from the surface waters by a layer within which the density increased so rapidly with depth that it had the character of a discontinuity layer and within this layer there was a distinct salinity maximum. The discontinuity layer or thermocline covered the whole area of the survey and showed a slight slope to seawards.

The water masses above the thermocline showed a small and irregular vertical temperature gradient, but within the thermocline itself, the gradient was very marked—about 9 deg. C. in 13 fathoms off the coast of Sierra Leone, and about 4 deg. C. in 5 fathoms off Ghana. The salinity gradient was most pronounced in the surface waters, especially near the coast. On proceeding away from the coast, the salinity of the surface waters increased rapidly, and at the same time the temperature decreased. Off the coast of Ghana, however, this tendency was reversed, presumably as a result of upwelling near the coast. In this region, colder and more saline water was found close to the surface inshore, and as a result the thermocline had a smaller vertical extension than elsewhere in the area of the survey.

Table 1. AVERAGE DEPTH OF THE THERMOCLINE OFF THE COAST OF THE BRITISH WEST AFRICAN TERRITORIES

Coast	No. of stations	Average depth from surface	
		Bottom of surface water (fathoms)	Bottom of thermocline (fathoms)
Gambia	12	10	24
Sierra Leone	10	12	28
Ghana	14	10	15
Nigeria	16	15	26

The average depth of the thermocline is indicated in Table 1. It will be seen that the bottom of the surface water approximates to that depth (10 fathoms) at which Postel and Salzen observed the change from euryhaline and eurythermal species to predominately marine. This suggests that the thermocline probably plays some part in determining the nature and distribution of the inshore fish fauna of West Africa. Unfortunately, the results of the 1952 hydrographic survey are insufficient to allow any precise relationships to be determined, but in view of the fact that the thermocline is a constant and widespread feature of the waters on the West African shelf, its presence should, perhaps, be considered as a contributory cause of the correspondence between the Tema area and the French Guinea shelf.

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² Postel, E., *Cons. Internat. Explor. Mer, Rapp. et Proc.-Verb.*, **137**, 10 (1955).

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Bixbyite from Nagpur

DURING an examination of polished sections from Prof. A. M. Bateman's collection of Indian manganese made during his trip in 1954 (1232a, Joda East Nagpur), I noticed a few grains of a greyish white mineral with a distinct yellow tint and a slightly greater hardness than braunite, with which it is associated. Etch tests with nitric acid, potassium cyanide, stannous chloride and hydrogen peroxide were negative. Microchemical tests indicated the

Table 1

<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>
4.52	1	2.14	6	1.49	1	1.10	2
3.34	1	1.87	1	1.46	2	1.14	1
3.19	2	1.80	2	1.40	8	1.07	8
2.98	1	1.71	1	1.35	2	1.05	7
2.73	10	1.66	9	1.25	1	1.03	2
2.33	4	1.53	2	1.17	1		

d, Spacings in Angstrom units; *I*, estimated intensities

presence of manganese and iron. X-ray photographs of the mineral were taken by the Debye-Scherrer method using iron *K* radiation. The *d* spacings observed from the film, as given in Table 1, agree fairly well with the values obtained by Fleischer and Richmond¹ for bixbyite from the Thomas Range in Utah.

Fleischer and Richmond give the formula (Mn/Fe)₂O₃ for bixbyite. Mason² has shown the chemical similarity and structural identity of bixbyite and sitaparite.

Fig. 1. The system Fe₂O₃—Mn₂O₃ (after Mason, *Amer. Mineral.*, **29**, 1944)

Fig. 1 indicates that the solubility of Fe₂O₃ in Mn₂O₃ increases with increasing temperature.

Bixbyite formed at high temperatures contains 45–60 per cent Fe₂O₃. Sitaparite formed during metamorphism of manganese ores contains about 30 per cent Fe₂O₃. Unmixing of these minerals into iron-poor sitaparite and iron-rich bixbyite has significance in geological thermometry.

Bixbyite has been reported from many localities including Patagonia, Sweden, South Africa, Utah and New Mexico. A survey of the literature shows that this is the first report of the mineral from India.

The above observations were made during a study of Indian manganese ores at the Laboratory of Economic Geology, Yale University.

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