NEW MICROFORAMINIFERA FROM THE ORBITOLINA-BEARING ROCKS OF TIBET AND BURMA*

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RECENTLY, while engaged on a monograph of the orbitolines found in India, Pakistan, Tibet and Burma (to be published in the *Palaeontologia indica*), the authors' attention was drawn to a number of foraminifera of minute size occurring in association with these orbitolines. Although some of these microforaminifera possess the general pattern of known genera of much larger size, absence of agglutinisation in the strict sense of the term which characterises most of their larger counterparts, proves that the apparent parallelism is no evidence of genetic relationship; also, that their dwarfism is not related to such factors as food, temperature of water, chemical composition, pH concentration, light, etc, because the associated larger foraminifera, consisting mainly of species of *Orbitolina*, are all of normal size. The dwarfism of the microforaminifera is thus inherent in the forms and quite independent of external stimuli and environment. Microforaminifera that would pass through a mesh of the size normally used for separating foraminifera have already been isolated from Tertiary rocks and recent faunas by Hoffmeister and Berry[1] and Wilson and Hoffmeister[2] while the causes of dwarfism have been discussed by several authors, among them Preston Cloud,[3] Dawson,[4] Kidder and Stuart,[5] Kidder, Lilley and Claff,[6] Lalicker,[7] Moore[8] and Scott.[9]

It was very clear that dwarfism of the microforaminifera briefly described below could not have been produced by the above mentioned factors. New generic and species names have, therefore, been proposed for them Further work on the forms occurring in all the *Orbitolina* horizons reviewed in our monograph referred to above, is in progress.

Descriptions of the genotypes supplement the brief generic diagnoses here given. Further details are being given in a more exhaustive paper. Since the exact relationships of the genera here described are uncertain, they have not been assigned family position.

Genus *Yanbonia*, nov.

Genotype *Yanbonia moniliformе*, sp. nov.

Generic Diagnosis.—The only known species is uniserial; chambers bulbous with aperture situated centrally. For further details see description of the genotype below

Description of Genotype.—Test uniserial, thick-walled, free, elongate, tapering towards the initial chamber; chambers subspherical, arranged in a rectilinear series; sutures straight, at right angles to the axis. The aperture appears to be terminal judging by a change in the contour along the median line of the later formed chambers.

Dimensions—Maximum length, ·5 mm.

Age.—Cenomanian; U. Burma.

Genus *Kutaungia*, nov.

Genotype *Kutaungia cretacea*, sp. nov.

Generic Diagnosis.—Forms initially biserial, becoming uniserial in later stage. The only known species possesses three subdepressed chambers in the uniserial stage.

Description of Genotype.—Test biserial in the earlier stages, becoming uniserial later; free, elongate, tapering gradually; biserial stage consisting of three to four chambers, with a solitary, more or less circular chamber initially, which might be the proloculum. Uniserial stage consisting of three chambers, which number is constant both in the Burmese and Tibetan specimens. The uniserial chambers are flattened and the sutures are more or less at right angles to the median longitudinal axis; aperture not visible.

Dimensions——Maximum length, ·2 mm.

Age.—Aptian-Cenomanian; U. Burma.

Genus *Hukawngia*, nov.

Genotype *Hukawngia problematica*, sp. nov.

Generic Diagnosis.—Forms initially coiled, becoming uniserial in later stages; chambers subdepressed; the uniserial stage consists of four chambers in the only known species.

Description of Genotype.—Test free, early chambers planispiarally coiled, later ones uniserial and rectilinear. There appear to be five to six chambers in the coiled portion; aperture not observed.

Dimensions.—Of the two specimens, one measures ·2 mm. and the other ·3 mm.

Age.—Cenomanian; U. Burma.

Genus *Irrawaddia*, nov.

Genotype *Irrawaddia trigonalis*, sp. nov.

Generic Diagnosis—Forms biserial with chambers increasing more or less rapidly in size in later stages, producing, in some cases (as in the genotype), a sharply triangular outline in section

Description of Genotype.—Test free, elongate, increasing rapidly in later growth stages; arrangement of chambers typically biserial; sutures straight in the early stages, becoming more or less incurved obliquely later.

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Dimensions.—Maximum length, ·5 mm.

Age.—Cenomanian ; U. Burma.

Irrawaddia tibetica, sp. nov.

Test free, elongate, tapering, chambers biserial throughout, sutures run oblique to the axis. There are six to seven chambers in each row ; aperture not observed.

Dimensions.—Maximum length approximately, ·25 mm.

essential characters of the genus. It is widely distributed geographically having been found in areas as far removed from each other as Khan-Sang La, in Tibet and Maingtha Chaung and Ku Taung, in Burma. This wide geographic distribution is likely to prove of great value in correlation.

Dimensions.—Maximum length, ·6 mm.

Age.—Aptian-Cenomanian ; U Burma.

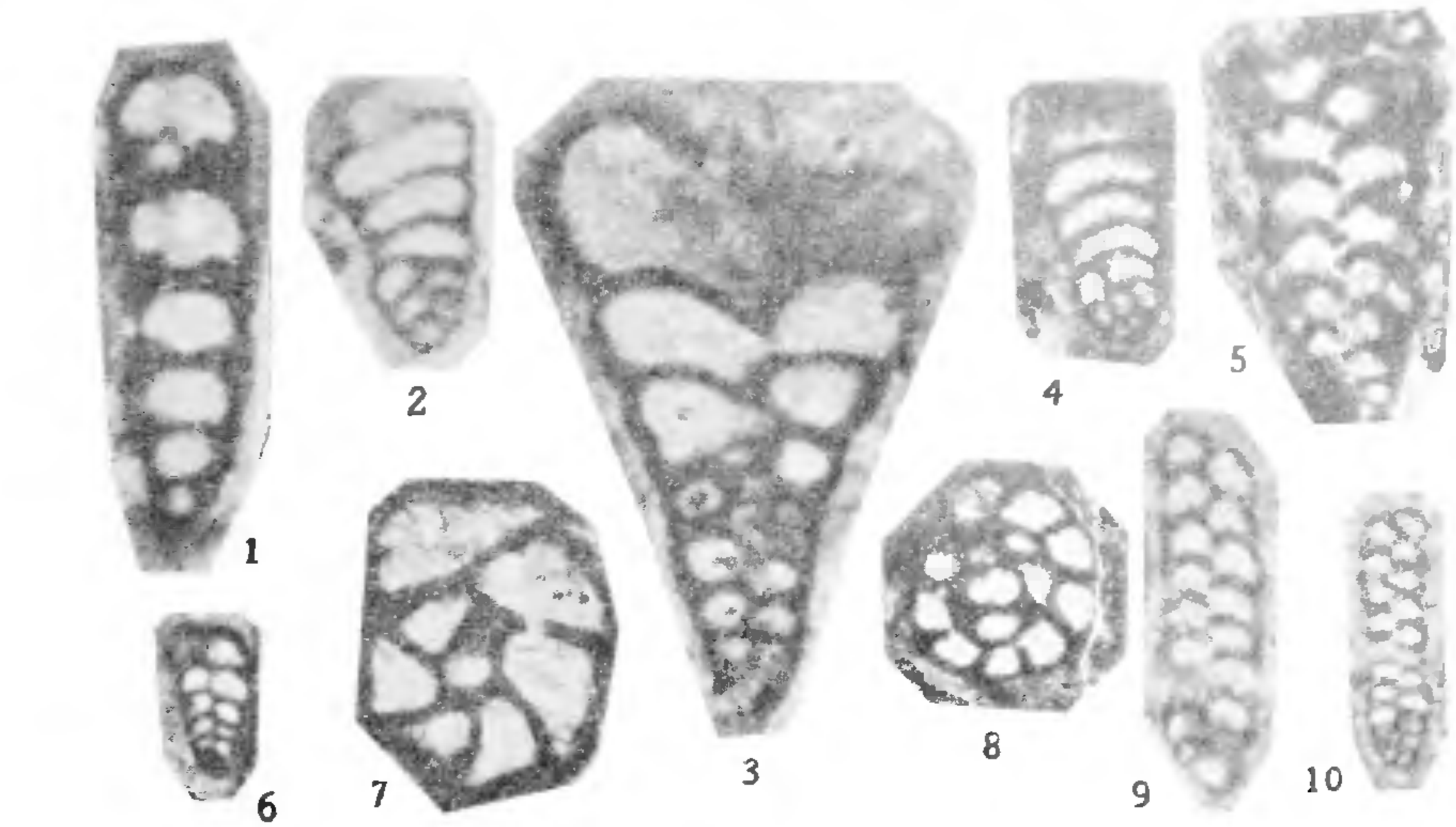

FIG. 1. *Yanbonia mouliforme*, gen. *et* sp. nov., × 100. FIG. 2. *Kutaungia cretacea*, gen. *et* sp. nov., × 125. FIG. 3. *Irrawaddia trigonalis*, gen. *et* sp. nov., × 120. FIG. 4. *Hukawangia problematica*, gen. *et* sp. nov., × 125. FIG. 5. *Mesania tibetica*, gen. *et* sp. nov., × 125. FIG 6 *Irrawaddia tibetica*, sp. nov., × 68. FIG. 7. *Kyatsokia tibetica*, gen. *et* sp. nov., × 140. FIG. 8. *Kyatsokia multilocularis*, sp. nov., × 105. FIG. 9. *Mesania vermiforme*, sp. nov., × 124. FIG. 10. *Mesania kutaungensis*, sp. nov., × 45.

Age.—Aptian-Cenomanian ; Tibet.

Genus *Mesania*, nov.

Genotype *Mesania vermiforme*, sp. nov.

Generic Diagnosis.—Forms biserial (rectilinear or conical) with chambers of more or less uniform size, except in early stages ; sutures concave towards the initial chamber, as a rule.

Description of Genotype.—Test free, narrow, elongate, straight, biserial throughout, of uniform width except in the initial stage ; nine to ten chambers constitute each row ; sutures deeply incurved and uniformly thick ; initial portion of shell slightly conical.

Dimensions.—Maximum length, ·3 mm.

Age.—Barremian-Aptian ; U. Burma.

Mesania kutaungensis, sp. nov.

Test narrow, elongate, biserial ; sutures slightly incurved. This form possesses the

Mesania tibetica, sp. nov.

Test free, elongate, biserial, gradually tapering, with eight chambers in each row ; sutures incurved and tending to thicken at marginal junctions The internal characters exhibited by this form appear to justify its reference to the genus *Mesania*, in spite of its rather tapering charatcer.

Dimensions.—The holotype measures ·4 mm. in length.

Age.—Aptian-Lower Cenomanian ; Tibet.

Genus *Kyatsokia*, nov.

Genotype *Kyatsokia tibetica*, sp. nov.

Generic Diagnosis.—Forms coiled, with chambers disposed more or less as in rotalids ; test calcareous ; number of whorls varying from one and a half to two and a half ; chambers increasing very gradually in size.

Description of Genotype.—Test calcareous, free, trochoid, rotaliform, consisting of one and a half whorls; sutures disposed obliquely to the axis of coiling, not deeply incurved; last whorl formed of six chambers.

Dimensions.—Maximum length, ·25 mm.

Age.—Aptian-Cenomanian; Tibet.

Kyatsokia multilocularis, sp. nov.

Test made up of two-and-a-half whorls, the last formed consisting of nine chambers This is a more tightly coiled form than *K. tibetica*, just described; sutures slightly obliquely disposed. A fairly large-sized initial chamber appears to be present in the central portion of the test.

Dimensions—Maximum length, ·2 mm.

Age.—Aptian-Cenomanian; Tibet.

The stratigraphic ranges assigned to the foregoing species are determined from those of the orbitolines with which the microforaminifera are associated.

The holotypes of all the species described above are preserved in the Geological Survey of India.

A detailed paper on these forms will be published in due course.

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6. Kidder, G. W., Lilly, D. M. and Claff, C. L., *Biol. Bull.*, 1940, **78**, 9.
7. Lalicker, G. G., *J. Sed. Petr.*, 1948, **18**, No. 2, 51. Pl. 1, Fig. 1.
8. Moore, R. C., *Ibid.*, 1948, **18**, No. 3, 126.
9. Scott, H. W., *Ibid.*, 1948, **18**, No. 2, 65, Fig. 1.

OBITUARY

DR. M. A. GOVINDA RAU

THE death of Dr M A Govinda Rau, Director, Alagappa Chettiar College of Technology, Madras, on November 19, has removed one of the pioneers in the field of chemical engineering in the country, and will be widely mourned by those who had the good fortune to know him.

M. A. Govinda Rau was born on 26th August at Viswammalsamudram in Trichinopoly District, and was the son of Rao Bahadur M. C S. Ananthapadmanabha Rau who retired as Principal, Government College, Kumbakonam. After a brilliant academic career in the Presidency College under Prof. W. Erlam Smith, Govinda Rau joined the Indian Institute of Science as a research student Later, he worked under Prof. Donnan of the University College, London, for his Ph D Degree. On his return from the United Kingdom, he joined the staff of the Indian Institute of Science and worked there first under Prof H E. Watson and later under Sir C. V. Raman.

In 1940, he organised the Department of Chemical Engineering which was started at the Institute, and was in charge of it for four years. When the Alagappa Chettiar College of Technology was started by the Madras University in 1944, he was first appointed as Reader in Chemical Engineering and later made Professor and Director. During the ten years of his stewardship he was responsible for building up the A C College of Technology to its present position. Though ailing for some time, he took an enthusiastic interest in the furtherance of the activities and technological development of the various sections of the College.

Dr. Govinda Rau was Vice-President of the Indian Institute of Chemical Engineers, Fellow of the Indian Academy of Sciences, President of the Faculty of Technology, Chairman, Board of Studies in Technology, and a member of various academic bodies. Nearly 60 original papers have been published by him relating to dielectric constants, dipole moments, ultrasonics, and various topics in chemical engineering. He was associated with *Current Science* from its very inception and was the Secretary of the Association for many years.

His contributions to physical chemistry, and the A C. College which he helped to shape are perhaps the fittest memorial to his life and work.

K. N. MENON.