

vibrating condenser electrometer measuring the potential difference (V) across R_2 . From the circuit constant and the measured value of V , $R_1 = ER_2/V$, since $R_1 \gg R_2$.

Mineral grains were closely sized, washed in distilled water, dried at 110° C., and conditioned at the selected relative humidity for at least 6 hr. Ten grains were placed between the rollers, the system was given at least 10 min. to settle, and the resistance was then measured. Ten measurements were normally made at each relative humidity value, namely, at 10, 20, 33, 52, 66, 84 and 100 per cent. A fresh set of grains was used for every measurement to obviate errors caused by ion transport or polarization in the mineral grain³.

When plotted, the curves of log resistance against per cent relative humidity were linear or gently curved. The results were found to be reproducible to within half an order. This apparently low reproducibility is due to the fact that the property being measured is the resistance of an insulator, at best a somewhat dubious parameter. Typical results are shown in Fig. 3, each point on the graph representing the mean of ten readings. Our curves differ from those obtained by Kakovsky and Revnivitsev in that only in a few cases are they strictly linear, and that some minerals attain a low limiting value of resistance due to saturation of the mineral surface by a water film at high relative humidities.

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¹ Kakovsky, I. A., and Revnivitsev, V. I., *Proc. Intern. Miner. Process. Congr.* 775 (1960).

² O'Brien, F. E. M., *J. Sci. Instrum.*, 25, 73 (1948).

³ Cohen, J., *J. Phys. Chem. Solids*, 16, 285 (1960).

Cell Dimensions and Interatomic Forces in Layer Lattice Silicates

THE factors which control the sheet dimensions of the layer lattice silicates have been carefully re-examined recently¹, both from a structural point of view², and by the methods of multiple regression analysis³. This has led to a new, more explicit geometrical model⁴ for the octahedral layers of these minerals, and thence to a detailed study of the balance of forces which must be involved. The results of the latter are outlined here.

Megaw, Kempster and Radoslovich⁵ have attempted to understand the feldspar structure, anorthite, by treating the network of bonds and bond-angles rather as a problem in statics, comparable with the design of bridge trusses. The same kind of approach is profitable for the layer lattice silicates, with the following general conclusions.

(1) The primary control of all three dimensions, a , b and c , is vested in the octahedral layer. In this layer the highly charged cations are only partly shielded electrostatically from each other across the shared octahedral edges. There is a strong mutual repulsion which is balanced by the limit of stretching of the cation-anion bonds, and the limit of compression towards each other of pairs of anions in these shortened shared edges (in accordance with Pauling's rules).

(2) Other factors exert control at a secondary level, or in extreme cases in an over-riding fashion. These factors include: (a) interlayer cation-surface oxygen

bonds; (b) net surface charge (for example, cation exchange capacity effects); (c) net octahedral layer charge; (d) polarization of anions, particularly surface hydroxyls; (e) interlayer hydrogen bonding; (f) surface hydroxyl-hydroxyl bonding; (g) limitations of tetrahedral deformation, governed by bond-lengths and anion-anion compression. I believe that detailed examples of each may be found in various layer silicate structures already determined accurately.

(3) For several quite accurate structures the reported minor variations in bond-lengths—both within one structure, and between structures—appear to be consistent with these general concepts. The variations apparently may be 'explained' by treating these minerals as essentially ionic structures and then considering the effects on the bonds of small but known variations in effective electrostatic valency. Very similar arguments have been used by other authors in discussing several rather unrelated inorganic structures determined with notable precision recently.

(4) If these ideas are substantially correct then they will allow much better prediction of trial structures of layer lattice silicates; should give convincing explanations for observed composition limits for the naturally occurring minerals⁶; cause considerable rethinking about the forces governing the morphology of kaolins and serpentines⁷; and have real bearing on the relative stability under weathering, and on the observed polymorphism, of the micas.

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¹ Radoslovich, E. W., *Nature*, 191, 67 (1961).

² Radoslovich, E. W., and Norrish, K., *Amer. Min.* (in the press).

³ Radoslovich, E. W., *Amer. Min.* (in the press).

⁴ Veitch, L. G., and Radoslovich, E. W. (in preparation).

⁵ Megaw, H. D., Kempster, C. J. E., and Radoslovich, E. W., *Acta Cryst.* (in the press).

⁶ Radoslovich, E. W. (in preparation).

⁷ Radoslovich, E. W. (in preparation).

ELECTRICAL ENGINEERING

Electrode Phenomena in Magneto-hydrodynamic Power Generation

RECENTLY¹ Maycock, Noé and Swift-Hook have described some results obtained in a magneto-hydrodynamic power generation experiment involving the use of a rocket motor and a kerosene-oxygen fuel mixture seeded with potassium. Both carbon and water-cooled copper electrodes were used, with the unexpected result in the latter case that high conductivities could be obtained despite the low electrode surface temperature of about 400° C. A possible explanation was suggested in terms of a thin carbon layer found on the electrode surface at the end of the experiment. It was thought that this layer might provide thermionic emission of electrons into the gas stream and thus permit 'electronic' conductivity to apply to this situation.

Working with cold electrodes in air plasmas produced by an electrically driven shock tube², we have observed similar high values of conductivity, but in a situation in which no carbon is present.