involving the use of butanol : acetic acid : water (4 : 1 : 5—v/v) as solvent and 5% aqueous solutions of nitrates of manganese, zinc or magnesium chlorides (or nitrates) or 3% aqueous solution of guanidine carbonate as spray reagents, have been developed for the detection of 5-hydroxy flavones and *a*-hydroxy quinones, when present in amounts of at least 5 μg each. The colour intensity has been found to increase in the case of compounds containing vicinal hydroxyl groups.

These reagents (except magnesium chloride) have shown better performance in comparison with the known spray reagents[1–4] [*p*-toluenesulphonic acid, 25% aqueous lead acetate (basic), 5% aqueous sodium carbonate and 1% methanolic sodium hydroxide solution.] The completely methylated flavone and anthraquinone do not give colour reaction with the reagent. Interestingly it has been observed that 3′,4′,5,7-tetramethyl quercetin does not give colour reaction with the reagent, in spite of the fact that it contains a hydroxyl group at C3 adjacent to carbonyl group.

The R_f values and colour observed with the spray reagents are given in Table I.

The authors are grateful to Prof. R. D. Tiwari, Dr. Jagadamba Singh (University of Allahabad), Prof. T. J. Mabry and Dr. P. Neuman (The University of Texas at Austin) for the authentic samples of some of the compounds reported in this paper.

Department of Chemistry, K. P. Tiwari.
University of Allahabad, M. Masood.
Allahabad, India, *April* 30, 1979.

1. Harborne, J. B., Mabry, T. J. and Mabry, H., *The Flavonoids*, Chapman and Hall, London, I ed., 1975, p. 24.
2. Kohli, J. C., *Ann. Chim.*, 1975, **10**, 323.
3. — and Arora, A. K., *Ibid.*, 1977, **2**, 21.
4. Geissman, T. A., *Modern Methods of Plant Analysis*, edited by K. Paech and M. V. Tracey, Springer–Verlag, Berlin, 1955, **3**, 450.
5. Tiwari, K. P., Masood, M. and Choudhury, R. N., *Curr. Sci.*, 1978, **47**, 678.
6. —, Minocha, P. K., Rathore, Y. K. S. and Masood, M., *Chromatographia* (In press). To be published in May, 1979 issue.

A NOTE ON THE PALAEOGEOGRAPHIC SIGNIFICANCE OF OCCURRENCE OF RECYCLED LOWER GONDWANA PALYFLORA IN MESOZOIC AND CENOZOIC SEDIMENTS OF ASSAM ARAKAN PROVINCE

The Assam–Arakan geological province includes the present states of Meghalaya, Assam, Arunachal, Nagaland, Mizoram, Tripura and Andaman–Nicobar Islands. Tectonically, West Bengal also forms the foreland shelf of the Arakan–Yoma folded belt.

Detailed palynological investigations from both surface and subsurface sequences have been conducted by the ONGC starting from 1957, and by the geologists of the Indo-Stanvac Petroleum Project (Biswas, 1961, *D.Sc. Thesis*, Calcutta University, unpublished).

The above study has indicated the occurrence of recycled Lower Gondwana palynomorphs from different parts of the Assam–Arakan province at different stratigraphic levels, within the Mesozoic and Cenozoic sequences.

In Tripura, *Sulcatisporites*, *Nuskoisporites*, *Striatites*, etc., have been reported from Miocene surface samples of Batchia anticline (Srivastava[7]) and Baramura anticline (Banerjee, 1965, unpublished report). Recycled Lower Gondwana taxa are also recovered from the ? Oligocene samples of Atharamura anticline. Salujha *et al.*[3] (1977, unpublished report) recorded recycled Lower Gondwana taxa from Pliocene surface samples of Tulamura anticline (91° 45′ E : 23° 15′ N). In Mizoram, reworked Lower Gondwana palyflora have been recorded in ? Oligocene and Miocene surface samples from Demagiri–Tuichang (92° 28′ 07″ E : 22° 54′ 30″ N) and other traverses (Banerjee, 1973, unpublished report). In Cachar near Haflong, Lower Gondwana forms have been reported from Miocene surface samples, more common towards the upper part (Banerjee, 1960, unpublished report). Salujha *et al.*[7] described recycled Lower Gondwana taxa, *viz.*, *Lahirites*, *Faunipollenites*, etc., from ? Miocene surface samples of South Shillong shelf. Sah[6] noted similar recycling from Langpar Formation of Therriaghat. Datta[3] recently reported *Parasaccites*, *Striatites*, etc., from Upper Cretaceous rocks near Dawki, Meghalaya, from Miocene beds at Nichuguard (93° 43′ E : 25° 45′ N), Nagaland and Miocene beds of Tipangpani area (95° 52′ E : 27° 18′ N), northeast Assam. Such reworking has been recorded from the Rewak Formation (? Upper Eocene–Oligocene) in the subsurface (90° 40° E : 25° 10′ N) of Garo Hills (Banerjee, 1973, unpublished report). From West Bengal subsurface, Biswas (1961, unpublished D.Sc. Thesis) has figured a disaccate grain comparable to *Pityosporites*, from the Jalangi Formation (Upper Cretaceous–Paleocene), whereas ONGC palynologists have indicated the occurrence of recycled Lower Gondwana taxa from Lower Miocene sediments. Baksi[1] reported occurrence of a number of Lower Gondwana palynomorphs from Upper Cretaceous subsurface sediments of West Bengal shelf. In West Bengal Offshore wells, these have been recorded from Pliocene sediments by the palynologists of IPE, ONGC, Dehra Dun. In Upper Assam, Lower Gondwana taxa, *viz.*, *Parasaccites*, *Verticipollenites*, *Striatites*, *Alisporites*, etc., have been recorded starting only from the base of Tipam Formation upwards in different wells drilled in Borholla, Naginijan, Amguri, Rudrasagar,

Lakwa, Geleki and other wells (Banerjee *et al.*[2]) and no pre-Tipam occurrence is so far known.

The temporal and spatial distribution of recycled Lower Gondwana palynomorphs, when viewed in regional perspective, have led to important synthesis pertaining to tectonic evolution and palaeogeographic reconstruction of Assam–Arakan geolcgical province, which had already been indicated in the tectonic map of India published by the ONGC[4]. These data have revealed that the Lower Gondwana sediments were widely distributed over the major parts of Assam–Arakan geological province and were subjected to various degrees of recycling consequent upon various phases of the tectonic movements of the Arakan–Yoma folded belt, Shillong massif as well as the Himalayan folded belt. At present, Lower Gondwana sediments are known from Singrimari (89° 53′ 30″ E : 25° 38′ 35″ N) to the northwest of Garo Hills; along the Sikkim, Bhutan, Arunachal foothill belt of the northeastern Himalayas and in the subsurface of northern part of Bangladesh in Kuchma (89° 19′ E: 24° 40′ N) and adjoining areas (Rahman[5]). Lower Gondwana sediments occurring to the west were the source of the recycled Lower Gondwana taxa at different stratigraphic sequences in West Bengal subsurface starting from at least Upper Cretaceous upwards. In South Shillong shelf, the recycling of the Lower Gondwana sediments took place from Upper Cretaceous upwards. In Cachar–Tripura–Mizoram areas, occurrences of reworked Lower Gondwana taxa are known from at least Lower Miocene upwards, if not earlier. It is considered that parts of Bangladesh and, probably of Shillong massif also, had cover of Lower Gondwana sequence acting as the provenance for the younger sediments of South Shillong shelf and Cachar–Tripura–Mizoram areas. In Upper Assam subsurface, recycling of Lower Gondwana taxa is considered to have taken place from Middle Miocene upwards and this can be correlated with the Middle Miocene uplift of the Himalayas when the Lower Gondwana sediments of the foothill belt were also uplifted and were recycled.

These data have revealed that the basin margins or the provenances in different parts of Assam–Arakan geological province have different history of tectonic evolution and the directions of sediment transport were also different.

The authors are grateful to Shri P. K. Chandra, Chief Geologist, and Shri C. K. Baruah, Dy. General Manager, Oil and Natural Gas Commission, Eastern Region, Nazira, for their permission to publish this account.

Regional Geological Laboratories, Oil and Natural Gas Commission, Eastern Region, Sibsagar, Assam, *May* 12, 1979.

A. K. Datta.
D. Banerjee.

1. Baksi, S. K., *Proc. Sem. Palaeopalynol. Indian Strati.* 1971, 1972, p. 188.
2. Banerjee, D., Misra, C. M. and Koshal, V. N., *Paleobotanist*, 1973, **20**, 1.
3. Datta, S. K., *Geophytology*, 1978, **8**, 131.
4. Eremenko, N. A. *et al.*, *Tectonic Map of India*, ONGC, Dehra Dun, 1968.
5. Rahman, H., *Proc. 6th World Petrol. Congr. Sec.* 1, 1963, p. 659.
6. Sah, S. C. D., *Aspects and Appraisal of Indian Palaeobotany* (eds. Surange *et al.*), 1974, p. 525.
7. Salujha, S. K., Rehman, K. and Kindra, G. S., *Bull. ONGC*, 1973, **10**, 109.
8. Srivastava, N. C., *Seminar on the Geology of NE India, Abstr.*, 1967, p. 19.

KARYOTYPES OF TWO SPECIES OF GRYLLIDS

Even though the karyotypes of a number of species of gryllids have been described[1–5] there is paucity of such information on south Indian gryllids. Further there is a need for reinvestigation of the cytologically known species using the newer chromosomal techniques for a better understanding of the morphology of the chromosomes of these species. Since no chromosomal work has been done on the genera *Gryllopsis* and *Teleogryllus* from India, karyotypic studies have been made on *Gryllopsis maculithorax* and *Teleogryllus* sp. belonging to the subfamily Gryllinae of Gryllidae. Lim *et al.*[1] have analysed the chromosomes of two species of *Teleogryllus* from the Australian region. Karyotypes of these species are compared with those from the present investigation.

Twenty specimens of both sexes of *G. maculithorax* (8 ♂, 12 ♀) and 11 males of *Teleogryllus* sp. were collected from the University campus, Manasa Gangotri, Mysore. Chromosomal preparations were made by the flame dry-Giemsa technique[6] using cells from the tests and hepatic caecae.

G. maculithorax showed a diploid number of 19 in the male and 20 in the female (Fig. 1). The autosomal complement consists of a pair of metacentric and 8 pairs of telocentric chromosomes which are in a graded series. In all the animals studied, one of the telocentric chromosomes of pair No. 2 showed a thread-like structure arising from the centromeric region. In most of the metaphase plates of the female one of the X-chromosomes appears more deeply stained and shorter than its homologue (Fig. 5).

The diploid number of *Teleogryllus* sp. is 27 ($2n$ ♂ = 27) with ten pairs of metacentric, two pairs of submetacentric and one pair of telocentric chromosomes (Fig. 3).