

### QUILON LIMESTONE FOUND AT KIDANGAYARA, A NEW LOCALITY

THE occurrence of fossiliferous limestone and carbonaceous clay, observed while deepening a well at Kidangayara (58 C/12; 9° 4' : 76° 35' 30") about four miles south-west of Suranad and seven miles north-west of Padappakara in the Quilon District, was recently brought to the notice of the writer. On visiting the site, it was found that the large blocks of limestone excavated from the well were already removed by local people and the debris heaped near the well consisted of carbonaceous clay and small blocks of limestone the largest of which measured about a foot in length. The limestone bed was under water at the time, but it was reliably learnt that it was at a depth of about one hundred feet. This new occurrence indicates that the Quilon limestone occupies a fairly large area. The limestone bed is rarely seen as outcrops but its occurrence at depth, as observed in wells, was first reported by General Cullen nearly a century ago at Padappakara, about seven miles north-east of Quilon town. Similar occurrences have been noted at Paravur, Nedungolam and Chathanur<sup>1</sup> which are about eight to nine miles south-east of Quilon. The limestone was described as bluish-grey, very tough and richly fossiliferous with *Orbiculina malabarica* as the characteristic fossil. At Chathanur there are two beds of limestone separated by a bed of carbonaceous sandy clay. The lower bed is a coral limestone. Probably the same is the case at Kidangayara.

The limestone is grey, tough and richly fossiliferous. Molluscan fossils are most abundant. The carbonaceous clay is laminated, plastic and dark-coloured with a distinct greenish tinge. A few nodules of chert were also collected, but it is difficult to say whether they came from the limestone or clay. The chert is almost black or brown in colour and intimately coated with calcareous matter which imparts a smooth surface. Some of the nodules are locally corroded.

A large number of fossils has been collected either by picking directly from the debris or by carefully separating from the limestone and clay. The fossils are marine and well preserved, and most of them are sufficiently good for palaeontological studies. They comprise foraminifers, gastropods, lamellibranchs, solitary and colonial corals, echinoderms, bryozoans (?), worms (?), etc. The residue, obtained by washing the carbonaceous clay, on examination under the binocular microscope, has revealed a few foraminifers, one millimetre in diameter,

provisionally identified as *Operculina*. *Orbiculina malabarica*,<sup>1</sup> the characteristic fossil of the Quilon limestone, was not seen in any of the Kidangayara specimens examined.

The Tertiary sequence in Kerala consists of the Warkala beds, and the underlying Quilon limestone.<sup>2</sup> Based on fossil studies the age is determined as Burdigalian or upper part of Lower Miocene<sup>3</sup> and considered equivalent to upper Gaj.

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Trivandrum, July 14, 1965.

1. Kumar, C. P. and Pichamuthu, C. S., *Quart. Jour. Geol. Min. and Met. Soc. Ind.*, 1933, 2, 90
2. Krishnan, M. S., *Geology of India and Burma*, 1960 p. 540.
3. Eames, F. E., *Geol. Mag.*, 1950, 4, 239.

### RELATIONSHIP BETWEEN THE GWALIOR AND JAHAZPUR FORMATIONS IN RAJASTHAN\*

Just north of the Vindhyan ranges near Bundi, greenish shales, siltstones and slates with a few bands of dark vitreous impersistent quartzites and a limestone band are seen. The argillaceous rocks are well exposed further towards north-west for nearly eight kilometres. Several dolerite dykes are also seen intruding these sediments. Coulson considered these sediments to be Gwaliors and indicated the difficulty in separating them from the metamorphosed rocks closely resembling the Aravallis. Heron first thought that the Gwaliors were younger than the Aravallis but was convinced later that the two were the same varying only in their degree of metamorphism.

Near Sabalपुरa and Jahazpur, two elongated synclines expose a quartzite-shale-dolomite sequence and these were mapped as Jahazpur Series by Brandshaw. This group was correlated with the Raialo Series by Heron on the basis of the presence of dolomite. The sections, however, do not indicate a break in sedimentation.

The argillaceous rocks show a gradual increase in the grade of metamorphism towards north-west. Shales and slates become phyllitic and these change to biotite-mica schists with andalusite, staurolite and garnet. At places, retrograde metamorphism is indicated by staurolites changing to chlorite. Nearer Deoli and west of Jahazpur the schists are progressively granitised from south-east to north-west.

An area of quartz vein-rich schists shows increase in granitisation finally to migmatite with mica-beryl-bearing pegmatites. These granites are typically late-tectonic and the increase in the grade of metamorphism is closely related to granitisation. The rocks within the Jahazpur syncline are not affected by granitisation probably due to obstruction by the outer quartzite. But at the same time the quartzite and limestone of the Sabalpura syncline are much cut up by pegmatites and granite.

Near Deoli and Jahazpur, the strike of the beds is N. 35° E.-S. 35° W. and towards south it changes to N. 65° E.-S. 65° W. The beds are folded into tight upright isoclinal and the axial planes are steeply inclined towards north-west or north. Foliation has been superimposed on bedding in the metasediments (schists); yet the siliceous bands are recognised in many places.

The rocks are well exposed and the sections indicate a continuous sequence of geosynclinal sediments. Even the quartzites exposed near Rajmahal and considered to be Delhi, are part of this sequence.

Systematic geological mapping of the area is being conducted and the senior author is working on an hypothesis that the entire sequence of sediments referred to above is part of a geosynclinal deposition much earlier in age than the undoubted Aravalli rocks which overlie the Banded Gneissic Complex with a first-order unconformity near Udaipur (Poddar). The granites and pegmatites found near Jahazpur and further west have to be correlated with an orogeny which was responsible for the Banded Gneissic Complex.

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Jaipur, July 29, 1965.

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1. Heron, A. M., *Mem. G.S.I.*, 1922, **45**, pt. 2, 132.
2. —, *Trans. Nat. Inst. Sci. Ind.*, 1935, **1** (2), 17.
3. Brandshaw, E. J., *Rec. G.S.I.*, 1927, **60**, pt. 1, 115.
4. Coulson, A. I., *Ibid.*, 1927, **60**, pt. 2, 186.
5. Pascoe, E. H., *Manual*, 1950, **1**, 349.
6. Poddar, B. C., *Curr. Sci.*, 1965, **34** (16), 183.

### SALINITY TOLERANCE AND CHLORIDE ION REGULATION IN A HOLEURYSALINE TELEOST, *TILAPIA MOSSAMBICA*

THERE have been several studies on the salinity tolerance, osmotic and ionic regulation in fishes.<sup>1-5</sup> The exotic mouth breeding cichlid *Tilapia mossambica* was introduced into Indian waters in 1952 and was shown to withstand

a wide range of salinity.<sup>6</sup> In the present investigation the salt tolerating capacity of this freshwater fish has been confirmed and the chloride ion regulation in the tissue fluids of the fish adapted to different saline media has been studied.

The fish were collected from local freshwater ponds and tanks where they do not have any access to saline waters in their natural habitat. The fish were fed daily with mosquito larvae and fried rice. Various concentrations of sea-water beyond 100% were obtained by evaporating the normal sea-water. The normal sea-water salinity was 32.5‰. After the programmed treatment in various experimental media the fish were stunned with a blow on the head and the muscle tissue was cut out of the animal. The tissue was gently squeezed and a fluid sample of about 0.2 ml. was collected. Since the tissues were not crushed the sample thus obtained is the extracellular fluid. The chloride concentration was estimated by electrometric titration with AgNO<sub>3</sub> using a Gallenkamp potentiometric microtitrator. The sampling and the estimation were carried out at room temperature (27° C.).

It was found that the fish withstand direct transfer to 50% and 100% sea-water without any apparent adverse effects. The fish do not survive in higher concentrations beyond 100% sea-water when they are transferred directly. But on gradual transfer with a week's sojourn in 50% and 100% sea-water and with a fortnight's sojourn in 125, 150 and 175% sea-water the fish could be taken to 200% sea-water. However, the fish fail to survive in any concentration beyond 200% sea-water (salinity = 65‰). This is in accordance with the previous finding on the same species in Indonesia.<sup>7</sup>

TABLE I

Tissue fluid chloride of *Tilapia mossambica* in various salinities

Medium	Medium salinity ‰	Medium Cl mM/l.	Tissue fluid chloride mM/l.	S.D.
Tap-water	..	..	96.0 (6)*	± 3.95
50% Sea-water	16.0	276.0	124.8 (6)	± 7.08
100%	32.5	552.0	183.0 (6)	± 7.35
150%	48.0	834.0	263.0 (6)	± 8.85
200%	65.0	1096.0	324.3 (6)	± 12.83

\* The figures in parenthesis indicate the number of estimations.

It is evident from the chloride concentration of the tissue fluid of the animals adapted to different salinities (Table I) that in all media except freshwater which is the natural medium,