by X-ray diffraction and qualitative examination of a portion of the analytical sample with EPMA. After deduction of 12.35 wt% of chalconatronite and normalization we obtain CuO 58.3, ZnO 0.6, CO_2 19.3, H_2O 22.0, corresponding to an empirical formula $(Cu_{5.01}Zn_{0.05})_{\Sigma 5.06}(CO_3)_3(OH)_{4.12}\cdot 6.3H_2O$, calculated on the basis of three carbon atoms. Ideal formula $Cu_5(CO_3)_3(OH)_4.6H_2O$ requires CuO 59.2, CO_2 19.59, H_2O 21.39.

The mineral is insoluble in water but soluble in dilute acids with effervescence.

Infra-red spectrum of georgeite is distinctly different from that of any other copper carbonate and shows the presence of both H_2O and OH^- in the mineral. The spectrum was obtained on a Perkins-Elmer instrument Model 521 using KBr pellet technique.

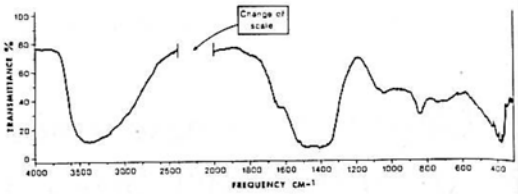

FIG. 1. Infra-red spectrum of georgeite.

Acknowledgements. The authors wish to thank the Great Boulder Mines Ltd. for permission to collect and investigate the material. Published with the permission of the Director, WA Government Chemical Laboratories and the Management and Board, Australian Selection Pty, Ltd. The infra-red investigation was carried out by Dr L. H. Little from the University of Western Australia whose help is gratefully acknowledged.

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[*Manuscript received 4 January 1978; revised 25 September 1978*]