On Senaite, a new Mineral belonging to the Ilmenite Group, from Brazil.

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THIS new ilmenite-like mineral, containing lead and manganese, was found in rounded fragments and rough crystals in the diamond-bearing sands of Diamantina, Minas Geraes, Brazil (at Dattas, Rio Cipó, &c.).

Crystallographic and other physical characters (E. H.).

The crystal system is rhombohedral, tetartohedral (trigonal rhombohedral of Groth). The vertical axis $c=0{\cdot}997$.

The mineral is very rich in faces. The rhombohedral planes are very bright, while the basal plane, owing to twinning, is generally uneven and, like the prism faces, dull.

Twins are very common. They are so-called supplementary twins on $\infty R2(10\bar{1})$, such as have been described by F. Becke on dolomite. The basal planes of the two individuals fall in one plane, and the prism faces meet at an angle of 30°.

Some of the measured angles approximate to angles obtained by Lévy for mohsite.[1] Thus—

	Senaite (Hussak)		Mohsite (Lévy)
$c(0001):S(\bar{2}021)=$	66°38½′	...	67°30′
,, $:r(10\bar{1}1)=$	49 4	...	50 21
,, $:z(40\bar{4}1)=$	77 33½	...	78 18

The mineral has no cleavage. The fracture is conchoidal, the hardness just above 6 (splinters scratch glass). The specific gravity is variable; that of the compact grains, apparently perfectly fresh and homogeneous,

[1] *Phil. Mag.* 1827, I, 221. In this paper no chemical characters are given, and it is only doubtfully that the mineral has been since referred to ilmenite.

used in the analysis, was 4·78 (G. T. P.), while that of decomposed crystals was as low as 4·22 (W. Florence), and that of undecomposed crystals with cavities as high as 5·301 (E. H.). The colour of the mineral is black, and the lustre sub-metallic. The colour of the powder is brownish black. In very thin splinters the mineral is transparent, with an oil-green to greenish-brown colour. It is weakly doubly refracting, non-pleochroic, and optically uniaxial. The mineral is not magnetic.

Some of the crystals are partially decomposed. In these cases the prism faces are covered with a brown coating of limonite, while the rhombohedral faces have a yellow earthy crust consisting of titanic acid, with only a trace of iron.

Chemical Characters (G. T. P.).

The mineral is infusible before the blowpipe, but after heating loses its lustre and shows signs of alteration, It is decomposed by hydrofluoric acid, by boiling sulphuric acid, and by fusion with hydrogen potassium sulphate. The material used in the quantitative analysis consisted of rounded fragments (not crystals) apparently quite fresh and homogeneous. The mineral was fused with hydrogen potassium sulphate. On treating with cold water and filtering, most of the lead was separated as sulphate, while the remainder in the filtrate was precipitated as sulphide by sulphuretted hydrogen. The titanic acid was thrown down by long-continued boiling, while carbonic acid was passed through the liquid. The iron was then precipitated by sodium acetate, and the manganese by ammonium sulphide.

The ferrous iron was determined by decomposing the mineral with hydrofluoric and sulphuric acids in an atmosphere of carbonic acid, and titrating with potassium permanganate.

The percentage of titanic acid was checked by a colorimetric determination which gave 56·85.

Under I. is given the result of the complete analysis made on 0·6382 gram, and under II. that of a preliminary analysis made on 0·3247 gram of a different sample.

	I.	Molecular ratios	II.	III.	IV.	V.
TiO_2	=57·21	·6962	56·11	59·20	63·31	69·51
PbO	=10·51	·0474	11·43			
FeO	= 4·14	·0562		4·90	35·99	28·67
Fe_2O_3	=20·22	·1267	25·16	32·11		
MnO	= 7·00	·0988	7·81	1·73		1·41
MgO	= 0·49	·0123			0·82	0·32
SnO_2	= 0·11	·0073		SiO_2 1·16	1·25	0·44
	99·68			99·10	101·37	100·45

The numbers lead to no very satisfactory formula. If all the iron be considered to be present as FeO, and the manganese as MnO_2 instead of MnO, we get approximately $(FePb)O.2(TiMn)O_2$; but in the present state of our knowledge of the composition of ilmenite, it would be rash to insist on such a formula. The amount of titanic acid is much too great for the ordinary ilmenite formula $FeO.TiO_2$ advocated by Penfield.[1]

For the sake of comparison, under III. is given the result of an analysis by Mackintosh[2] of an ilmenite from Brazil; and under IV. the result of an analysis by Peek[3] of a so-called ilmenite from Bedford Co., Virginia. In both of these analyses the amount of TiO_2 is too great for the ordinary formula of ilmenite. Under V. are given the numbers obtained in the analysis of Janovsky's iserite[4] which correspond to the formula $FeO.2TiO_2$.

The low specific gravity (4·78) of the material analysed with respect to that of the crystals (5·3) would suggest that it was altered. It gave, however, no loss on ignition, and showed no external signs of decomposition. A crystal fragment with specific gravity 5·08 showed on analysis the presence of iron, titanium, lead and manganese, and in appearance was precisely similar to the material quantitatively analysed.

The name senaite has been given to the mineral in honour of Prof. Joachim da Costa Sena, of Ouro Preto, Minas Geraes, Brazil, from whom the samples of sand containing the mineral were received.

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1 *Amer. Journ. Sci.* 1897, IV, 108.
2 *Amer. Jour. Sci.* 1885, XXIX, 342.
3 *Amer. Chem. Journ.* 1897, XIX, 232.
4 *Ber. Akad. Wien.* 1880, 80 (1), 34.