Os(VIII), Os(VI), Au(III), Pt(IV), Pd(II), Ir(III), Ti(IV) and Hg(II) interfere considerably and the anions like F^-, Cl^-, Br^-, I^-, NO_3^-, SO_3^-, CH_3COO^-, tartrate, phosphate, thiosulphate do not interfere (to an extent of 4000 ppm). The interference of certain metals could be reduced by using tartrate, citrate, fluoride and phosphate as masking agents.

About 0.1 g of the alloy is weighed in a 50 ml beaker and treated with 3 ml of concentrated nitric acid and heated gently. After the alloy is dissolved, the excess of nitric acid is removed by heating with 6 ml of concentrated HCl and evaporated to dryness on a steam bath after each addition. The residue is dissolved in distilled water and diluted to 500 ml. An aliquot of the solution was then treated with the reagent, the volume made up to 25 ml and the absorbance measured at 366 nm. The results of the analysis in table 1 are in good agreement with those obtained by dimethylglyoxime method[2].

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A NEW COLLECTION OF FOSSILS FROM THE PRECAMBRIAN VINDHYAN SUPERGROUP OF CENTRAL INDIA

S. M. MATHUR
Centre of Advanced Study in Geology, University of Saugar, Sagar 470 003, India.

ALTHOUGH the sediments of the Vindhyan Supergroup of central India are well suited for the preservation of organic remains, few macrofossils have been found in them, and there is considerable controversy regarding their exact systematic position, affinities and ages. Among them the most significant is *Fermoria*[1,2]. It occurs in the Suket Shale formation of the Semri Group around Rampura town in the Neemuch district of Madhya Pradesh. A new collection has been made from the cuttings from a newly dug well in Jamalpura village near Rampura, and it includes several species not recorded from the Suket Shale or any other Vindhyan formation so far. Their occurrence has important bearing on the age of this supergroup and evolution of life in the Precambrian. This is a preliminary note on the findings; the collection is under detailed study and systematic descriptions will be published elsewhere. The collection is deposited in the Northern Region of the Geological Survey of India, Lucknow, under registration No. NRP-1/72.

The collection consists of several thousand individual bodies made up of several species, most of which are being reported for the first time from the Precambrian Vindhyan sediments. They occur closely packed together along partings of thinly laminated and fissile shale. They are mostly embedded on the upper surface of the shale layers; the lower surface may also have a few that may have accidentally adhered there while splitting the shale. The shale is of two kinds: one is compact, hard, and dark grey in colour; the other is olive green in colour and softer. The fossils are much more abundantly distributed in the dark variety than in the green.

The species could be broadly divided into two main habits, *viz.*, rounded and elongated. All the species occur together randomly mixed up without any apparent segregation.

The most abundant fossil is *Fermoria*, which is also identified in the past variously as *Protobolella*, *Vindhyanella*, and *Krishnania* by different investigators[1-3]. A reassesment of these forms has shown that all of them are congeneric with *Chuaria* Walcott 1899 according to Ford and Breed[4]. This conclusion is confirmed by the study of the present material[5]. The *Chuaria* in the new collection is mostly 2-3 mm in diameter, but smaller specimens up to 1 mm are also seen, though larger than 3.5 mm are extremely rare. There are evidently two species of *Chuaria* in this collection, though some authors[4,6] consider that all forms should be assigned to a single species, *C. circularis*. One species (type No. NRP-1/72/1) is dark coloured, chitinous, and has distinct wrinkles along its borders (figure 1A). The other (type No. NRP-1/72/2) is greyish, much lighter in colour, and does not show any ornamentation (figure 1B). The number of specimens of the first type is much fewer than the second. Since both occur together on the same slab of shale, the difference in their morphology is apparently not due to any difference in the condition of their preservation which could give dissimilar appearance to the same species, but because they represent different and separate species. The dark form with wrinkles

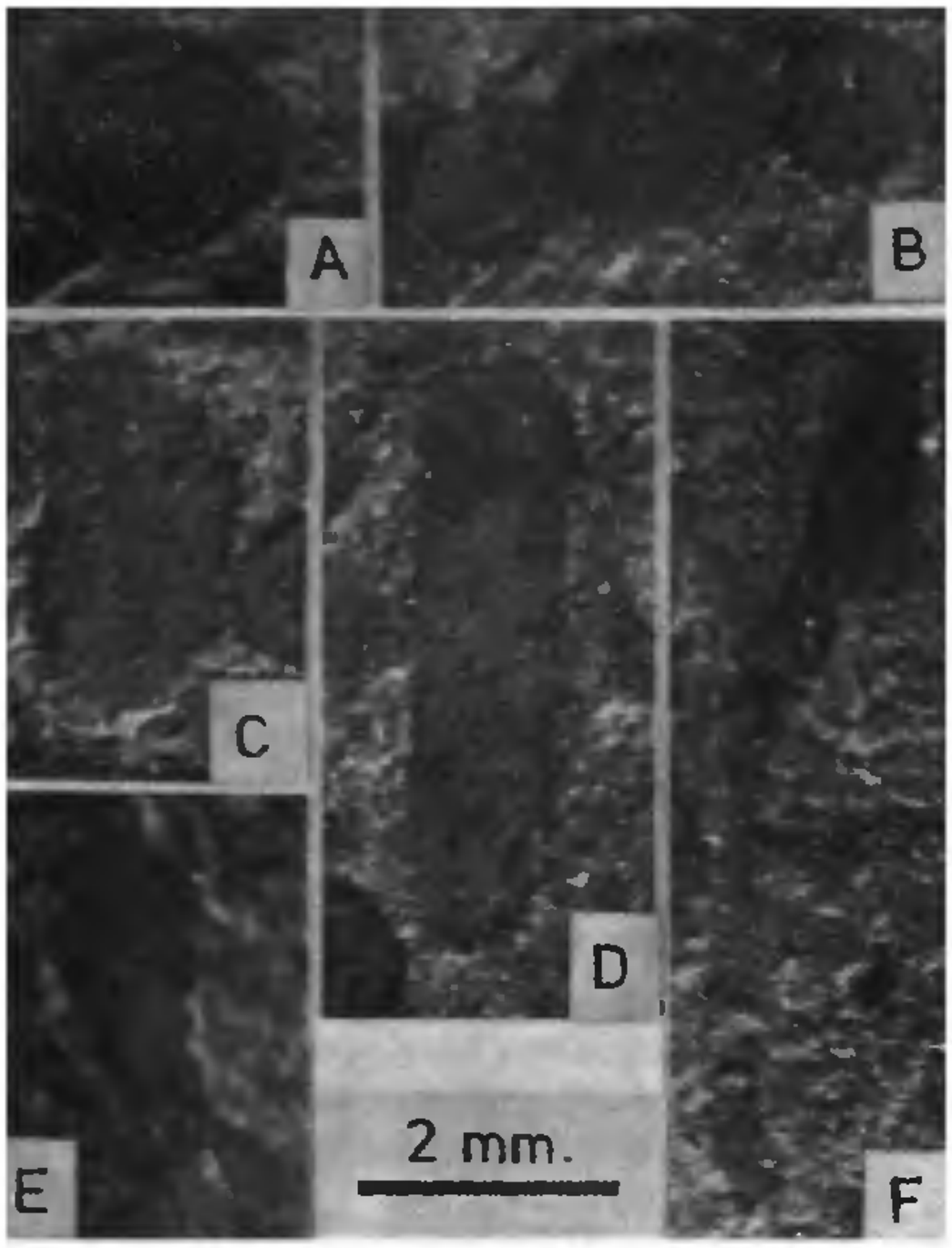

Figure 1. Fossils from the Suket Shale (Vindhyan Supergroup) **A**—*Chuaria circularis* Walcott 1899. **B**—*Chuaria fermorei* Mathur 1983 sp. nov. **C**—*Morania antiqua* Fenton and Fenton 1937. **D**—*Tawuia suketensis* Mathur 1983 sp. nov. **E**—*Tawuia rampuraensis* Mathur 1983 sp. nov. **F**—*Vindhyania jonesii* Mathur 1983 gen. et sp. nov.

is identified as *C. circularis*, while the lighter coloured, ornamentationless form is named *C. fermorei* sp. nov. The specific name honours Sir Lewis L. Fermor after whom the original, generic name *Fermoria*—now redundant—was given by Chapman[4].

Another rounded form (type No. NRP-1/72/3) found in the collection, but infrequently, is elliptical or near elliptical in shape, 2 × 3 mm to 3 × 4 mm in size and contains no recognisable ornamentation. It is identified as the genus *Morania* Walcott 1919 and species *M. antiqua* Fenton and Fenton 1937, although the forms in the present author's collection are much smaller in size (figure 1C). There is no evidence that *Morania* could be deformed *Chuaria* as proposed by Hofmann and Aitken[7].

Another type (type No. NRP-1/72/4) occurring in profusion on the same slabs of shale is a rod-like structure, 4-14 mm long and 1-2.5 mm wide, which was considered by Sahni and Shrivastava[3] as a filament attached to *Fermoria*. In the present collection it occurs unattached and independent, and is identified as *Tawuia* Hofmann 1979. Two species are noted in the collection: *T. suketensis* sp. nov. is rod-like with parallel sides and rounded ends with sharp but slightly uneven outlines (figure 1D); it occurs in abundance. The species is named after the formation in which it is found. The second species (type No. NRP-1/72/5), *T. rampuraensis* sp. nov., is similar but tapering towards one end (figure 1E); it is much less frequent in occurrence, and is named after the type locality. Neither of the two species of *Tawuia* show any markings or ornamentation, and they are of the same hue as *Chuaria fermorei*.

Another fossil (type No. NRP-1/72/6) in the collection which occurs less frequently than *Tawuia*, but often enough, is a slender, filamentous form, 6–12 mm long and 0.5–1 mm wide, whose one end is wider than the other, and it has a slight bend or curve in the middle. It is recognised as a new form *Vindhyania jonesii* gen. et sp. nov. (figure 1F). The generic name is derived from the supergroup in which the fossil occurs, and the specific name is in commemoration of H. C. Jones, the geologist of the Geological Survey of India who discovered fossils for the first time in these ancient strata in 1908.

The exact systematic positions of these Precambrian fossils are still a matter of debate. According to the present view *Chuaria* and *Morania* are considered as sphaeromorphid acritarchs, and *Tawuia* and *Vindhyania* are of algal affinity.

Before the radiometric dates of some of the Vindhyan formations became available during recent years, the age of this supergroup remained uncertain because none of the fossils found in it could be used with any degree of certainty for the purpose. In this connection the identification of *Chuaria* and other related fossils in the Vindhyan described here assumes considerable importance since *Chuaria* is now taken as a stratigraphic index fossil of Late Precambrian age with a range from roughly 1000 Ma ago to the beginning of the Cambrian[4]. Probably *Chuaria* has also been found in the upper part of the Changchenh System of northeastern China which is at least 1600 Ma old[7]. Several forms found in the Suket Shale, like *Chuaria circularis*, *Tawuia*, and *Morania*, have also been obtained from the Little Dal Group of Mackenzie Mountains in northwestern Canada, whose age is estimated at 1100 Ma to 800 Ma ago[7]. The isotopic age of the base of the Semri Group in this part of the country is possibly 1400 Ma[8], which fits in the age range for *Chuaria* occurring in several Precambrian formations in many parts of the world. This seems to be the first assemblage of fossils found in the Semri Group of the Vindhyan Supergroup which definitely

indicates its Proterozoic age, and may serve to lay at rest the controversy about the age at least of the lower part of this supergroup. It may also serve for world-wide correlation of the late Precambrian (Proterozoic).

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TISSUE CULTURE OF CHINESE TALLOW — AN EUPHORBIACEOUS TREE

VARSHA GANDHI
9407 Westheimer No. 325A, Houston, Texas 77063, USA

MOST of the studies on plant tissue culture are confined to herbaceous angiosperms and in many species plantlet regeneration has been obtained[1]. Among the tree species, studies are mostly on gymnosperms[2]. The angiospermous trees attempted for tissue culture and organogenesis are very few namely eucalyptus[3], sandalwood[4], teak[5], poplar[6], aspen[7] and jack tree[8].

The potential of trees as a source of biomass has generated interest in growing and harvesting trees. The possibilities of applying tissue culture method to accelerate tree breeding programme, early development and reproduction, vegetative propagation and selection of genetically improved strains are now being widely investigated.

The rapid growth rate of chinese tallow (*Sapium sebiferum*), and its use as biomass, resistance to insects and pathogens, easy availability, and high amount of oil in the seed coat are the factors that led to the present study on the tissue culture of this tree species.

Seeds of chinese tallow, *Sapium sebiferum* (L.) Roxb. were obtained from the mature fruits collected from the trees growing in Houston. For germination, the outer layer of the seed coat was carefully removed and the seeds were sterilized in Clorox (commercial bleach) and washed with sterile-distilled water. The seed was then split open to remove the inner hard layer of the seed coat and then placed on solidified medium[9]. Root, cotyledon and hypocotyl pieces from the seedlings were cut and placed on MS medium supplemented with different growth hormones. All cultures were incubated at 27 ± 2°C and at 10 hr photoperiods provided by fluorescent tubes.

Seeds (without seed coat) germinated in a week on MS medium (figure 1A). Small pieces (5–8 mm) of the root, cotyledon and hypocotyl were cut from 15–20 day-old seedling and cultured on following media: MS + KN + 2,4-D (both 0.5, 1 or 2 ppm); MS + KN (1 ppm); MS + 2,4-D + NAA (both 1 or 2 ppm); MS + 2,4-D + IAA (both 1 ppm); MS + 2,4-D (1 ppm) + NAA (1 ppm) + CM (15%) and MS + BAP (1 ppm)*.

The root pieces did not show any sign of growth even when maintained for several months on different media. The cotyledon pieces also did not produce calli; however, on media containing 2,4-D and KN (1 or 2 ppm each) or KN (1 ppm) or 2,4-D and IAA (1 ppm each), the cotyledon pieces increased in size, became fleshy and pale green. A small white friable mass of cells was observed in the central region of the cotyledon pieces. Further growth did not occur on any of the media tried.

The hypocotyl pieces produced calli on all the media containing 2,4-D. Media containing both KN and 2,4-D at concentrations of 1 and 2 ppm each proved to be the best. The callus formation started from both the cut and exposed ends of the explant after 10–15 days of inoculation. After 30–40 days the whole surface of the explant produced mass of cells (figure 1B). In another 20 days good, white, fleshy callus was produced. The calli (whole or in pieces) were transferred to fresh media with the same composition or with addition of yeast extract or NAA. The size of calli increased and new masses of cells were produced (figure 1C). The cultures were established by transferring these calli after every 20-25 days. For

Abbreviations: KN-Kinetin; 2,4-D-2,4-dichlorophenoxy acetic acid; NAA-naphthalene acetic acid; IAA-indole-3-acetice acid; CM-coconut milk; BAP benzyl amino purine.