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OCCURRENCE OF STEVENSITE IN THE GREEN RIVER  
FORMATION OF WYOMING<sup>1</sup>

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The authigenic minerals found in the Eocene Green River Formation already make an imposing list. In the interest of keeping the record current, it seems worth while to add the occurrence of stevensite. The bed, which consists largely of stevensite, is about 4 inches thick and is extensive. The sample taken for study and analysis contains organic matter and carbonates. Because both calcite and dolomite are present in virtually all the rocks examined or analyzed in this member of the Green River Formation, we assumed they were both present in this bed. It was also assumed that calcite and dolomite were present in amounts necessary to account for the CO<sub>2</sub> found by analysis. By trial and error it was found that 5.2 per cent of calcite and 7.3 per cent of dolomite come close to balancing the amounts of both CO<sub>2</sub> and CaO available. The remaining CO<sub>2</sub> (0.18 per cent) is probably to be balanced by iron, either as siderite or sideritic calcite. The 7.3 per cent of dolomite requires 1.58 per cent of MgO, which is subtracted from the total MgO before recalculation of the analysis.

The stevensite bed is light chocolate brown, probably owing to the 2.78 per cent of organic matter it contains. From what has already been learned about the history of the Green River Formation it can be inferred that the clay formed in, or on the bottom of, Gosiute Lake when that lake was at a low level and was strongly saline. Studies to be reported elsewhere indicate that the brine was probably rich in carbonates, sulfates, and chlorides of Mg, Na, and K, and probably also in SiO<sub>2</sub>.

The closely similar hectorite (=ghassoulite) has been reported as an authigenic mineral in lake beds of Africa (Jeanette, 1952). It is pertinent also to note that Eardley (1938, pp. 1344-1346) suggested the presence of a hydrated magnesium silicate in sediments now forming in Great Salt Lake, Utah. Rubey and Callaghan (1936, pp. 130-138) reported considerable quantities of a hydrated magnesium silicate (parasepiolite?) in

<sup>1</sup> Publication authorized by the Director, U. S. Geological Survey.

TABLE 1. CHEMICAL COMPOSITION OF STEVENSITE CLAY BED FROM THE WILKINS PEAK MEMBER OF THE GREEN RIVER FORMATION, SWEETWATER COUNTY, WYOMING.

A, CLAY AS COLLECTED; B, RECALCULATED TO ELIMINATE THE CARBONATES AND ORGANIC MATTER

|                                | A                    | B      |
|--------------------------------|----------------------|--------|
| SiO <sub>2</sub>               | 45.24                | 53.37  |
| Al <sub>2</sub> O <sub>3</sub> | 0.81                 | 0.91   |
| Fe <sub>2</sub> O <sub>3</sub> | 0.56                 | 0.66   |
| TiO <sub>2</sub>               | 0.08                 | 0.09   |
| CaO                            | 5.16                 | —      |
| MgO                            | 22.95 - 1.58 = 21.37 | 25.29  |
| MnO                            | 0.02                 | 0.02   |
| Na <sub>2</sub> O              | 0.24                 | 0.28   |
| K <sub>2</sub> O               | 0.02                 | 0.02   |
| Li <sub>2</sub> O              | 0.11 <sup>1</sup>    | 0.13   |
| H <sub>2</sub> O - 110° C      | 8.42                 | 9.94   |
| H <sub>2</sub> O + 110° C      | 7.42                 | 8.76   |
| CO <sub>2</sub>                | 5.95                 | —      |
| F                              | 0.77 <sup>2</sup>    | 0.91   |
| Organic matter                 | 2.78                 | —      |
|                                | 100.53               | 100.38 |
| Minus oxygen corr. for F       | -0.32                | -0.38  |
|                                | 100.21               | 100.00 |

Analyst: Joseph J. Fahey.

<sup>1</sup> Determined spectrographically by Harry Bastron.<sup>2</sup> Determined by Sarah Berthold.

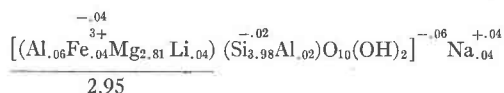
the magnesite deposits of the Overton district of Nevada. They interpret those deposits, with strong supporting evidence, as chemical precipitates formed in saline playa lakes.

The sample analyzed was collected from the upper part of the Wilkins Peak Member of the Green River Formation in sec. 31, T. 19 N., R. 105 W., Sweetwater County, Wyoming. It was analyzed, as collected, by Fahey and the x-ray identification was kindly made for us by Mary E. Mrose of the U. S. Geological Survey.

The resulting composition, after calculating out the carbonates, approximates the composition of stevensite given by Faust, Hathaway, and Millot (1959, p. 344), except that the total water is high and the values for SiO<sub>2</sub> and MgO correspondingly low. It differs also in having a significant content of Li<sub>2</sub>O and F, but not enough to regard it as hectorite.

From this recalculated analysis the formula, which was generously

calculated for us by Margaret D. Foster of the Geological Survey, can be written thus:



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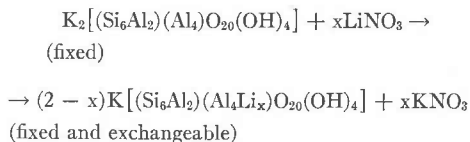
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REMOVAL OF REACTION PRODUCTS FROM MUSCOVITE  
TREATED WITH MOLTEN LITHIUM NITRATE<sup>1</sup>

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White (1954, 1956) published a method for reducing the negative layer charge of dioctahedral muscovite in which the muscovite is treated with lithium nitrate at 300° C. The reaction can be represented thus (White, 1958):



In this reaction the lithium ions displace potassium ions from layer positions, and some of the lithium ions migrate into empty octahedral sites. The net result is the lowering of layer charge.

Norrish (1954) showed that the layer charge is inversely proportional to the swelling ability of a clay mineral: hence, the reduction of layer charge should result in expansion of muscovite. White (1954, 1956, 1958) and Bronson *et al.* (1960) observed expansion in dioctahedral muscovite after treatment with molten lithium nitrate.

This method of reducing layer charge, accompanied by initiation and

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