

VII. *Analysis of an altered Siderite from Helton Beacon Lead Mine, near Appleby.*

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IT appeared of interest to determine the nature of the alteration which has changed the light greenish or brownish yellow siderite to the dark, almost perfectly black, glossy crystals so often seen on specimens from this neighbourhood.

The material, gathered from the heap of a mine, consisted of massive siderite, crystallised on its natural surfaces in the form of small curved primary rhombohedrons, and associated with quartz, pyrites, blende, and other minerals. The alteration had commenced on the more exposed external parts, and had gradually extended inwards to a depth of about one eighth of an inch, though here and there in deeper cavities the crystals remained quite fresh. The colours ranged from black, or deep blackish brown, through purplish brown and light brown to the yellowish or greenish original tint. There is no perceptible difference in the vitreous lustre of the fresh and altered parts.

For analysis only the most altered crystals were detached and carefully selected, in order to secure as nearly as possible the most advanced stage of the alteration. The rust-brown powder was dried at about 100° C. (a loss of weight of about 1 per cent. occurred, which appeared due in part to hygroscopic moisture) and was submitted to analysis with the following result :

	I.	II.	III.
CO <sup>2</sup> ...	88·49	—	—
SiO <sup>2</sup> (gangue)	1·53	1·65	—
FeO*	—	51·50	—
MnO ...	—	5·92	—
CaO ...	—	3·21	—
MgO ...	—	2·86	—
H <sup>2</sup> O ...	—	—	1·48

\* The iron is all given as FeO for simplicity.

From these numbers I have calculated the composition as under :

				<i>Atomic ratio.</i>	
SiO <sup>2</sup> (gangue)	...	...	1.59	—	—
FeCO <sup>3</sup>	...	...	68.69	—	—
MnCO <sup>3</sup>	...	...	9.59	—	—
CaCO <sup>3</sup>	...	...	5.72	—	—
MgCO <sup>3</sup>	...	...	6.01	—	—
Fe <sup>2</sup> O <sup>3</sup>	...	...	18.80	831	1
H <sup>2</sup> O	...	...	1.48	822	1

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101.88

No attempt was made to determine the state of oxidation of the manganese in presence of a ferrous salt, and in the calculation I have therefore assumed that the manganese carbonate was unaltered, and that only the ferrous carbonate had suffered a change. It is, however, probable that it has also been in part decomposed to manganic hydrate; in which case the result of the calculation will not be impaired because the atomic weights of iron and manganese are so nearly alike.

The atomic ratio of the ferric oxide and the water given off at red heat seems to suggest that the hydrate has a constitution similar to that of Göthite (Fe<sup>2</sup>O<sup>3</sup>, H<sup>2</sup>O), and that on further alteration more water may be taken up.

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