

On Gibbsite from the Palni Hills in Southern India.

By H. WARTH, D.Sc.

Late Deputy Superintendent, Geological Survey of India.

(Communicated by F. R. MALLETT.)

[Read November 12, 1901.]

THE mineral described below was found by the present writer, in the year 1893, at Kodikanal on the Palni Hills, in the Madura District of the Madras Presidency. These hills, which rise at Kodikanal to a height of 7000 feet above the sea, form a range some thirty miles long in a WSW.-ENE. direction, with a breadth about half as great. They are composed of grey igneous rock, belonging to Mr. T. H. Holland's 'Charnockite' series, the slight foliation being in a direction coincident with that of the range, while the dip is at high angles. The mountains are at present mostly clothed with grass only, the soil being highly charged with peaty matter, and moderately fertile.

It is between this soil and the underlying rock that the mineral in question occurs, forming a loose bed about one foot thick. The bed was seen to be continuous throughout excavations which had been made over an area of several acres for planting purposes.

The mineral is perfectly amorphous, and takes the form of nodular plates up to half an inch in thickness. It becomes polished on rubbing with the fingers, and owing to its porosity it adheres readily to the tongue. The specific gravity is 2.42, and the colour nearly white with a cream or reddish tint.

On analysis of a pulverized sample, dried slightly above 100° C., I obtained the following results:—

	Found.	Calculated to 100.	Theory. (Al ₂ O ₃ .3H ₂ O).
H ₂ O . . .	33.74	34.95	34.58
Al ₂ O ₃ . . .	62.80	65.05	65.42
Fe ₂ O ₃ . . .	0.44	100.00	100.00
CaO . . .	0.20		
MgO . . .	0.03		
SiO ₂ . . .	2.78		
TiO ₂ . . .	0.04		
	<u>100.08</u>		

The approximation to the theoretical composition of gibbsite ($\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$) is therefore very close, and would be somewhat closer still if the ferric oxide were regarded as replacing an equivalent amount of alumina. Whatever part, however, it may have played originally, the ferric oxide now seems, in the main at least, to exist as an impurity, being chiefly concentrated in the minute fissures and cavities of the mineral. So far as I am aware, this is the first observed occurrence of gibbsite in India.

The mineral dissolves easily in hot, somewhat concentrated, sulphuric acid, and in hot sodium hydrate solution; less perfectly in hot hydrochloric acid. In the cold these solvents act very slowly. To determine the action of the reagents mentioned, I treated six portions of the pulverized mineral, each weighing one gram, with solvent, and after washing and igniting the residues, calculated the percentages of the original hydrous mineral corresponding to them:—

Solvent.	Temperature.	Duration of treatment.	Mineral left undissolved.
H_2SO_4 (sp. gr. 1.35)	boiling	5 minutes	3.8 per cent.
H_2SO_4 (sp. gr. 1.35)	cold	2 hours	57.7 „
HCl (sp. gr. 1.10)	boiling	5 minutes	20.7 „
HCl (sp. gr. 1.10)	cold	2 hours	83.7 „
NaOH (conc. sol.)	boiling	5 minutes	2.1 „
NaOH (conc. sol.)	cold	2 hours	86.9 „

The mineral does not decrepitate when heated in fragments. After ignition before the blowpipe, it scratched quartz and the specific gravity increased to 3.68. The pulverized mineral heated over the blowpipe became snow-white after cooling, notwithstanding the iron present¹.

In respect to origin, the mineral would seem to be a product of atmospheric decomposition of the underlying igneous rock. The composition of gibbsite is the same as that of the precipitate which forms when a current of carbon dioxide is passed through a solution of sodium aluminate, as in the technical preparation of pure alumina from bauxite. In the case of the Indian mineral, some alkaline aluminate may have been derived from the weathering rock, and acted on in dilute solution beneath the soil by carbon dioxide dissolved in percolating water, the alumina being thus precipitated as gibbsite.

¹ Cf. Chemical News, 1901, vol. lxxiv, p. 305.