

of the Mysore schist exhibits, is in the presence of 2.60% of Na_2O . The igneous rocks adjoining and underlying the banded ferruginous quartzites of the Bababudan Hills, are many of them rich in soda, as may be seen from the prevalence of albite and acid oligoclase. I ascribe the soda content of the bababudanite-magnetite schist to the sediments being derived from these spilitic rocks.

Jayaram looked upon bababudanite as a "secondary metamorphic mineral derived from the alteration of impure grits and tuffs of the Champion gneiss series" (1923, p. 40). This is followed on the next page, by the statement, "the occurrence of this amphibole seems to be precisely comparable to that of tourmaline in the altered acidic rocks of the Champion gneiss series," which makes it rather difficult to understand his view regarding the origin of this amphibole.

In a previous note in this journal⁹ (Pichamuthu, C. S., and Srinivasa Rao, M. R., 1933, pp. 276-77), it was shown that the amphiboles occurring in the banded magnetite quartzites of the Bababudan Hills were formed by contact metamorphic action due to the intrusive epidiorite dykes, and had nothing to do with the origin of the ironstones themselves. I consider the bababudanite-magnetite schists also to have had a similar origin.

In view of the suggestion made by Slater, that the banded ferruginous quartzites have been produced through the metamorphism of layers of a rock described by him as "aphanitic greenstone," I carefully examined

⁹ Pichamuthu, C. S., and Srinivasa Rao, M. R., "Amphiboles in the Bababudan Iron Ore Rocks," *Current Science*, 1933, 1.

the occurrences of this rock, not only from his type area near the 23rd milestone on the Chikmagalur-Lingadhalli road, but from several other exposures in the road sections between Mulaingiri (Δ 6310) and Kondekhan ($13^\circ 33' : 75^\circ 46'$). These are usually very thin intercalations, often exhibiting extraordinarily fine bandings. The rock is dark in colour and mixed with abundant ferruginous dust. When altered, it is converted into a yellow ochreous material. There is practically no grit. The exposures of this rock near the Kondekhan coffee estate house are highly jointed, the joint faces being very smooth. The specific gravity of specimens collected here is 2.65; in other parts of the Bababudan Hills, I have observed a range in specific gravity between 2.51 and 2.75. Sections cut from this rock do not exhibit any igneous character. The rock could best be described as a mudstone or argillite.

The rock is normally soft but has been hornfelsed near igneous contacts, with the result that it has become extremely compact and tough, the fracture suggesting a glassy rock. This is caused by the development of mica or amphibole with the typical decussate structure characteristic of a hornfels (*vide* Fig. 1B).

From what has been said above, it will be seen that the amphibole-magnetite schists of the Bababudan Hills have developed in certain bands as the result of contact metamorphism, and that they do not represent remnants of the parent rock from which the banded ferruginous quartzites have originated. The "aphanitic greenstones" of Slater are merely interbanded argillitic layers which have become hornfelsed near igneous intrusives.

Madras Fisheries Department.

RECORD of another year's good work is contained in the Administration Report of the Madras Fisheries Department for the year 1933-34.

"The outstanding event of the year which has brought back some measure of prosperity to the fishing industry of the West Coast was the return of the oil sardine in unexpected abundance after an absence almost complete for an unusually long series of years." It is unfortunate, however, that maximum advantage could not be taken of the abundance of fish owing to the prevailing economic depression. Attention may

here be directed to an observation made by the Director (p. 22): "When the sardines became rich in oil, and boat loads were available at a nominal price, the station had run out of funds. When the funds were actually sanctioned, the sardines had ceased to occur and the amount had to lapse." It shows that the Government methods in dealing with economic problems require revision and it seems desirable that there should be a special provision in the departmental budget which could be drawn upon only in cases of emergency.

The oil sardine is unquestionably the

most important economic fish of the West Coast and any efforts made to study its migratory habits and to forecast its relative abundance year by year will no doubt help to ameliorate the condition of the fishing industry permanently. In Western countries years of observations and experiments have yielded valuable data regarding the wanderings of the principal food-fishes and it is gratifying to learn that similar observations were made during the year by the Madras Fisheries Department with regard to oil sardines to elucidate the causes responsible for the abundance of the species during 1933. At present the data collected may not give any clue to the solution of the problem, but series of such observations carried over a number of years are bound to prove useful. The feeding and breeding habits of the oil sardine and the hydrographical data of the areas of their occurrence are likely to yield interesting results. The abundance of the species along the Malabar Coast shows that it prefers waters of fairly high salinity and their time of occurrence is such—August to December, period of maximum abundance in 1933 being last week of October—that there is usually a considerable change in the coastal fauna of India due to the lowering of the salinity in certain areas on account of the monsoon rains.

Hilsa is another migratory fish of great economic importance and the Madras Fisheries Department has been carrying out investigations regarding its artificial culture and life-history. Regular observations in the field have revealed that in the Godavari below the Dowlaiswaram *Hilsa* of varying sizes are present throughout the year. The Director observes that "At any rate the important fact that young *Hilsa* up to 8½ inches reside in the lower reaches of the river and do not go to the sea seems fairly well established." The publication of the full results of these investigations will be watched with considerable interest by Bengal and Sind where there is an extensive fishery of this species.

The migratory habits of *Hilsa* seem to be associated with the lowering of the salinity of the sea water on account of heavy rains.

The abundance of the species along the East Coast and its absence along the West Coast also point to the same conclusion. The Department's efforts to introduce *Hilsa* along the West Coast are not likely to meet with success as there are no large rivers in that area for the fish to run up for spawning purposes.

Catla, a tank-fish of northern India, has been successfully introduced in the Madras Presidency where it flourishes in reservoirs, tanks, and in the lower reaches of the Cauvery. It is doubtful, however, whether any good can result from the stocking of the upper waters of the Cauvery because the fish is not adapted to live in clear, rapid-running waters. In all such experiments it is most essential that due regard should be paid to the ecology of the species subjected to artificial cultivation.

The report shows advance in our knowledge in several other respects also, as for example, the success obtained in keeping live oysters under artificial conditions at the Krusadi Biological Station, the construction of effective barriers against the enemies of pond-fishes, the success obtained in the use of CO₂ as the best preserving medium for the long storage of prawns, etc., etc. The achievements of the Department have encouraged the Imperial Council of Agricultural Research to subsidise a scheme of research for a central freshwater biological station and fish farm at Madras and another scheme of research relating to fish oil, guano and manure.

It is recorded with great satisfaction that a course of lessons in pisciculture is in preparation by the Department. It was a long-felt need and the fisheries are bound to benefit by such a regular course of training of the young men of the fishing community.

The report besides containing matters of general administration, is full of scientific results obtained by the Department during 1933-34. The Department, especially its energetic Director, is to be congratulated on the success achieved and it is hoped that under the patronage of the Imperial Council of Agricultural Research it will be possible to usher in a new era of fishery research in India.

S. L. H.