Vredenburgite from the peroxide manganese ores of Dongri Buzurg, Maharashtra, India

VREDENBURGITE occurring as one of the relict primary manganese ore minerals in the peroxide type of manganese ores of Dongri Buzurg, Maharashtra, India is represented by the intergrowth, β-vredenburgite of Mason (1947). This paper deals with the mineralogy and chemical characters of this mineral and outlines the effects of enrichment of the primary ore on it.

General characters of the manganese ore. The peroxide manganese ore band at Dongri Buzurg has a strike extension of about 1·50 m and forms the southern limb of an easterly plunging synform with the axial plane dipping steeply (60° to 75°) to the south. The ore body lies along the contact of garnet–staurolite–mica schist and granitized mica schist of the pre-Cambrian Sausar Series, with the thickness at the central portion nearly 22 m decreasing considerably at both ends.

The ore consists mainly of pyrolusite of three distinct generations, cryptomelane, and some hollandite and minor manganite, all of which replace to various degrees the primary minerals braunite, bixbyite, vredenburgite, etc. The grain size of the vredenburgite and other associated primary minerals in this ore varies from 0·03 to 0·33 mm. Moreover, there is a general tendency of the grains to increase in size with the structural depth. The ore shows various colloform structures like botryoidal, kidney, and stalactitic forms. The long axes of the botryoidal forms show a preferred orientation near the schist contact, but away from it within the ore body this orientation is lost (Sinha Roy, 1961).

This deposit is unique in the sense that it is the only important peroxide manganese deposit within the primary gonditic manganese ore belt of Central India. This abnormality is explained by a colloidal mobilization along structural weak zones of the manganese from the manganiferous primary constituents of gondite to Mn–sol with its subsequent stabilization and coagulation by K-influx attending granitization, the imprints of which are seen within the country rock (Sinha Roy, 1960). The primary minerals showing partial alteration are often encountered as small isolated pockets within the megascopic rotund and botryoidal bodies defined by the secondary manganese minerals. The samples of the vredenburgite under consideration were collected from several such pockets.

Mineralogy, texture, and chemical characters. The vredenburgite, which in the hand specimen is characterized by its magnetic nature and bright bronzy lustre, consists mainly of jacobsite and about 1 to 2 % of hausmannite.

Hausmannite occasionally occurs as very thin oriented lamellae along preferred directions within jacobsite. The most striking feature of the majority of the specimens is the absence of this typical intergrowth texture. In such specimens an irregular rim of an earlier generation pyrolusite with lower reflectivity (25 %, air) than that (33 %, air) of pyrolusite of later generations is seen around jacobsite. The nature of occurrence and the paragenetic position of this pyrolusite suggests that it possibly represents the altered product of completely exsolved and subsequently segregated hausmannite. Though jacobsite shows partial alteration, the hausmannite lamellae in the intergrowth texture of vredenburgite are preferentially replaced to the penultimate stage by pyrolusite and cryptomelane. These are the reasons why in most cases the typical ex-solution texture of vredenburgite in this ore is obliterated. Apart from the effects of enrichment the other reason of such a replacement may be sought in the fact that the original homogeneous α-vredenburgite broke down on unmixing not only to jacobsite and hausmannite but also to some free MnO_2 (Fermor, 1938), which subsequently replaced hausmannite preferentially as pyrolusite and cryptomelane. The primary nature of this MnO_2 is however questioned by Mason (1947). Nevertheless, the reason of the preference for hausmannite to jacobsite in this replacement is not clearly known.

A partial chemical analysis of the vredenburgite occurring in intimate association with cryptomelane was made on material separated by a hand magnet in water from ore crushed to −100 A.S.T.M. mesh size. Micrometric and chemical analysis of the magnetic fraction gave:

Mineral	*Wt.* %	Fe_2O_3 %	MnO %	*Insolubles* %	H_2O %
Vredenburgite	89·5	59·4	35·8	0·12	3·9
Cryptomelane	10·5				

Assuming that all the Fe_2O_3 is contributed by vredenburgite and that its only other constituent is MnO, the composition of vredenburgite is 66·3 % Fe_2O_3, 33·7 % MnO.

It is interesting to note in this connection that the result when plotted in the diagram showing the fields of magnetite–jacobsite–vredenburgite–hausmannite (Mason, 1947) falls in the field of jacobsite and not in that of vredenburgite, that the iron content of this mineral is appreciably higher than that of the normal Indian vredenburgites which contain Fe_2O_3 31·29 to 28·85 % (Fermor, 1909), and that its composition approaches very close to that of ideal jacobsite ($MnFe_2O_4$), Fe_2O_3 69·24 % and MnO 30·76 %.

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